

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

Test Report No. : E087R-017

AGR No. : A082A-099R

Applicant : SEWOO TECH CO., LTD.
Address : Doosung Bd., 689-20, Kumjung-dong, Kunpo-si, Kyunggi-do, 435-862, Korea

Manufacturer : SEWOO TECH CO., LTD.
Address : Doosung Bd., 689-20, Kumjung-dong, Kunpo-si, Kyunggi-do, 435-862, Korea

Type of Equipment : Mobile Printer with Bluetooth Module

FCC ID. : WF5LK-P20B

Model Name : LK-P20B

Multiple Model Name : GNPS002 B

Serial number : N/A

Total page of Report : 44 pages (including this page)

Date of Incoming : June 09, 2008

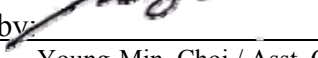
Date of issue : July 08, 2008


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.

Prepared by: 
Young-Min, Choi / Asst. Chief Engineer
EMC Div.
ONETECH Corp.

Reviewed by: 
Y. K. Kwon / Managing Director
EMC Div.
ONETECH Corp.

CONTENTS

PAGE

1. VERIFICATION OF COMPLIANCE	5
2. TEST SUMMARY	6
2.1 TEST ITEMS AND RESULTS	6
2.2 ADDITIONS, DEVIATIONS, EXCLUSIONS FROM STANDARDS	6
2.3 RELATED SUBMITTAL(S) / GRANT(S)	6
2.4 PURPOSE OF THE TEST	6
2.5 TEST METHODOLOGY	6
2.6 TEST FACILITY	6
3. GENERAL INFORMATION	7
3.1 PRODUCT DESCRIPTION	7
3.2 ALTERNATIVE TYPE(S)/MODEL(S); ALSO COVERED BY THIS TEST REPORT.	7
4. EUT MODIFICATIONS	7
5. SYSTEM TEST CONFIGURATION	8
5.1 JUSTIFICATION	8
5.2 PERIPHERAL EQUIPMENT	8
5.3 MODE OF OPERATION DURING THE TEST	8
5.4 CONFIGURATION OF TEST SYSTEM	9
5.5 ANTENNA REQUIREMENT	9
6. PRELIMINARY TEST	9
6.1 AC POWER LINE CONDUCTED EMISSIONS TESTS	9
6.2 GENERAL RADIATED EMISSIONS TESTS	9
7. TEST DATA FOR BLUETOOTH MODE	10
7.1. 20DB BANDWIDTH	10
7.1.1 OPERATING ENVIRONMENT	10
7.1.2 TEST SET-UP	10
7.1.3 TEST EQUIPMENT USED	10
7.1.4 TEST DATA	10
7.2. HOPPING FREQUENCY SEPARATION	13
7.2.1 OPERATING ENVIRONMENT	13
7.2.2 TEST SET-UP	13

7.2.3 TEST EQUIPMENT USED	13
7.2.4 TEST DATA	13
7.3. NUMBER OF HOPPING CHANNELS	15
7.3.1 OPERATING ENVIRONMENT	15
7.3.2 TEST SET-UP	15
7.3.3 TEST EQUIPMENT USED	15
7.3.4 TEST DATA	15
7.4 TIME OF OCCUPANCY	19
7.4.1 OPERATING ENVIRONMENT	19
7.4.2 TEST SET-UP	19
7.4.3 TEST EQUIPMENT USED	19
7.4.4 TEST DATA	20
7.5 MAXIMUM PEAK OUTPUT POWER.....	23
7.5.1 OPERATING ENVIRONMENT	23
7.5.2 TEST SET-UP	23
7.5.3 TEST EQUIPMENT USED	23
7.5.4 TEST DATA	24
7.5.4.1 TEST RESULT AT GFSK MODULATION	24
7.5.4.2 TEST RESULT AT DQPSK MODULATION	24
7.5.4.3 TEST RESULT AT 8DPSK MODULATION	24
7.6 100 KHZ BANDWIDTH OUTSIDE THE FREQUENCY BAND	27
7.6.1 OPERATING ENVIRONMENT	27
7.6.2 TEST SET-UP FOR CONDUCTED MEASUREMENT	27
7.6.3 TEST SET-UP FOR RADIATED MEASUREMENT	27
7.6.4 TEST EQUIPMENT USED	27
7.6.5. TEST DATA	28
7.6.5.1. TEST DATA FOR CONDUCTED EMISSION.....	28
7.6.5.2. TEST DATA FOR RADIATED EMISSION	32
7.6.5.2.1. RADIATED EMISSION WHICH FALL IN THE RESTRICTED BAND	32
7.6.5.2.2. SPURIOUS & HARMONIC RADIATED EMISSION.....	33
7.7 PEAK POWER SPECTRUL DENSITY	35
7.7.1 OPERATING ENVIRONMENT	35
7.7.2 TEST SET-UP	35
7.7.3 TEST EQUIPMENT USED	35

7.7.4 TEST DATA	35
8. RADIO FREQUENCY EXPOSURE.....	38
8.1 RF EXPOSURE LIMIT	38
8.2 EUT DESCRIPTION.....	38
8.3 TEST RESULT.....	38
9. RADIATED EMISSION TEST.....	39
9.1 OPERATING ENVIRONMENT	39
9.2 TEST SET-UP	39
9.3 TEST EQUIPMENT USED	39
9.4 TEST DATA	40
10. CONDUCTED EMISSION TEST	42
10.1 OPERATING ENVIRONMENT	42
10.2 TEST SET-UP	42
10.3 TEST EQUIPMENT USED	42
10.4 TEST DATA	43

1. VERIFICATION OF COMPLIANCE

APPLICANT : SEWOO TECH CO., LTD.
 ADDRESS : Doosung Bd., 689-20, Kumjung-dong, Kunpo-si, Kyunggi-do, 435-862, Korea
 CONTACT PERSON : Mr. Hyung-Hee, Han / Senior Engineer
 TELEPHONE NO : +82-31-459-8200
 FCC ID : WF5LK-P20B
 MODEL NAME : LK-P20B
 SERIAL NUMBER : N/A
 DATE : July 08, 2008

EQUIPMENT CLASS	<i>DSS – PART 15 SPREAD SPECTRUM TRANSMITTER</i>
KIND OF EQUIPMENT	Mobile Printer
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	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) (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 (a) (2)	Minimum 6dB Bandwidth	Met the Limit / PASS
15.247 (b) (3)	Maximum Peak Conducted Output Power	Met the Limit / PASS
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 / PASS
15.209 and 15.109	Radiated Emission Limits	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 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 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do, 464-862, Korea. Description details of test facilities were submitted to the Federal Communications Commission on August 31, 2005 (Registration Number: 92819 and 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 SEWOO TECH CO., LTD., Model LK-P20B (referred to as the EUT in this report) is a Mobile Printer which has a function of Bluetooth or WLAN module and has ports for USB and RS-232C port. The ports for computing peripheral device shall be subject to DoC procedure and issued by another test report. This report is for Bluetooth function and the report for the WLAN will be issued by other report. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Mobile Printer with Bluetooth
TEMPERATURE RANGE	-20 °C ~ +60 °C
OPERATING FREQUENCY	Bluetooth: 2 402 MHz ~ 2 480 MHz
RF OUTPUT POWER	-0.33 dBm
NUMBER OF CHANNEL	79 Channels
DATA TRANSFER RATE	1 Mbps
MODULATION TYPE	GFSK, DQPSK, and 8DPSK
ANTENNA	MFR.: AMOTECH, Model No.: ALA931C5
ANTENNA CONNECTOR TYPE	Internal Chip Antenna
ANTENNA GAIN	3.50 dBi
LIST OF EACH OSC. OR CRYSTAL. FREQ.(FREQ.>=1 MHz)	16 MHz and 40 MHz on main board 26 MHz on the Bluetooth board
NUMBER OF LAYER	2 Layers: Bluetooth Board, 4 Layers: Main board
EXRERNAL CONNECTOR	USB, RS-232C, DC Power Input Ports

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

-. The following lists consist of the added model and their differences.

	Model Name	Model Differences
Basic Model	LK-P20B	-
Multiple Model	GNPS002B	Only model designation according to buyer's request.

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
Main Board	N/A	LK-P20	N/A
MSR Board	N/A	MSR1050A-3	N/A
MSR Sensor	N/A	N/A	N/A
RC Card Board	SCSpro Co., Ltd.	SCS-IFM1v0	N/A
Bluetooth Board	N/A	MD-4DR	N/A

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
LK-P20B	SEWOO TECH CO., LTD.	WF5LK-P20B	Mobile Printer (EUT)	Test Jig
N/A	N/A	N/A	Test Jig	EUT and Notebook PC
PP10L	Dell Computer	DoC	Notebook PC	Test Jig
MO56UOA	Dell Computer	DoC	Mouse	Notebook PC

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, Bluetooth was set at Low Channel (2 402 MHz), Middle Channel (2 441 MHz), and High Channel (2 480 MHz). To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes. Also the EUT was tested at battery charging mode.

The EUT was tested at each GFSK, DQPSK and 8DPSK modulation, but this test report covers only GFSK, because GFSK modulation has worse RF output level.

5.4 Configuration of Test System

Line Conducted Test: The power cord of the EUT 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.

5.5 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 installed inside of 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)
GFSK	X
DQPSK	-
8DPSK	-

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)
GFSK	X
DQPSK	-
8DPSK	-

7. TEST DATA FOR BLUETOOTH MODE

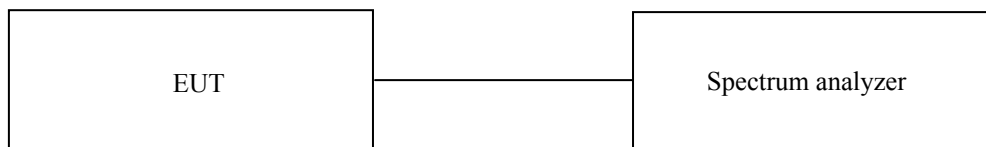
7.1. 20dB BANDWIDTH

7.1.1 Operating environment

Temperature : 24 °C
Relative humidity : 40 %R.H.

7.1.2 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.



7.1.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - 8564E	HP	Spectrum Analyzer	3650A00756	June 19, 2007

All test equipment used is calibrated on a regular basis.

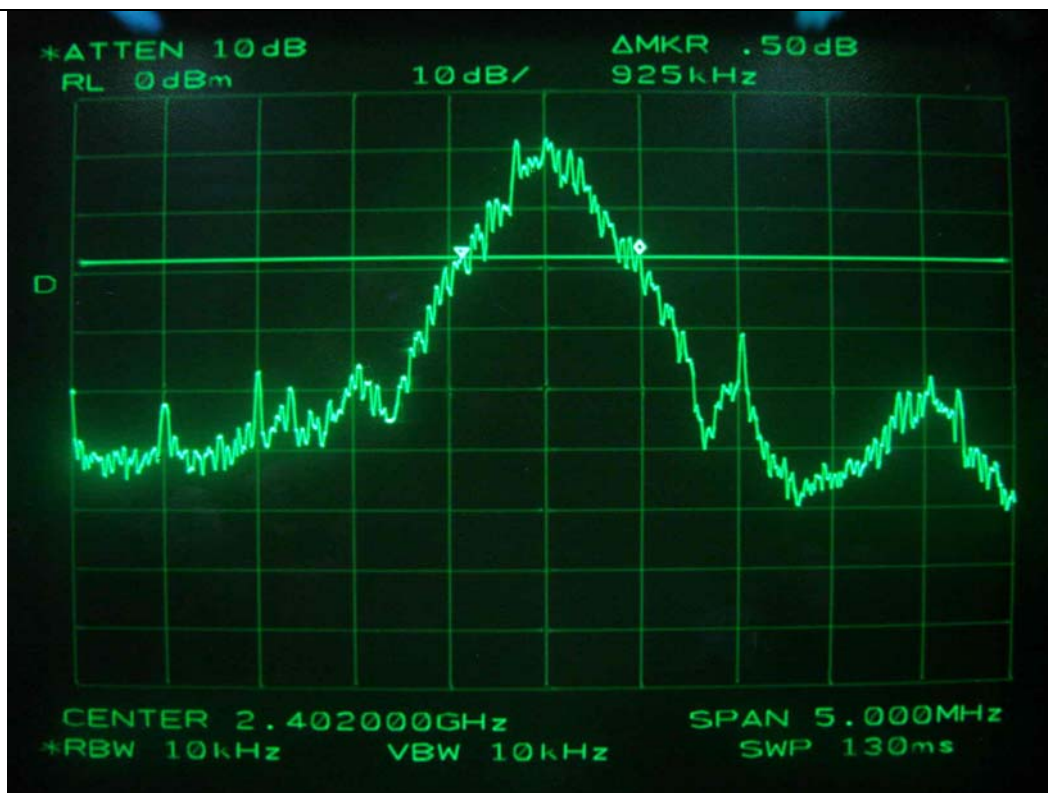
7.1.4 Test data

- Test Date : May 21, 2008
- Test Result : Pass

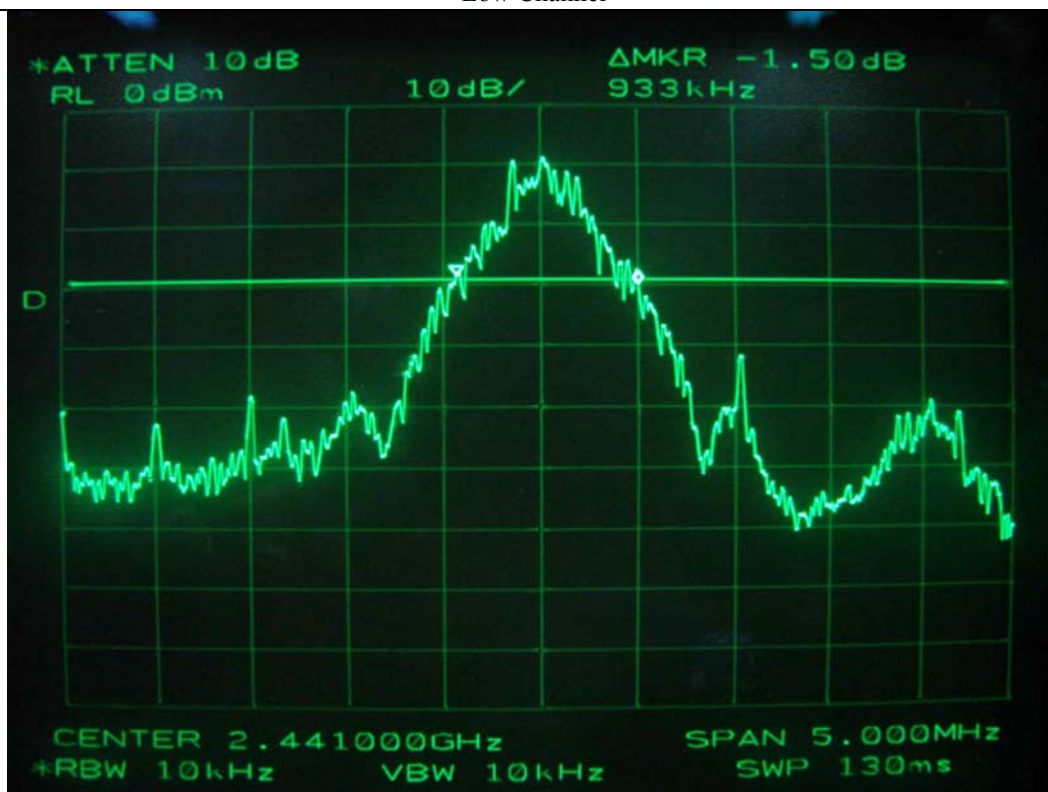
CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (kHz)	LIMIT (kHz)	MARGIN (kHz)
Low	2 402	925	1 000	-75
Middle	2 441	933	1 000	-67
High	2 480	925	1 000	-75

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

Tested by: Ki-Hong, Nam / Project Engineer



Low Channel



Middle Channel



High Channel

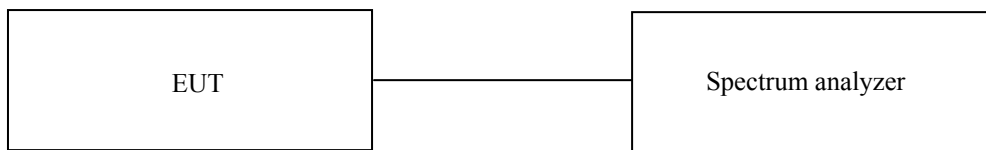
7.2. HOPPING FREQUENCY SEPARATION

7.2.1 Operating environment

Temperature : 24 °C
Relative humidity : 40 %R.H.

7.2.2 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.



7.2.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - 8564E	HP	Spectrum Analyzer	3650A00756	June 19, 2007

All test equipment used is calibrated on a regular basis.

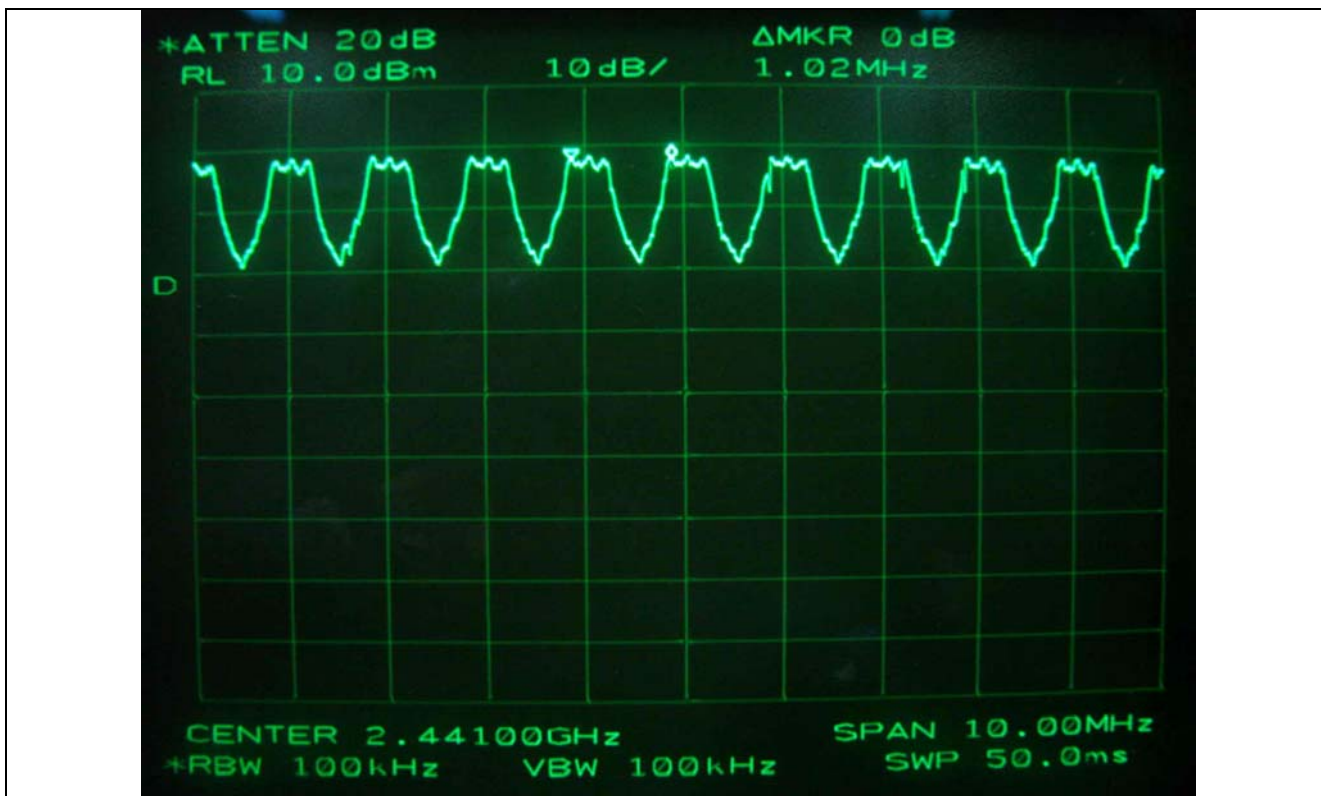
7.2.4 Test data

- Test Date : May 21, 2008
- Test Result : Pass

MEASURED VLAUE (kHz)	LIMIT, 20dB Bandwidth (kHz)	MARGIN (kHz)
1 020	933	-87

기홍

Tested by: Gi-Hong, Nam / Project Engineer



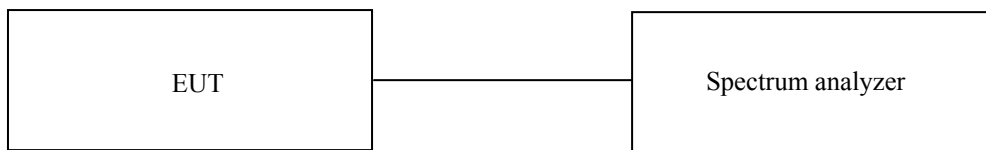
7.3. NUMBER OF HOPPING CHANNELS

7.3.1 Operating environment

Temperature : 24 °C
Relative humidity : 40 %R.H.

7.3.2 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.



7.3.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - 8564E	HP	Spectrum Analyzer	3650A00756	June 19, 2007

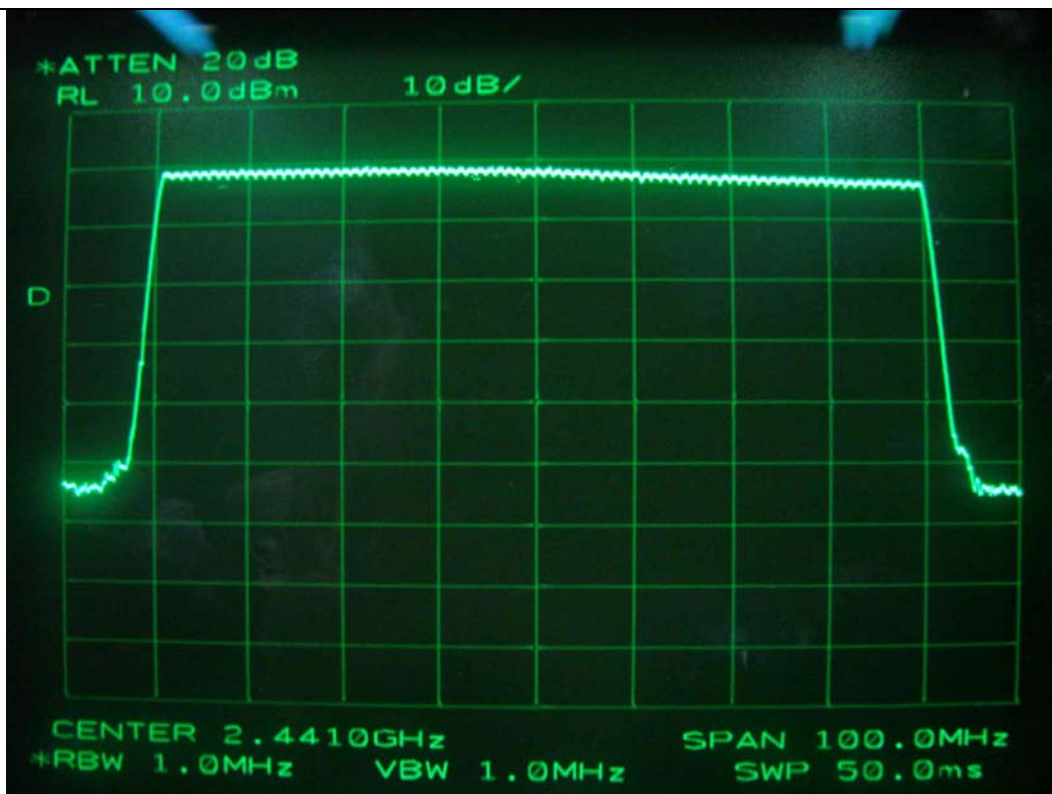
All test equipment used is calibrated on a regular basis.

7.3.4 Test data

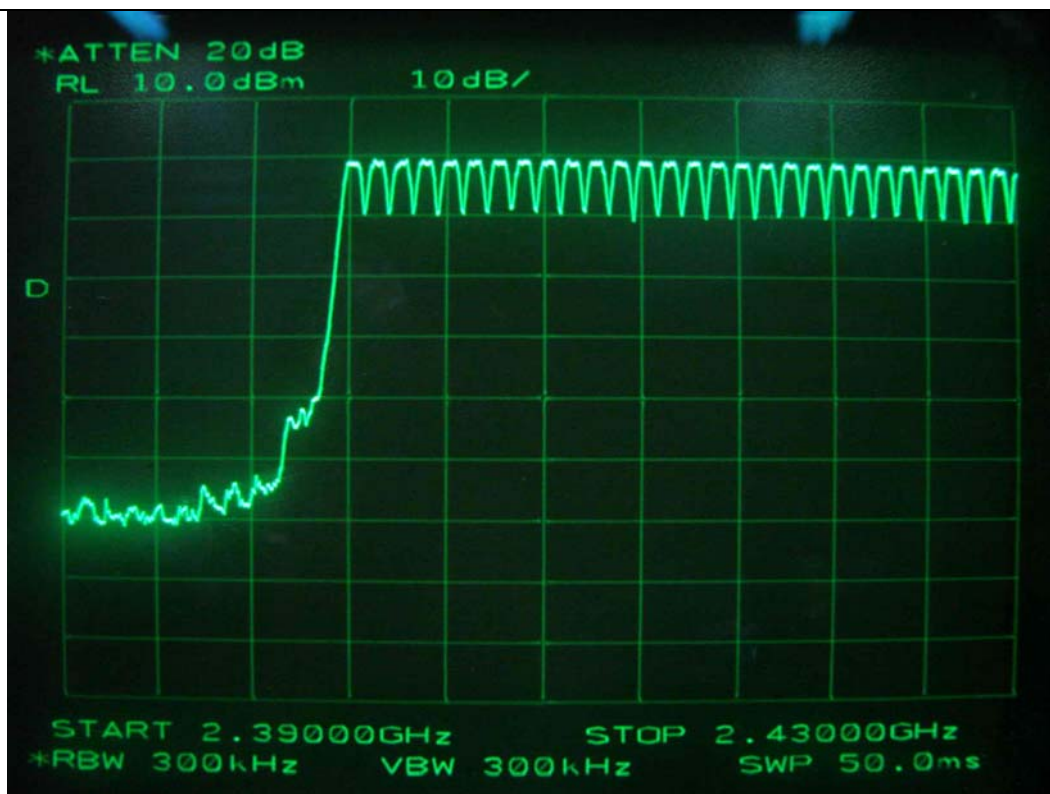
- Test Date : May 21, 2008
- Test Result : Pass

MEASURED VLAUE (Number)	LIMIT (Number)	MARGIN (Number)
79	Minimum of 15	64

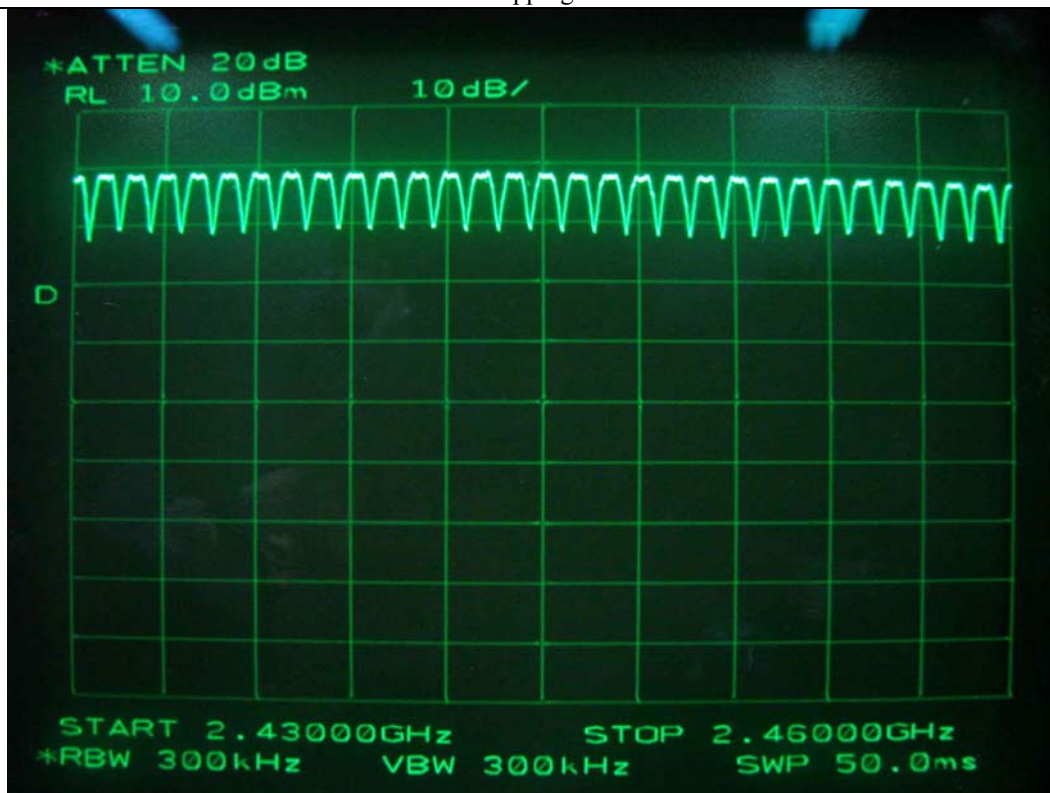
Tested by: Gi-Hong, Nam / Project Engineer



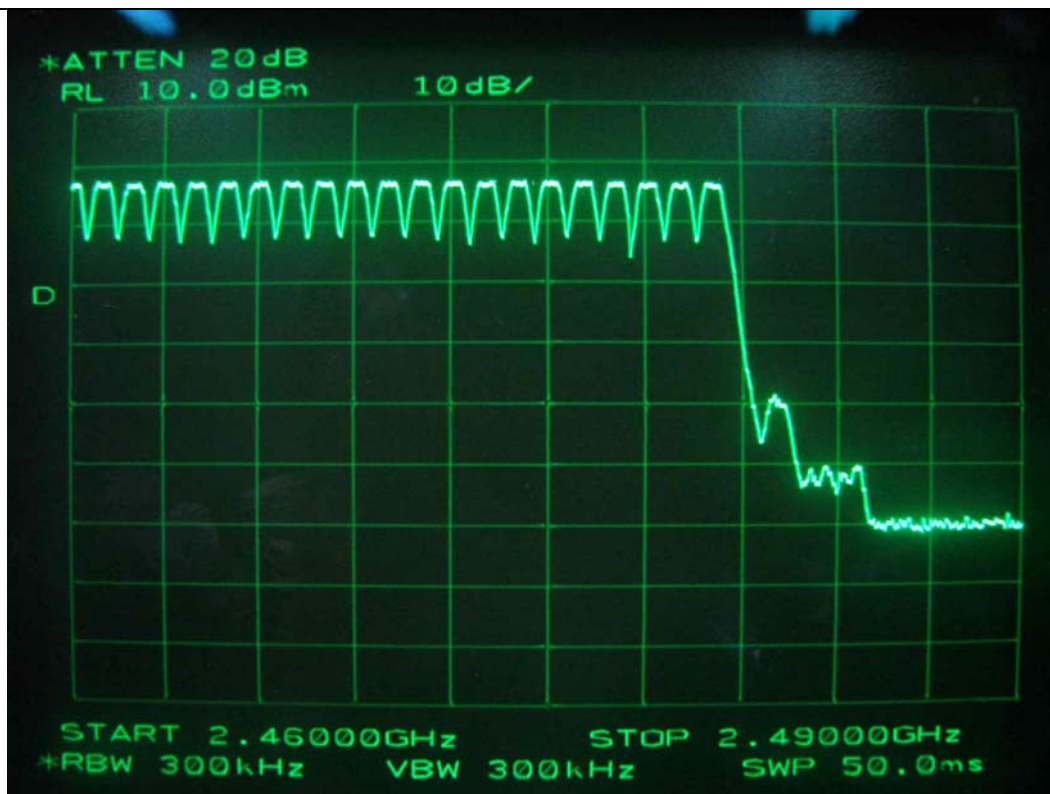
Total number of hopping channel: $28+30+21 = 79$



Number of hopping channel: 28



Number of hopping channel: 30



Number of hopping channel: 21

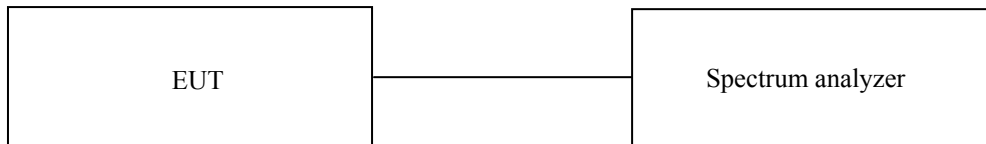
7.4 TIME OF OCCUPANCY

7.4.1 Operating environment

Temperature : 24 °C
Relative humidity : 40 %R.H.

7.4.2 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.



7.4.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	8564E	HP	Spectrum Analyzer	3650A00756	June 19, 2007

All test equipment used is calibrated on a regular basis.

7.4.4 Test data

- Test Date : May 21, 2008

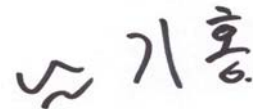
The system makes worst case 1600 hops per second or 1 time slot has a length of 625us with 79 channels.

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 5 times 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.

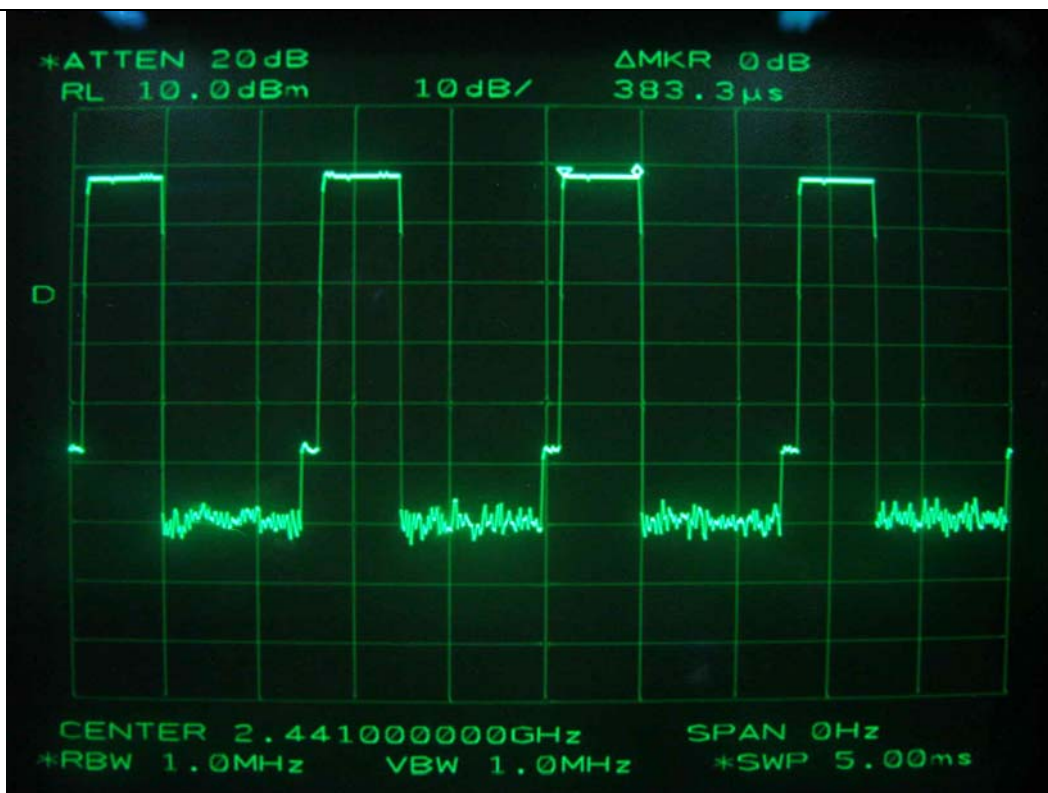
Packet Type	Pulse Time (ms)	Hops per second with channels	Period Time (ms)	Total Dwell Time (ms)	Limit (ms)	Test Result
DH1	0.383 3	10.13	31.6	122.70	400	PASS
DH3	1.633 0	5.06	31.6	261.11	400	PASS
DH5	2.900 0	3.38	31.6	309.74	400	PASS

Total dwell time is calculated as following.

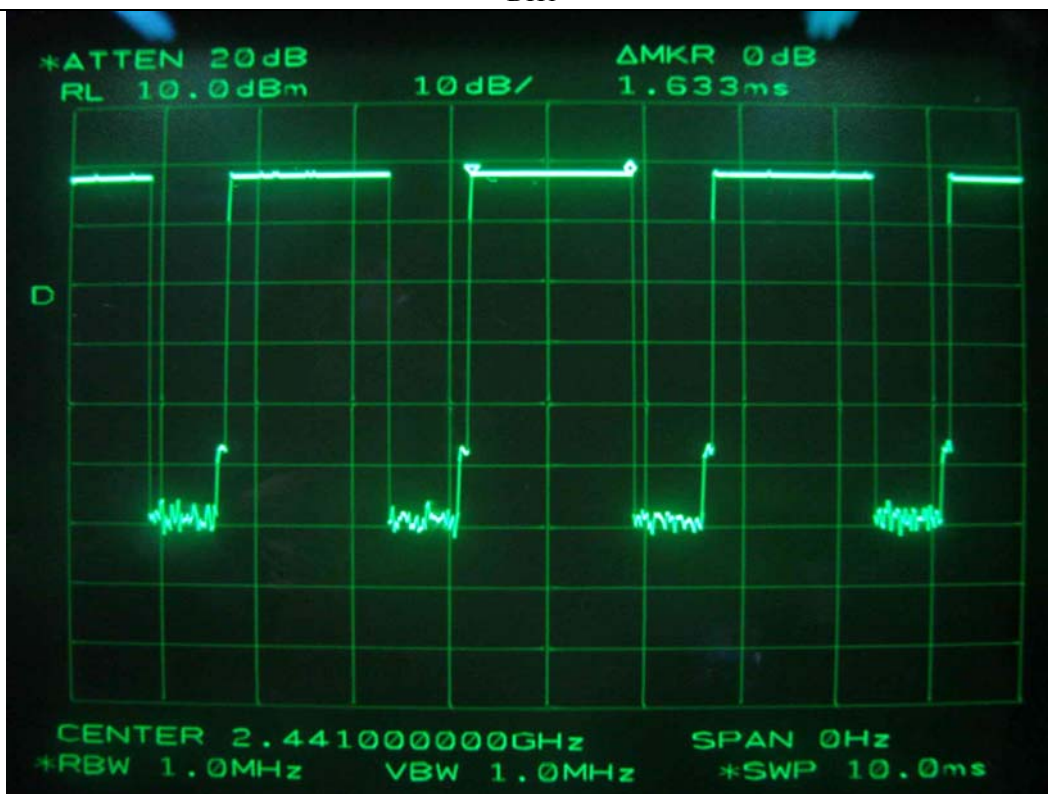
Total Dwell Time = Pulse time * Hops per second with channels * period time



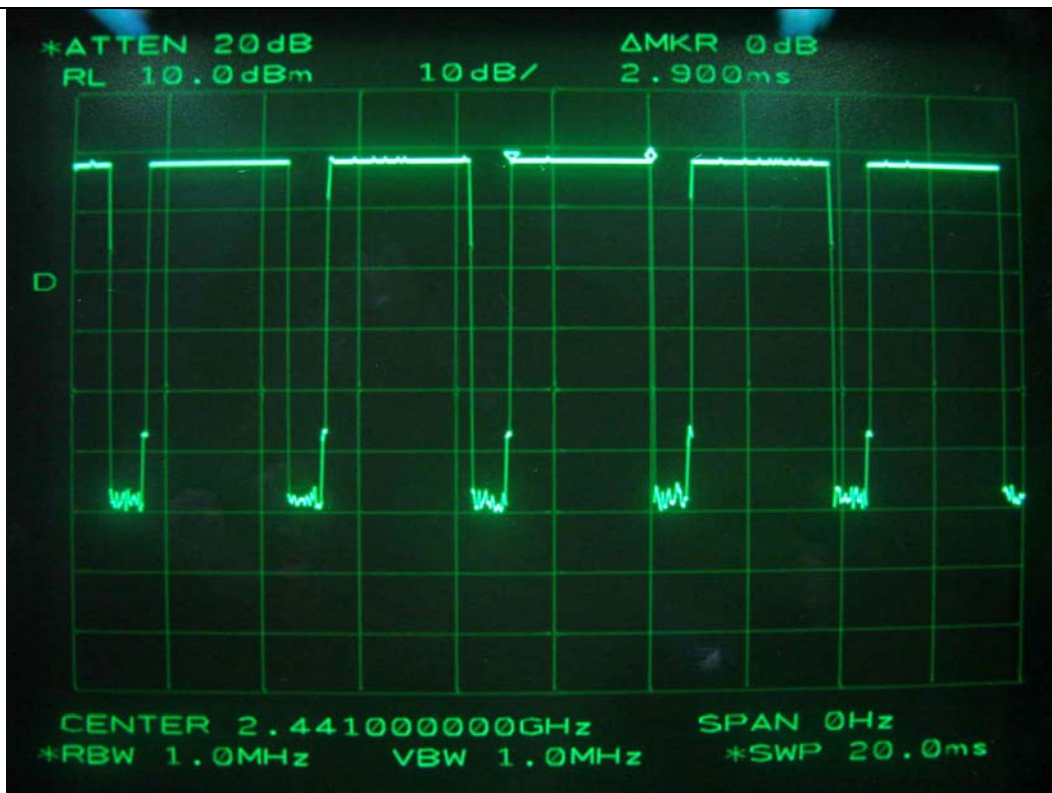
Tested by: Gi-Hong, Nam / Project Engineer



DH1



DH3



DH5

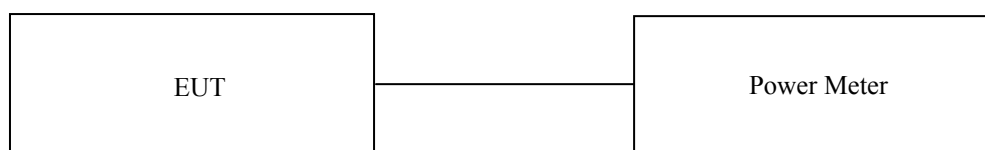
7.5 MAXIMUM PEAK OUTPUT POWER

7.5.1 Operating environment

Temperature : 24 °C
Relative humidity : 40 %R.H.

7.5.2 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.



7.5.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - 8564E	HP	Spectrum Analyzer	3650A00756	June 19, 2007

All test equipment used is calibrated on a regular basis.

7.5.4 Test data

-. Test Date : May 21, 2008

-. Test Result : Pass

7.5.4.1 Test result at GFSK Modulation

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402	-0.33	30.0	-30.33
Middle	2 441	-1.00	30.0	-31.00
High	2 480	-3.00	30.0	-33.00

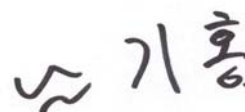
7.5.4.2 Test result at DQPSK Modulation

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402	-1.03	30.0	-31.03
Middle	2 441	-1.90	30.0	-31.90
High	2 480	-3.12	30.0	-33.12

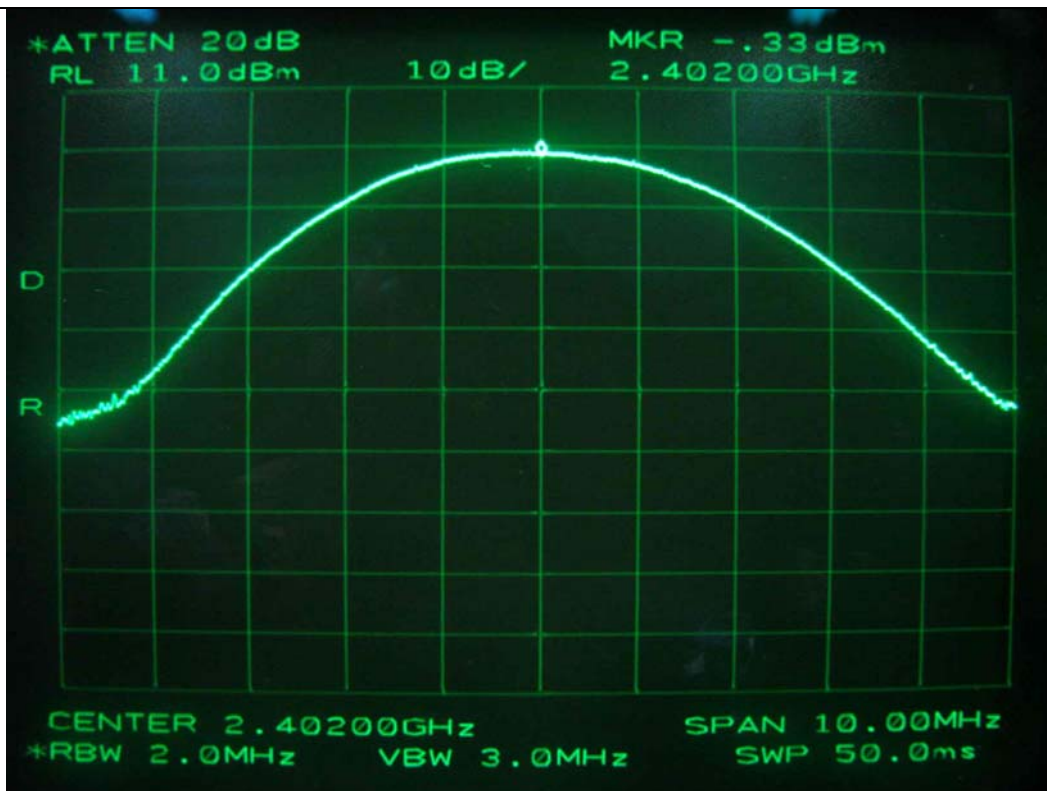
7.5.4.3 Test result at 8DPSK Modulation

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402	-1.60	30.0	-31.60
Middle	2 441	-1.99	30.0	-31.99
High	2 480	-3.24	30.0	-33.24

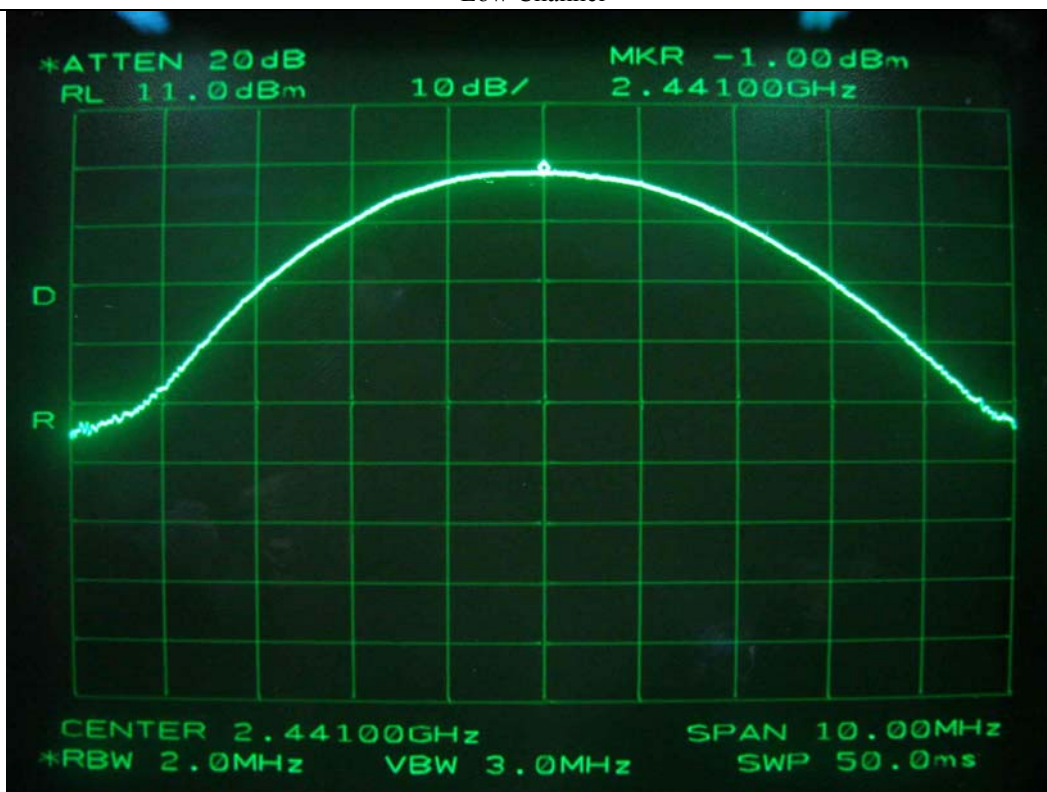
Acc. to above test result, only test data for GFSK Modulation was captured in this test report.



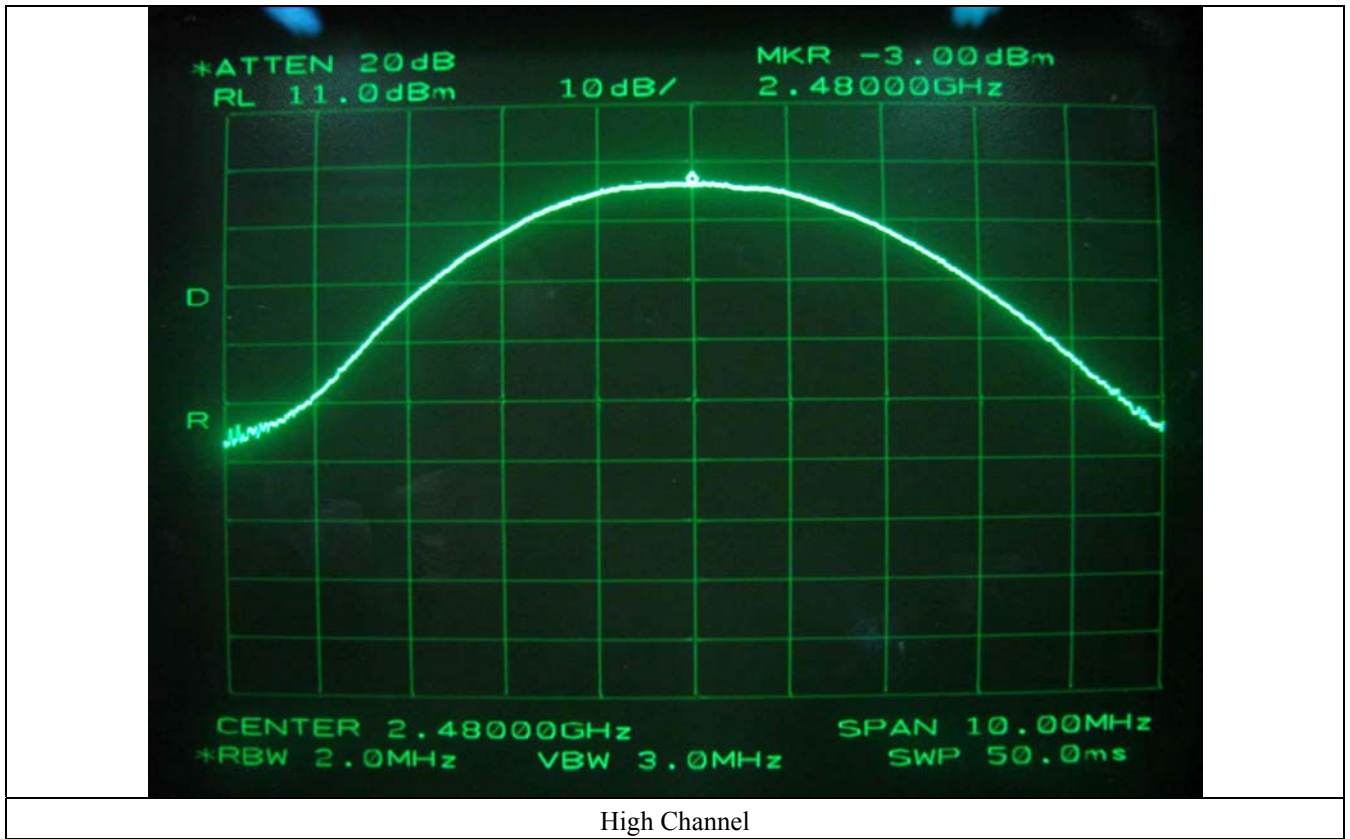
Tested by: Gi-Hong, Nam / Project Engineer



Low Channel



Middle Channel



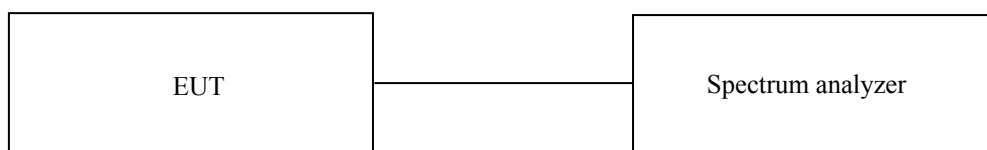
7.6 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

7.6.1 Operating environment

Temperature : 27 °C
Relative humidity : 47 %R.H.

7.6.2 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.



7.6.3 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.

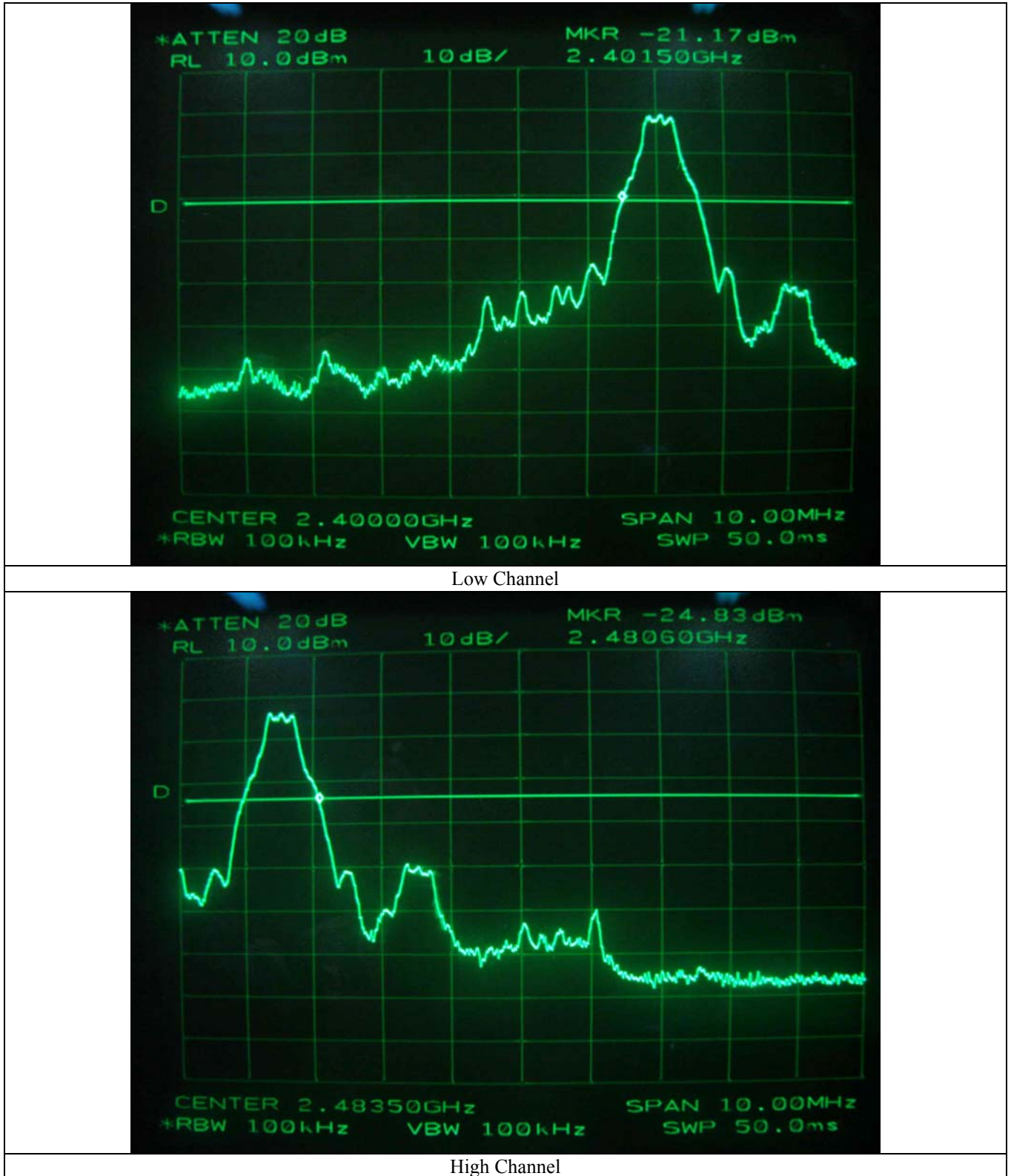
7.6.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	8564E	Hewlett-Packard	Spectrum Analyzer	3650A00756	June 19, 2007
■ -	8447D	Hewlett-Packard	Amplifier	2727A04987	June 19, 2007
□ -	83051A	Agilent	Preamplifier	3950M00201	June 20, 2007
■ -	F-40-5000-RF	RLC Electronics	Highpass Filter	0425	July 15, 2007
■ -	MA220	HD	Turn Table	N/A	N/A
■ -	HD240	HD	Antenna Mast	N/A	N/A
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D294	July 03, 2006(2Y)
■ -	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.

7.6.5. Test data

7.6.5.1. Test data for conducted emission

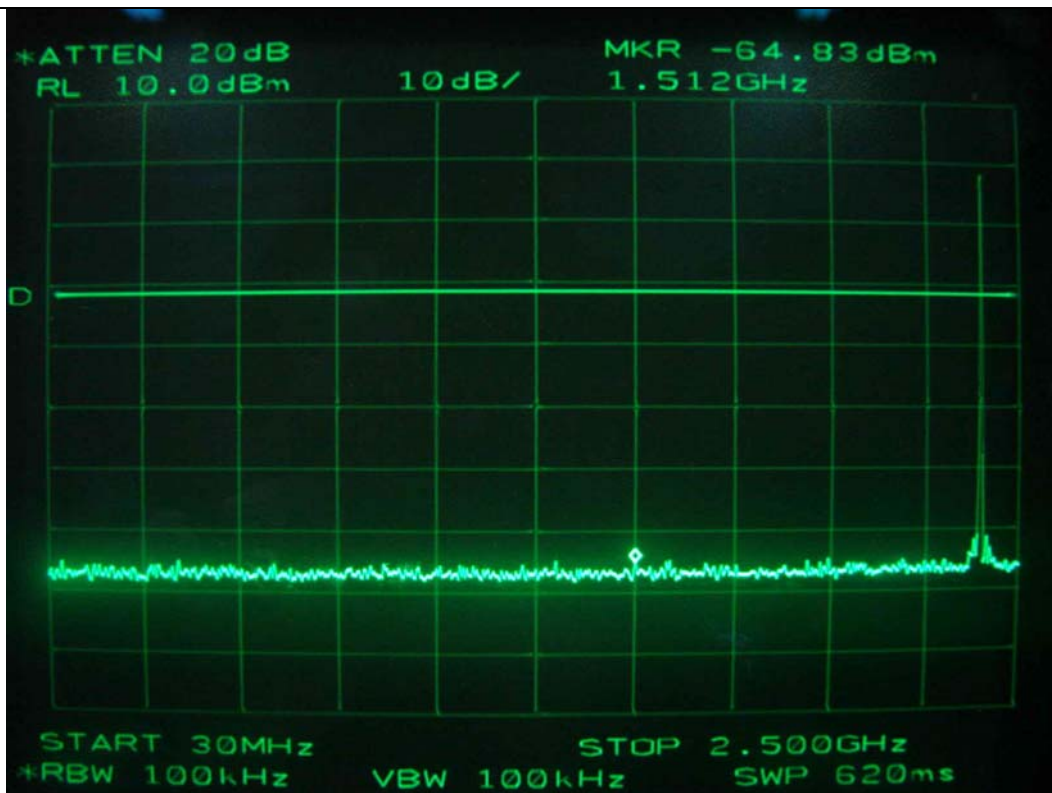


It should not be reproduced except in full, without the written approval of ONETECH.

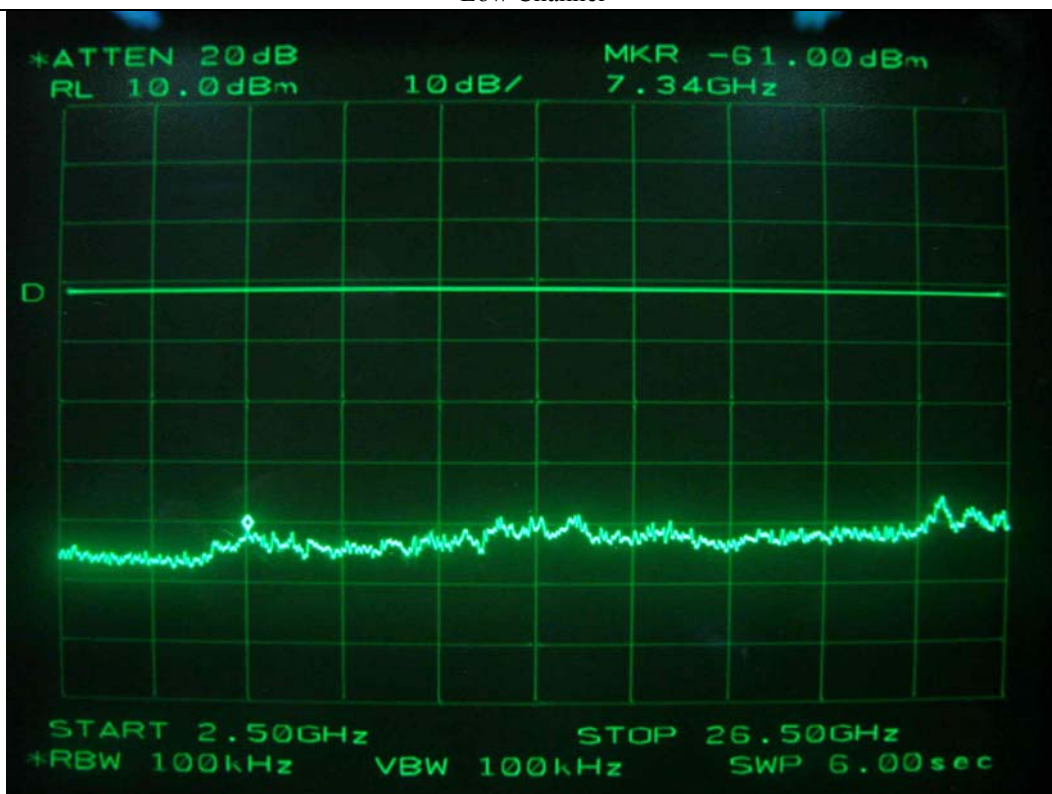
EMC-003 (Rev.1)

HEAD OFFICE : #505 SK Apt. Factory 223-28, Sangdaewon1-dong, Jungwon-gu, Seongnam-si, Gyeonggi-do 462-705 Korea
(TEL: +82-31-746-8500, FAX: +82-31-746-8700)

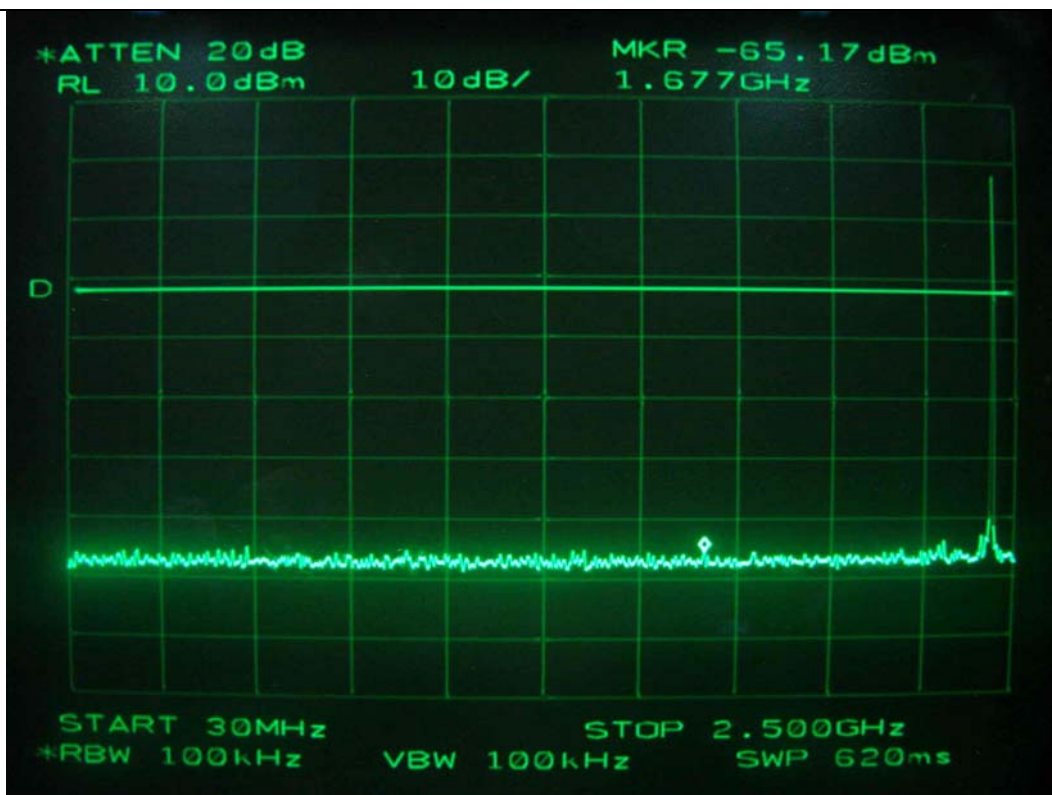
EMC Testing Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea. (TEL: +82-31-765-8289, FAX: +82-31-766-2904)



Low Channel



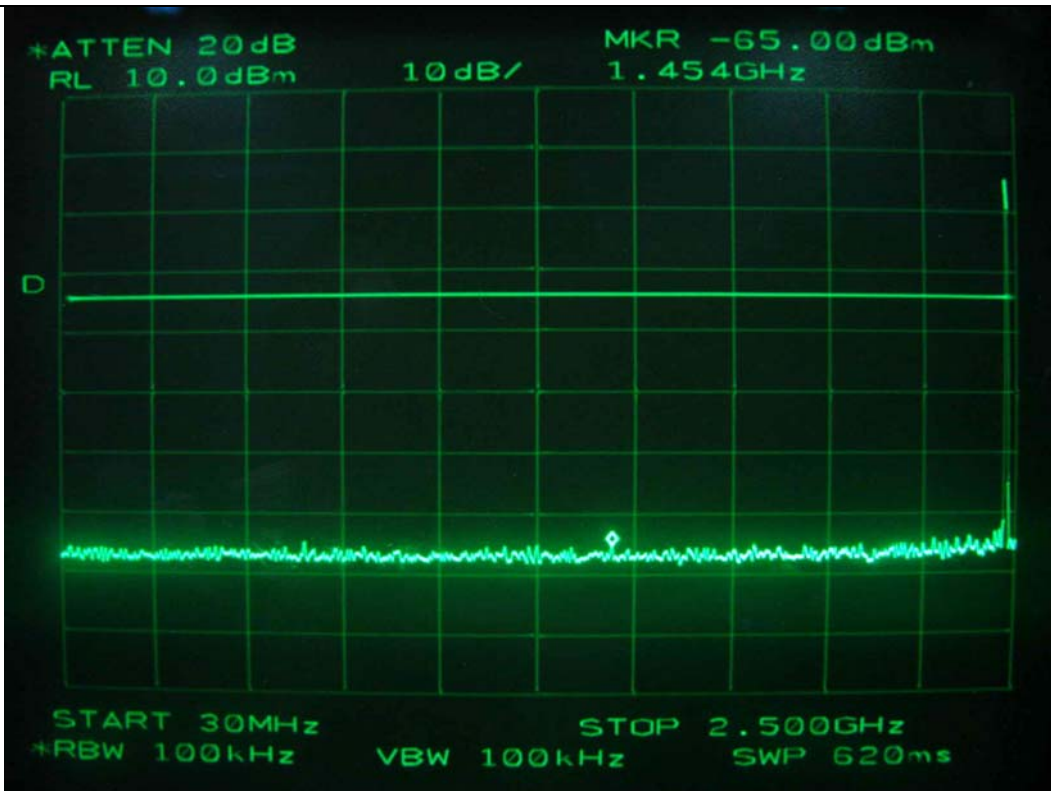
Low Channel



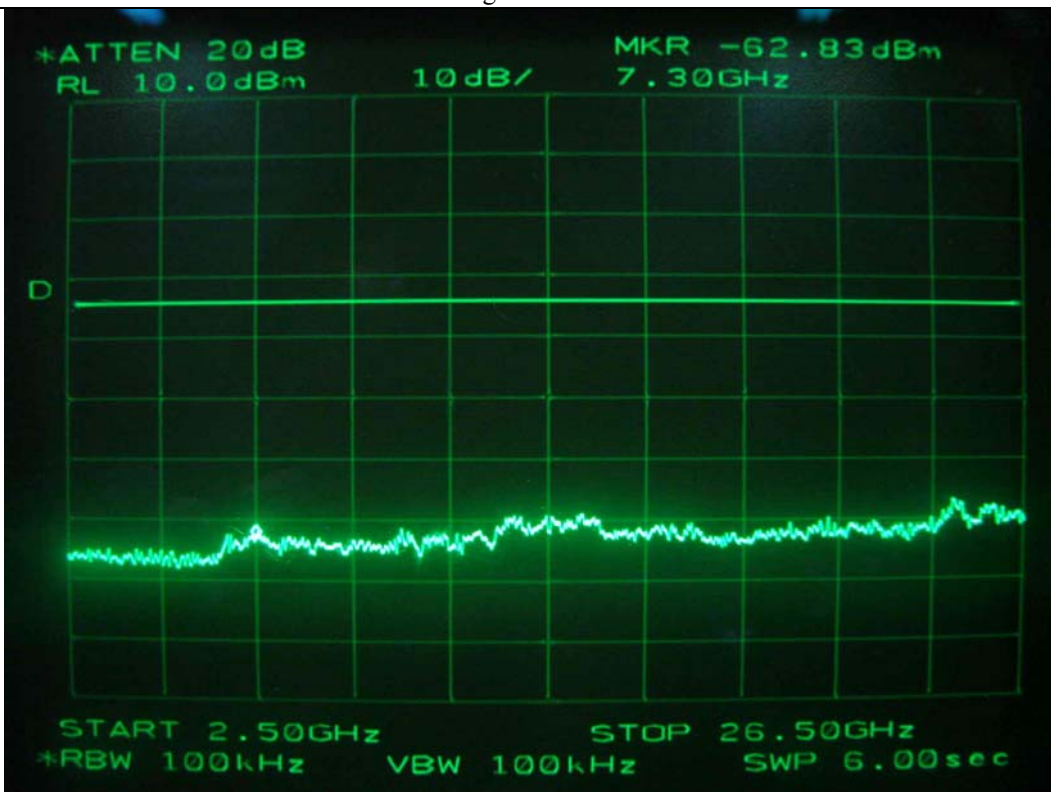
Middle Channel



Middle Channel



High Channel



High Channel

7.6.5.2. Test data for radiated emission

7.6.5.2.1. Radiated Emission which fall in the Restricted Band

- Test Date : May 23, 2008
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 25 GHz
- Measurement distance : 1 m
- Operating Condition : Low / High Channel
- Result : PASSED

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									
2 390.00	34.33	Peak	H	27.26	3.83	26.1	39.32	74.0	-34.68
	24.83	Average	H				29.82	54.0	-24.18
	34.00	Peak	V				38.99	74.0	-35.01
	24.67	Average	V				29.66	54.0	-24.34
Test Data for High Channel									
2 483.50	34.00	Peak	H	27.55	3.83	26.1	39.28	74.0	-34.73
	25.33	Average	H				30.61	54.0	-23.40
	34.17	Peak	V				39.45	74.0	-34.56
	25.50	Average	V				30.78	54.0	-23.23

Tabulated test data for Restricted Band

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

기홍

Tested by: Gi-Hong, Nam / Project Engineer

7.6.5.2.2. Spurious & Harmonic Radiated Emission

- Test Date : May 23, 2008
- 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, 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 25 GHz
- Measurement distance : 1 m
- Result : PASSED

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									
2 402.00	59.00	Peak	H	27.30	3.83		90.13	-	
	59.33	Peak	V				90.46	-	
4 804.00*	33.33	Peak	H	31.60	6.54	26.10	45.37	74.00	-28.63
	25.00	Average	H				37.04	54.00	-16.96
	33.50	Peak	V				45.54	74.00	-28.46
	25.17	Average	V				37.21	54.00	-16.79
Test Data for Middle Channel									
2 441.00	60.83	Peak	H	27.42	3.83		92.08	-	
	61.50	Peak	V				92.75	-	
4 882.00*	33.17	Peak	H	31.74	6.59	26.10	45.40	74.00	-28.60
	24.67	Average	H				36.90	54.00	-17.10
	33.50	Peak	V				45.73	74.00	-28.27
	25.00	Average	V				37.23	54.00	-16.77

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	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Test Data for High Channel									
2 480.00	59.33	Peak	H	27.53	3.83		90.69	-	
	60.00	Peak	V				91.36	-	
4 960.00*	33.33	Peak	H	31.87	6.64	26.10	45.74	74.00	-28.26
	24.83	Average	H				37.24	54.00	-16.76
	33.67	Peak	V				46.08	74.00	-27.92
	25.00	Average	V				37.41	54.00	-16.59

Tabulated test data for Restricted Band

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



Tested by: Gi-Hong, Nam / Project Engineer

7.7 PEAK POWER SPECTRUL DENSITY

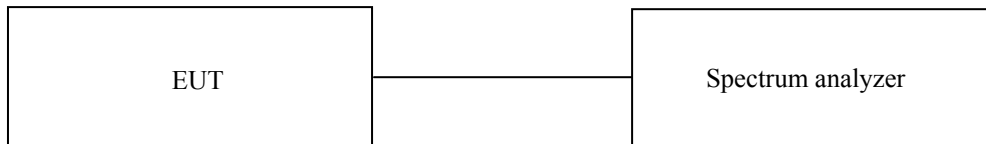
7.7.1 Operating environment

Temperature : 24 °C
Relative humidity : 40 %R.H.

7.7.2 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.



7.7.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - 8564E	HP	Spectrum Analyzer	3650A00756	June 19, 2007

All test equipment used is calibrated on a regular basis.

7.7.4 Test data

- Test Date : May 21, 2008
- Result : PASSED BY -21.50 dB at Low Channel

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402	-13.50	8.00	-21.50
Middle	2 441	-14.83	8.00	-22.83
High	2 480	-15.17	8.00	-23.17

Tabulated test data for Peak Power Spectral Density.

Remark: See next page for measurement data.

기홍

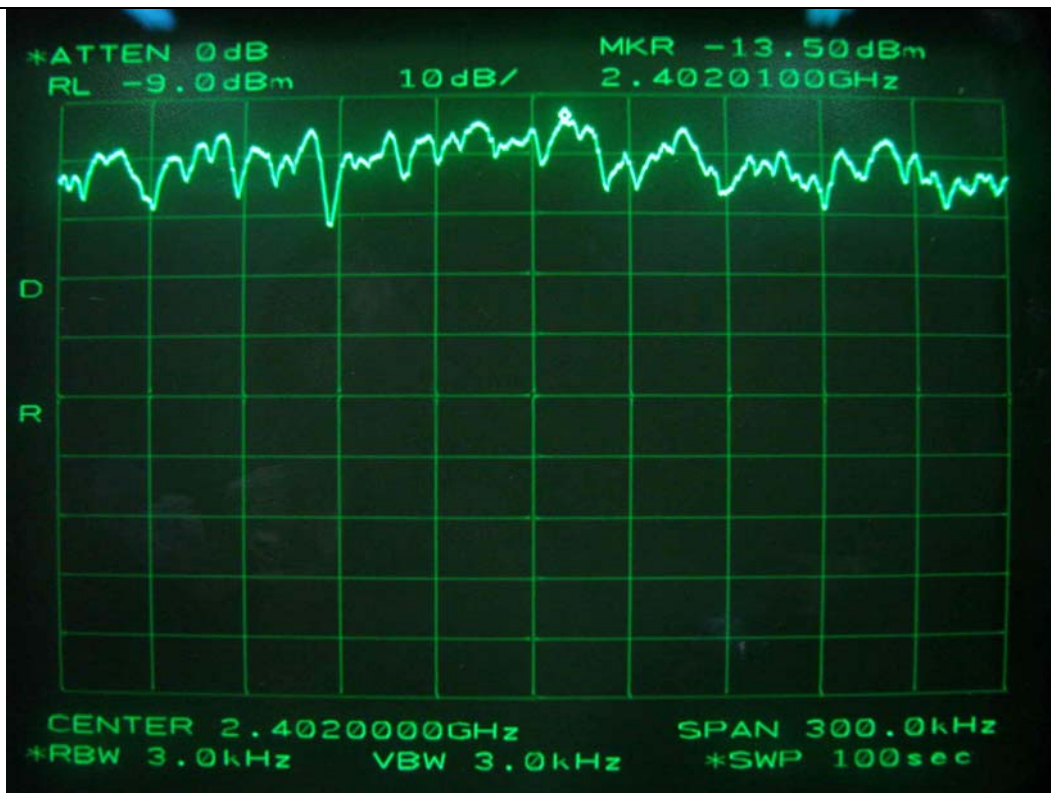
Tested by: Gi-Hong, Nam / Project Engineer

It should not be reproduced except in full, without the written approval of ONETECH.

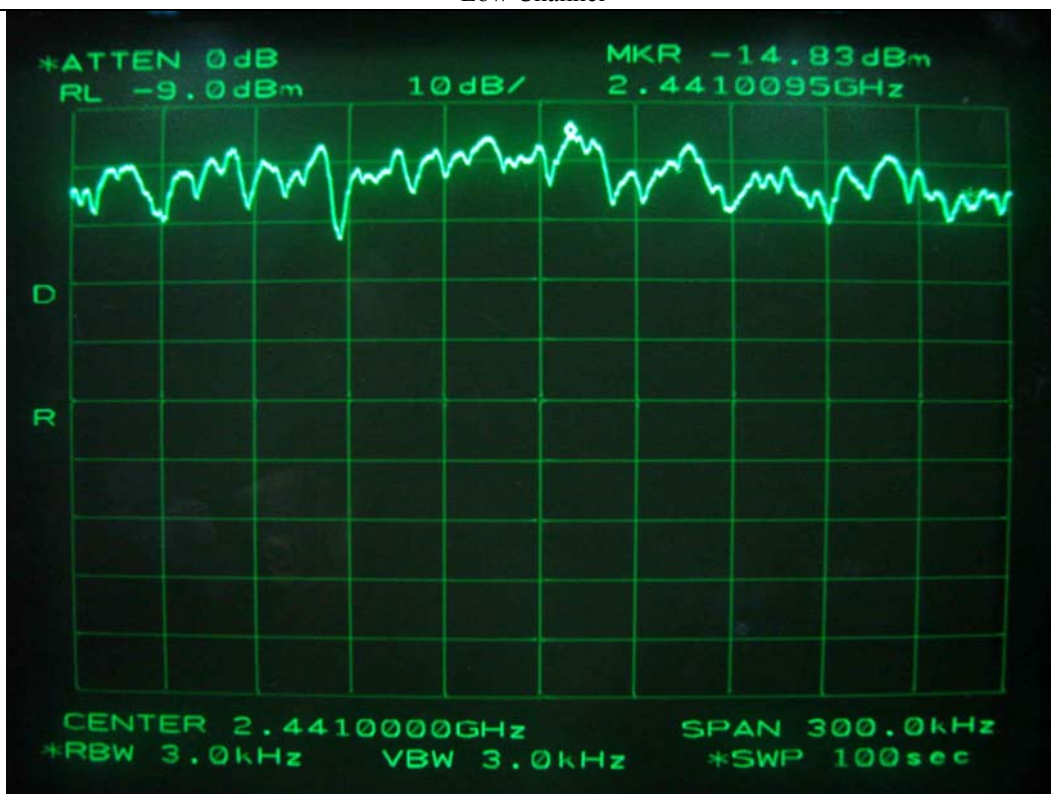
EMC-003 (Rev.1)

HEAD OFFICE : #505 SK Apt. Factory 223-28, Sangdaewon1-dong, Jungwon-gu, Seongnam-si, Gyeonggi-do 462-705 Korea
(TEL: +82-31-746-8500, FAX: +82-31-746-8700)

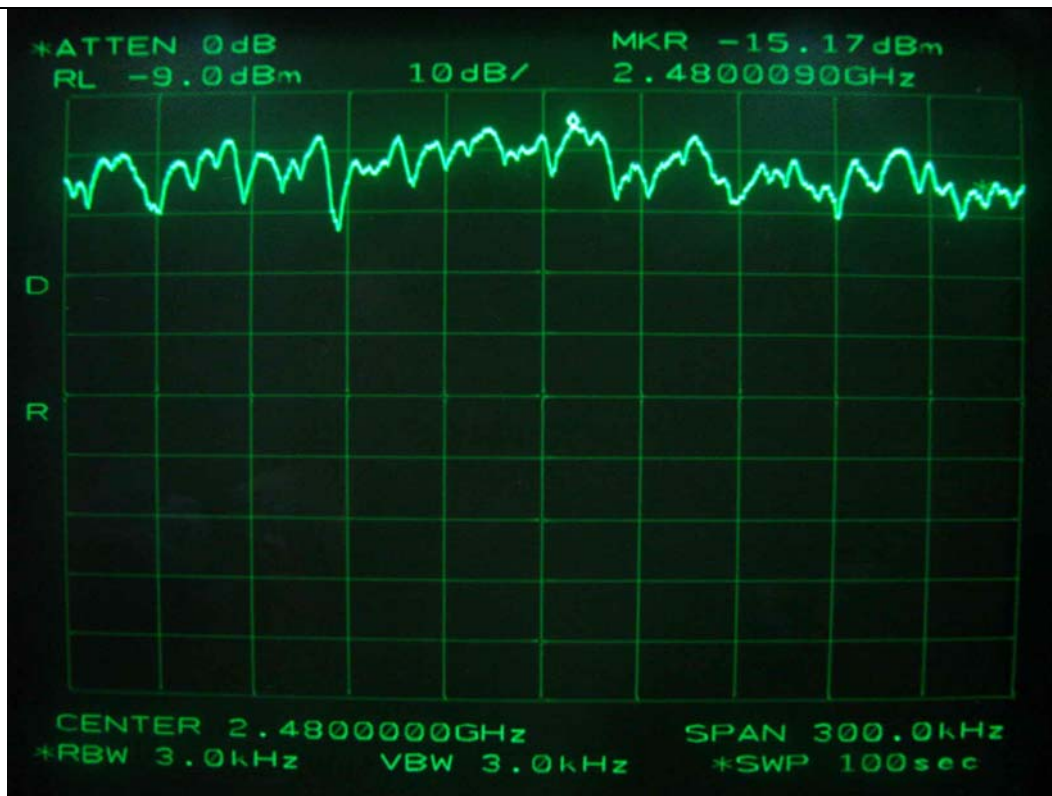
EMC Testing Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea. (TEL: +82-31-765-8289, FAX: +82-31-766-2904)



Low Channel



Middle Channel



High Channel

8. RADIO FREQUENCY EXPOSURE

8.1 RF Exposure Limit

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

8.2 EUT Description

Kind of EUT	Mobile Printer with Bluetooth
Operating Frequency Band	<input type="checkbox"/> WLAN: 2 400 ~ 2 483.5 MHz <input type="checkbox"/> WLAN: 5 180 ~ 5 320 MHz / 5 500 ~ 5 700 MHz <input type="checkbox"/> WLAN: 5 745 ~ 5 825 MHz <input checked="" type="checkbox"/> Bluetooth: 2 400 ~ 2 483.5 MHz
Device Category	<input checked="" type="checkbox"/> Portable (<20 cm separation) <input type="checkbox"/> Mobile (>20 cm separation) <input type="checkbox"/> Others
Max. Output Power	-0.33 dBm (0.93mW)
Used Antenna	Internal Chip Antenna
Used Antenna Gain	3.50 dBi
Exposure Evaluation Applied	<input type="checkbox"/> MPE <input type="checkbox"/> SAR <input checked="" type="checkbox"/> N/A

8.3 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:

$$60/f(\text{GHz}) = 60/2.480 = 24.19\text{mW}.$$

So, the device meets the RF exposure requirement.

9. RADIATED EMISSION TEST

9.1 Operating environment

Temperature : 27 °C
Relative humidity : 47 %R.H.

9.2 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 30 MHz to 1 000 MHz 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.

9.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	ESVS10	Rohde & Schwarz	EMI Test Receiver	827864/005	Dec. 21, 2007
■ -	8566B	HP	Spectrum Analyzer	3407A08547	June 20, 2007
■ -	8447D	Hewlett Packard	Amplifier	2727A04987	June 19, 2007
■ -	MA240	HD GmbH	Antenna Master	N/A	N/A
■ -	HD100	HD GmbH	Position Controller	N/A	N/A
■ -	DS420S	HD GmbH	Turn Table	N/A	N/A
■ -	VHA9103	Schwarzbeck	Biconical Antenna	91031852	Feb. 13, 2008
■ -	9108-A(494)	Schwarzbeck	Log Periodic Antenna	62281001	Feb. 13, 2008

All test equipment used is calibrated on a regular basis.

9.4 Test data

- Test Date : May 23, 2008
- Resolution bandwidth : 120 kHz
- Frequency range : 30 MHz ~ 1 000 MHz
- Measurement distance : 3 m
- Result : PASSED
- Channel : Low

Frequency (MHz)	Reading (dBuV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
142.98	17.30	V	14.72	2.56	34.58	43.52	-8.94
188.44	16.50	H	15.99	2.76	35.25	43.52	-8.27
335.62	13.50	V	15.29	3.51	32.30	46.02	-13.72
357.40	20.00	H	15.65	3.67	39.32	46.02	-6.70
430.28	18.33	H	16.91	4.28	39.52	46.02	-6.50
529.61	19.50	H	19.10	4.90	43.50	46.02	-2.52

Tabulated test data for Radiated Electromagnetic Field

- Channel : Middle

Frequency (MHz)	Reading (dBuV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
142.98	17.17	V	14.72	2.56	34.45	43.52	-9.07
188.44	16.33	H	15.99	2.76	35.08	43.52	-8.44
335.62	13.67	V	15.29	3.51	32.47	46.02	-13.55
357.40	19.83	H	15.65	3.67	39.15	46.02	-6.87
430.28	18.50	H	16.91	4.28	39.69	46.02	-6.33
529.61	19.33	H	19.10	4.90	43.33	46.02	-2.69


Tabulated test data for Radiated Electromagnetic Field

-. Channel : High

Frequency (MHz)	Reading (dBuV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
142.98	17.50	V	14.72	2.56	34.78	43.52	-8.74
188.44	16.25	H	15.99	2.76	35.00	43.52	-8.52
335.62	14.00	V	15.29	3.51	32.80	46.02	-13.22
357.40	20.17	H	15.65	3.67	39.49	46.02	-6.53
430.28	18.33	H	16.91	4.28	39.52	46.02	-6.50
529.61	19.67	H	19.10	4.90	43.67	46.02	-2.35

Tabulated test data for Radiated Electromagnetic Field

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



Tested by: Gi-Hong, Nam / Project Engineer

10. CONDUCTED EMISSION TEST

10.1 Operating environment

Temperature : 24 °C
Relative humidity : 34 %R.H.

10.2 Test set-up

The EUT was placed on a wooden table, 0.8 meters height above the floor. The EUT was connected to AC/DC adaptor and the power of AC/DC adaptor was connected through a 50 ohm/ 50 uH + 5 ohm Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

10.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	ESHS10	Rohde & Schwarz	EMI Test Receiver	834467/007	May 13, 2008
■ -	NSLK 8128	Schwarzbeck	AMN	8128-216	July 04, 2007
□ -	3825/2	EMCO	AMN	9109-1867	June 16, 2008

All test equipment used is calibrated on a regular basis.

10.4 Test data

- . Type of Test : Intentional Radiator
- . Test Date : May 23, 2008
- . Resolution bandwidth : 9 kHz
- . Frequency range : 0.15 MHz ~ 30 MHz
- . Test Result : PASSED BY -27.62 dB at 4.25 MHz

Frequency (MHz)	Line	Peak (dBuV)		Margin (dB)
		Emission level	Q.P Limits	
0.15	N	34.19	65.73	-31.54
0.16	H	32.47	65.21	-32.74
3.23	H	21.88	56.00	-34.12
3.70	N	22.48	56.00	-33.52
4.25	H	28.38	56.00	-27.62
5.05	N	26.84	60.00	-33.16
Frequency (MHz)	Line	Average (dBuV)		Margin (dB)
		Emission level	Limits	
-				
-				

Line Conducted Emissions Tabulated Data

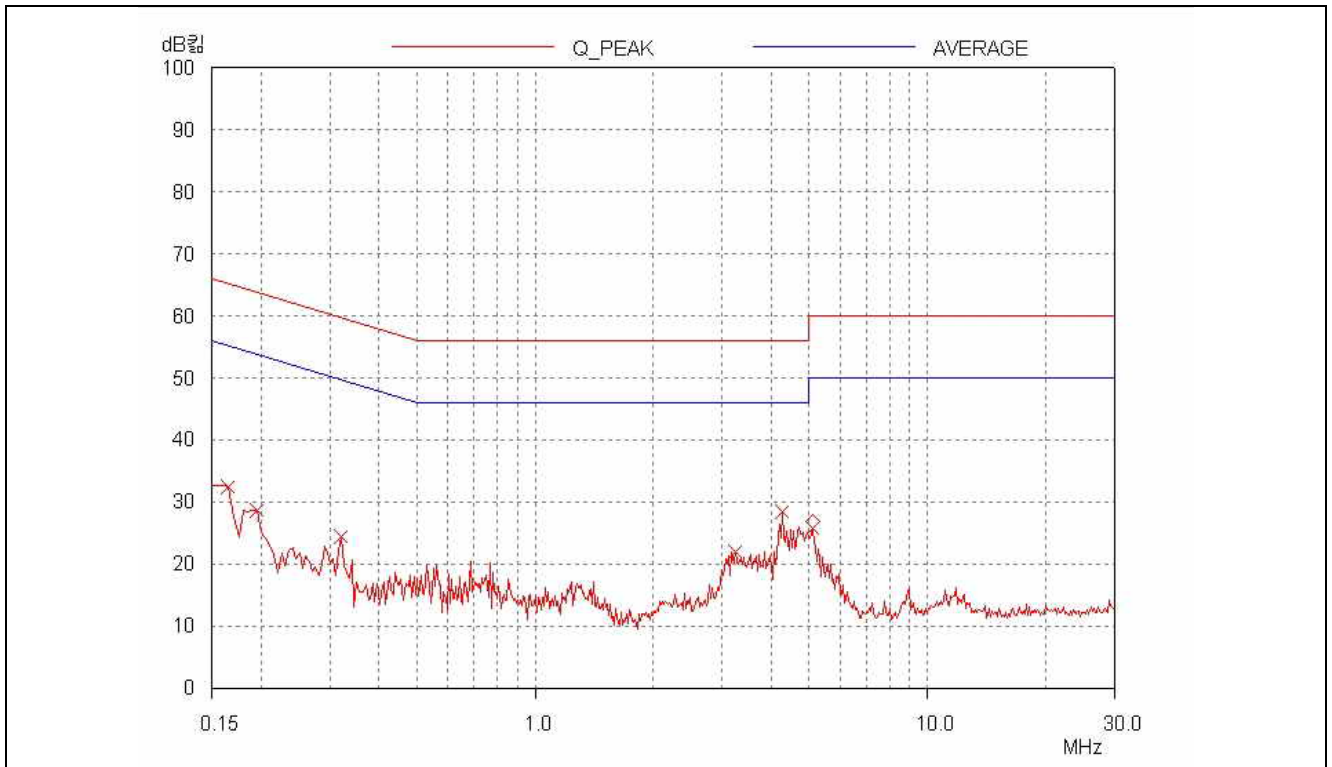
Remark : “H”: Hot Line, “N”: Neutral line

Average mode was not measured, because peak values were under the Average limit.

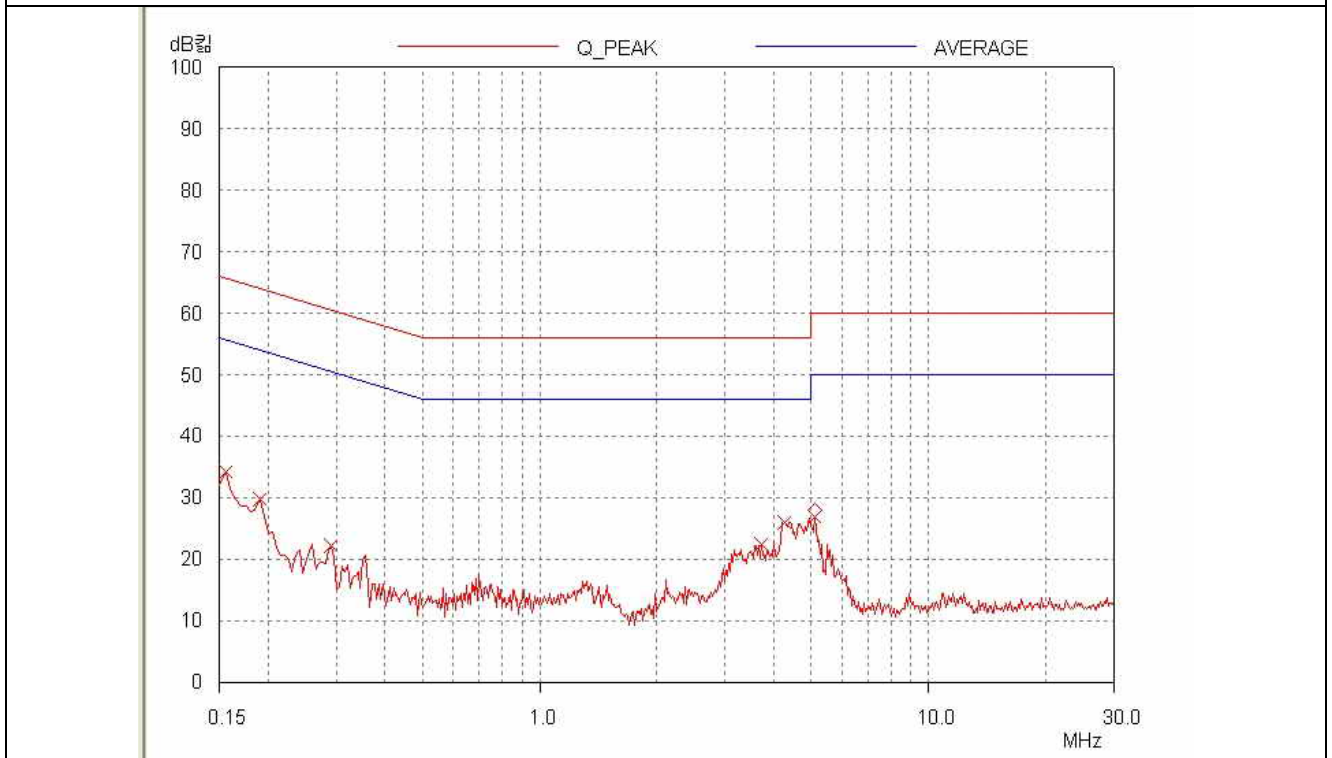
See next page for an overview sweep performed with peak detector modes.

기홍

Tested by: Gi-Hong, Nam / Project Engineer



HOT LINE



NEUTRAL LINE

It should not be reproduced except in full, without the written approval of ONETECH.

EMC-003 (Rev.1)

HEAD OFFICE : #505 SK Apt. Factory 223-28, Sangdaewon1-dong, Jungwon-gu, Seongnam-si, Gyeonggi-do 462-705 Korea
(TEL: +82-31-746-8500, FAX: +82-31-746-8700)

EMC Testing Dept : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea. (TEL: +82-31-765-8289, FAX: +82-31-766-2904)