

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


**Test Report No.** : E08OR-011  
**AGR No.** : A088A-082  
**Applicant** : XROAD CO., LTD.  
**Address** : 9F, DooWon B/D, 503-5, Sinsa-dong, Gangnam-gu, Seoul, 135-746, Korea  
**Manufacturer** : XROAD CO., LTD.  
**Address** : 9F, DooWon B/D, 503-5, Sinsa-dong, Gangnam-gu, Seoul, 135-746, Korea  
**Type of Equipment** : Portable GPS Navigation Device  
**FCC ID.** : WST-MI4300  
**Model Name** : MI4300  
**Multiple Model Name** : MI4350XT, MI4300XT, MI4350X, MI4300X  
**Serial number** : N/A  
**Total page of Report** : 71 pages (including this page)  
**Date of Incoming** : August 27, 2008  
**Date of issue** : October 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

<b>1. VERIFICATION OF COMPLIANCE .....</b>	<b>5</b>
<b>2. TEST SUMMARY.....</b>	<b>6</b>
<b>2.1 TEST ITEMS AND RESULTS.....</b>	<b>6</b>
<b>2.2 ADDITIONS, DEVIATIONS, EXCLUSIONS FROM STANDARDS .....</b>	<b>6</b>
<b>2.3 RELATED SUBMITTAL(S)/ GRANT(S) .....</b>	<b>6</b>
<b>2.4 PURPOSE OF THE TEST .....</b>	<b>6</b>
<b>2.5 TEST METHODOLOGY .....</b>	<b>6</b>
<b>2.6 TEST FACILITY .....</b>	<b>6</b>
<b>3. GENERAL INFORMATION.....</b>	<b>7</b>
<b>3.1 PRODUCT DESCRIPTION.....</b>	<b>7</b>
<b>3.2 ALTERNATIVE TYPE(S)/MODEL(S); ALSO COVERED BY THIS TEST REPORT. ....</b>	<b>7</b>
<b>4. EUT MODIFICATIONS .....</b>	<b>7</b>
<b>5. SYSTEM TEST CONFIGURATION.....</b>	<b>8</b>
<b>5.1 JUSTIFICATION .....</b>	<b>8</b>
<b>5.2 PERIPHERAL EQUIPMENT.....</b>	<b>8</b>
<b>5.3 MODE OF OPERATION DURING THE TEST.....</b>	<b>8</b>
<b>5.4 CONFIGURATION OF TEST SYSTEM .....</b>	<b>8</b>
<b>5.5 ANTENNA REQUIREMENT .....</b>	<b>9</b>
<b>6. PRELIMINARY TEST .....</b>	<b>9</b>
<b>6.1 AC POWER LINE CONDUCTED EMISSIONS TESTS.....</b>	<b>9</b>
<b>6.2 GENERAL RADIATED EMISSIONS TESTS.....</b>	<b>9</b>
<b>7. 20DB BANDWIDTH.....</b>	<b>10</b>
<b>7.1 OPERATING ENVIRONMENT .....</b>	<b>10</b>
<b>7.2 TEST SET-UP .....</b>	<b>10</b>
<b>7.3 TEST EQUIPMENT USED .....</b>	<b>10</b>
<b>7.4 TEST DATA.....</b>	<b>11</b>
<b>7.4.1 Test result at GFSK Modulation .....</b>	<b>11</b>
<b>7.4.2 Test result at DQPSK Modulation.....</b>	<b>11</b>
<b>7.4.3 Test result at 8DPSK Modulation .....</b>	<b>11</b>
<b>8. HOPPING FREQUENCY SEPARATION .....</b>	<b>17</b>

<b>8.1 OPERATING ENVIRONMENT .....</b>	<b>17</b>
<b>8.2 TEST SET-UP .....</b>	<b>17</b>
<b>8.3 TEST EQUIPMENT USED .....</b>	<b>17</b>
<b>8.4 TEST DATA .....</b>	<b>18</b>
<b>8.4.1 Test result at GFSK Modulation .....</b>	<b>18</b>
<b>8.4.2 Test result at DQPSK Modulation.....</b>	<b>18</b>
<b>8.4.3 Test result at 8DPSK Modulation .....</b>	<b>18</b>
<b>9. NUMBER OF HOPPING CHANNELS .....</b>	<b>21</b>
<b>9.1 OPERATING ENVIRONMENT .....</b>	<b>21</b>
<b>9.2 TEST SET-UP .....</b>	<b>21</b>
<b>9.3 TEST EQUIPMENT USED .....</b>	<b>21</b>
<b>9.4 TEST DATA .....</b>	<b>21</b>
<b>10. TIME OF OCCUPANCY .....</b>	<b>25</b>
<b>10.1 OPERATING ENVIRONMENT .....</b>	<b>25</b>
<b>10.2 TEST SET-UP .....</b>	<b>25</b>
<b>10.3 TEST EQUIPMENT USED .....</b>	<b>25</b>
<b>10.4 TEST DATA .....</b>	<b>26</b>
<b>11. MAXIMUM PEAK OUTPUT POWER.....</b>	<b>29</b>
<b>11.1 OPERATING ENVIRONMENT .....</b>	<b>29</b>
<b>11.2 TEST SET-UP .....</b>	<b>29</b>
<b>11.3 TEST EQUIPMENT USED .....</b>	<b>29</b>
<b>11.4 TEST DATA .....</b>	<b>30</b>
<b>11.4.1 Test result at GFSK Modulation .....</b>	<b>30</b>
<b>11.4.2 Test result at DQPSK Modulation.....</b>	<b>30</b>
<b>11.4.3 Test result at 8DPSK Modulation .....</b>	<b>30</b>
<b>12. 100 KHZ BANDWIDTH OUTSIDE THE FREQUENCY BAND .....</b>	<b>36</b>
<b>12.1 OPERATING ENVIRONMENT .....</b>	<b>36</b>
<b>12.2 TEST SET-UP FOR CONDUCTED MEASUREMENT .....</b>	<b>36</b>
<b>12.3 TEST SET-UP FOR RADIATED MEASUREMENT .....</b>	<b>36</b>
<b>12.4 TEST EQUIPMENT USED .....</b>	<b>36</b>
<b>12.5. TEST DATA FOR CONDUCTED EMISSION.....</b>	<b>37</b>
<b>12.5.1. Test result at GFSK Modulation .....</b>	<b>37</b>
<b>12.5.2. Test result at DQPSK Modulation.....</b>	<b>41</b>
<b>12.5.3. Test result at 8DPSK Modulation .....</b>	<b>45</b>
<b>12.6. TEST DATA FOR RADIATED EMISSION .....</b>	<b>49</b>

12.6.1. Radiated Emission which fall in the Restricted Band (GFSK Modulation).....	49
12.6.2. Radiated Emission which fall in the Restricted Band (DQPSK Modulation) .....	50
12.6.3. Radiated Emission which fall in the Restricted Band (8DPSK Modulation) .....	51
12.6.4. Spurious & Harmonic Radiated Emission (GFSK Modulation) .....	52
12.6.5. Spurious & Harmonic Radiated Emission (DQPSK Modulation).....	54
12.6.6. Spurious & Harmonic Radiated Emission (8DPSK Modulation) .....	56
<b>13. PEAK POWER SPECTRUL DENSITY .....</b>	<b>58</b>
13.1 OPERATING ENVIRONMENT .....	58
13.2 TEST SET-UP .....	58
13.3 TEST EQUIPMENT USED .....	58
13.4 TEST DATA .....	59
13.4.1 Test result at GFSK Modulation .....	59
13.4.2 Test result at DQPSK Modulation.....	59
13.4.3 Test result at 8DPSK Modulation .....	59
<b>14. RADIO FREQUENCY EXPOSURE.....</b>	<b>65</b>
14.1 RF EXPOSURE LIMIT .....	65
14.2 EUT DESCRIPTION .....	65
14.3 TEST RESULT.....	65
<b>15. RADIATED EMISSION TEST.....</b>	<b>66</b>
15.1 OPERATING ENVIRONMENT .....	66
15.2 TEST SET-UP .....	66
15.3 TEST EQUIPMENT USED .....	66
15.4 TEST DATA .....	67
<b>16. CONDUCTED EMISSION TEST .....</b>	<b>69</b>
16.1 OPERATING ENVIRONMENT .....	69
16.2 TEST SET-UP .....	69
16.3 TEST EQUIPMENT USED .....	69
16.4 TEST DATA .....	70

## 1. VERIFICATION OF COMPLIANCE

APPLICANT : XROAD CO., LTD.  
 ADDRESS : 9F, DooWon B/D, 503-5, Sinsa-dong, Gangnam-gu, Seoul, 135-746, Korea  
 CONTACT PERSON : Mr. Sung-Kook, Ahn / General Manager  
 TELEPHONE NO : +82-2-3014-6234  
 FCC ID : WST-MI4300  
 MODEL NAME : MI4300  
 SERIAL NUMBER : N/A  
 DATE : October 08, 2008

EQUIPMENT CLASS	<b><i>DSS – PART 15 SPREAD SPECTRUM TRANSMITTER</i></b>
KIND OF EQUIPMENT	Portable GPS Navigation Device
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
2.1093	RF Exposure 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

Both conducted and 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 open area test site and conducted 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 FCC (Registration No: 340658) and IC (Registration No: IC3736-2), 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 ISO 17025.

### 3. GENERAL INFORMATION

#### 3.1 Product Description

The XROAD CO., LTD., Model MI4300 (referred to as the EUT in this report) is a Portable GPS Navigation Device which has a function of Bluetooth, navigation and data read/written modes. This report is for Bluetooth function and the report for the other modes will be issued by other report according to FCC DoC procedure. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Portable GPS Navigation Device
TEMPERATURE RANGE	0 °C ~ +55 °C
OPERATING FREQUENCY	2 402 MHz ~ 2 480 MHz
RF OUTPUT POWER	3.00 dBm
NUMBER OF CHANNEL	79 Channels
CHANNEL SEPARATION	1 MHz
DATA TRANSFER RATE	1 Mbps, 2 Mbps, 3 Mbps
MODULATION TYPE	GFSK, DQPSK, and 8DPSK
USED ANTENNA	MFR.: AMOTECH, Model No.: AMAN542012XR01
ANTENNA CONNECTOR TYPE	Dielectric Chip Antenna
ANTENNA GAIN	2.79 dBi
LIST OF EACH OSC. OR CRYSTAL. FREQ.(FREQ.>=1 MHz)	13 MHz, 12 MHz and 24.576 MHz
NUMBER OF LAYER	8 Layers
ELECTRICAL RATING	DC 3.7 V, 2 A from a battery or DC 5 V, 2 A from AC/DC adaptor
USED AC/DC ADAPTOR	MFR.: Perfect Power, Model No. PA-050200SN Input: AC 100 V ~ 240 V, 0.5 A, Output: DC 5 V, 2.0 A
EXRERNAL CONNECTOR	USB, Antenna Port, DC In, Earphone, SD Card

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

-. The difference(s) compared to the EUT is as follows:

	Model Name	Model Differences
Basic Model	MI4300	-
Multiple Model	MI4350XT, MI4300XT, MI4350X, MI4300X	Only model designation according to buyer's request.

Remark: The manufacturer is responsible for the compliance of all variants.

### 4. EUT MODIFICATIONS

-. None

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)

## 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	XROAD	XROAD MI4300 PP Rev1.0	N/A
Antenna Board	N/A	N/A	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
MI4300	XROAD CO., LTD.	WST-MI4300	Portable GPS Navigation Device (EUT)	-
TC-3000B	TESCOM	N/A	Bluetooth Tester	EUT

### 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. The EUT was tested at each GFSK, DQPSK and 8DPSK modulation during the test.

### 5.4 Configuration of Test System

**Line Conducted Test:** The EUT was connected to adaptor and the power line of adaptor 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 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
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
GFSK	X
DQPSK	-
8DPSK	-

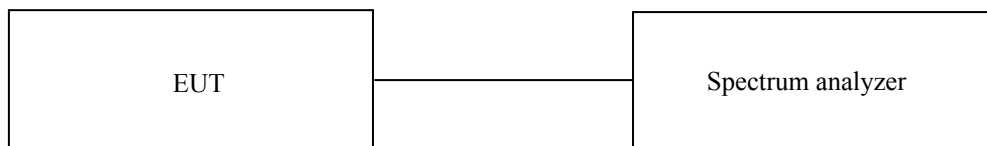
## 7. 20dB BANDWIDTH

### 7.1 Operating environment

Temperature : 26 °C  
Relative humidity : 50 %R.H.

### 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	Last Cal.
■ -	8564E	HP	Spectrum Analyzer	3650A00756	June 16, 2008

All test equipment used is calibrated on a regular basis.

#### 7.4 Test data

- Test Date : September 16, 2008  
- Test Result : Pass

##### 7.4.1 Test result at GFSK Modulation

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (kHz)
Low	2 402	933
Middle	2 441	933
High	2 480	942

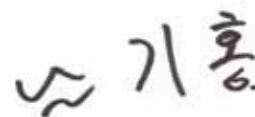
##### 7.4.2 Test result at DQPSK Modulation

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (kHz)
Low	2 402	1 258
Middle	2 441	1 258
High	2 480	1 258

##### 7.4.3 Test result at 8DPSK Modulation

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (kHz)
Low	2 402	1 225
Middle	2 441	1 225
High	2 480	1 225

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



Tested by: Ki-Hong, Nam / Project Engineer



Low Channel (GFSK Modulation)



Middle Channel (GFSK Modulation)



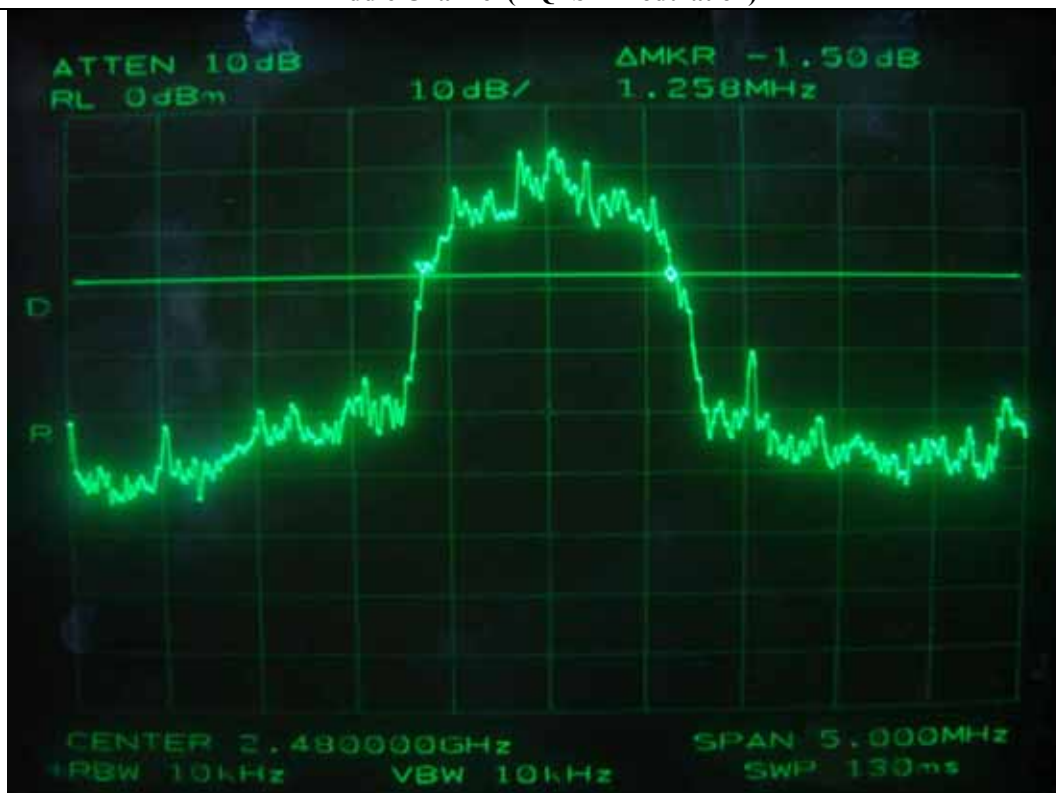
High Channel (GFSK Modulation)



Low Channel (DQPSK Modulation)



Middle Channel (DQPSK Modulation)



High Channel (DQPSK Modulation)

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)

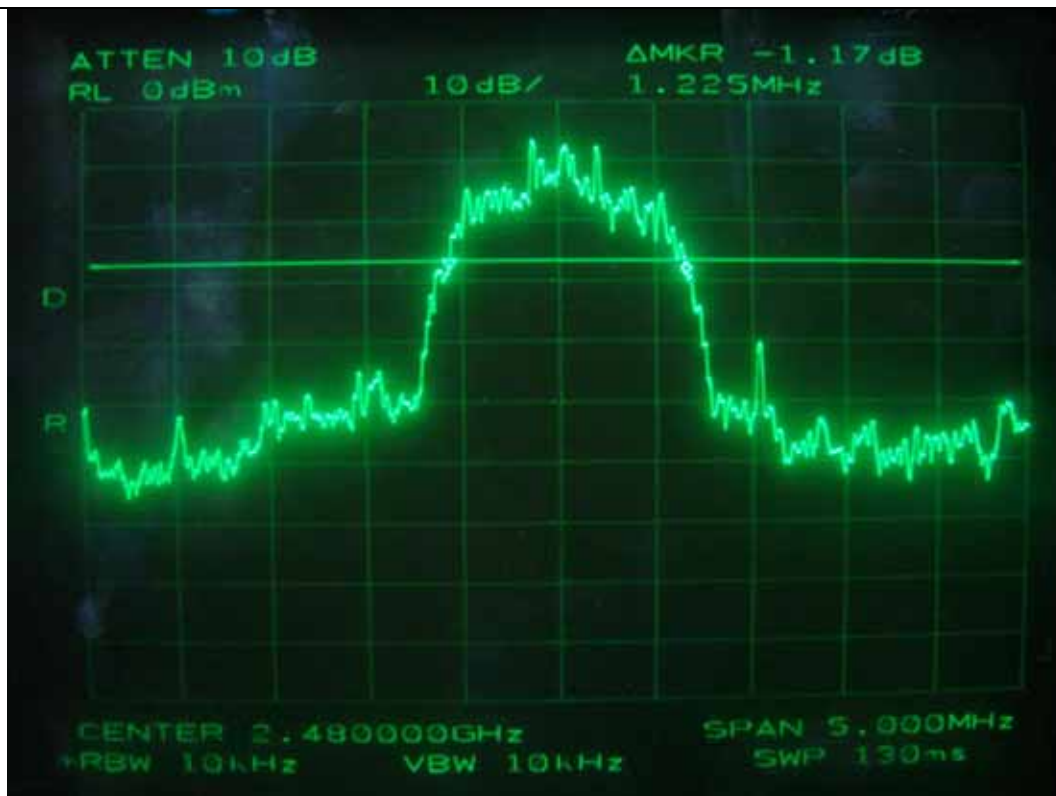




Low Channel (8DPSK Modulation)



Middle Channel (8DPSK Modulation)



High Channel (8DPSK Modulation)



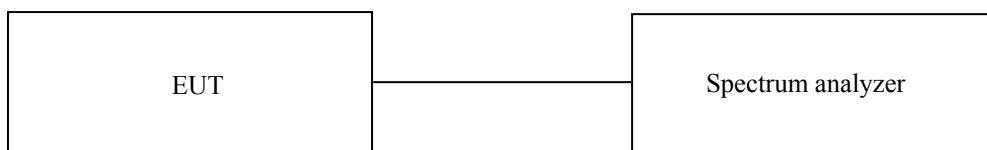
## 8. HOPPING FREQUENCY SEPARATION

### 8.1 Operating environment

Temperature : 26 °C  
Relative humidity : 50 %R.H.

### 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	Last Cal.
■ - 8564E	HP	Spectrum Analyzer	3650A00756	June 16, 2008

All test equipment used is calibrated on a regular basis.

#### 8.4 Test data

- Test Date : September 16, 2008  
- Test Result : Pass

##### 8.4.1 Test result at GFSK Modulation

MEASURED VLAUE (kHz)	LIMIT	MARGIN (kHz)
1 000	942	-58

##### 8.4.2 Test result at DQPSK Modulation

MEASURED VLAUE (kHz)	LIMIT	MARGIN (kHz)
1 000	839	-161

##### 8.4.3 Test result at 8DPSK Modulation

MEASURED VLAUE (kHz)	LIMIT	MARGIN (kHz)
1 000	817	-183



Tested by: Ki-Hong, Nam / Project Engineer



GFSK Modulation



DQPSK Modulation

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)



8DPSK Modulation

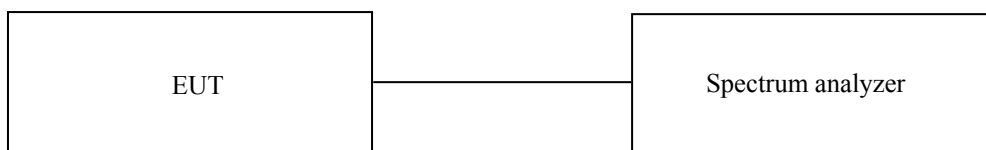
## 9. NUMBER OF HOPPING CHANNELS

### 9.1 Operating environment

Temperature : 26 °C  
Relative humidity : 50 %R.H.

### 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

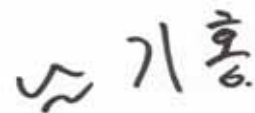
Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - 8564E	HP	Spectrum Analyzer	3650A00756	June 16, 2008

All test equipment used is calibrated on a regular basis.

### 9.4 Test data

- Test Date : September 16, 2008  
- Test Result : Pass

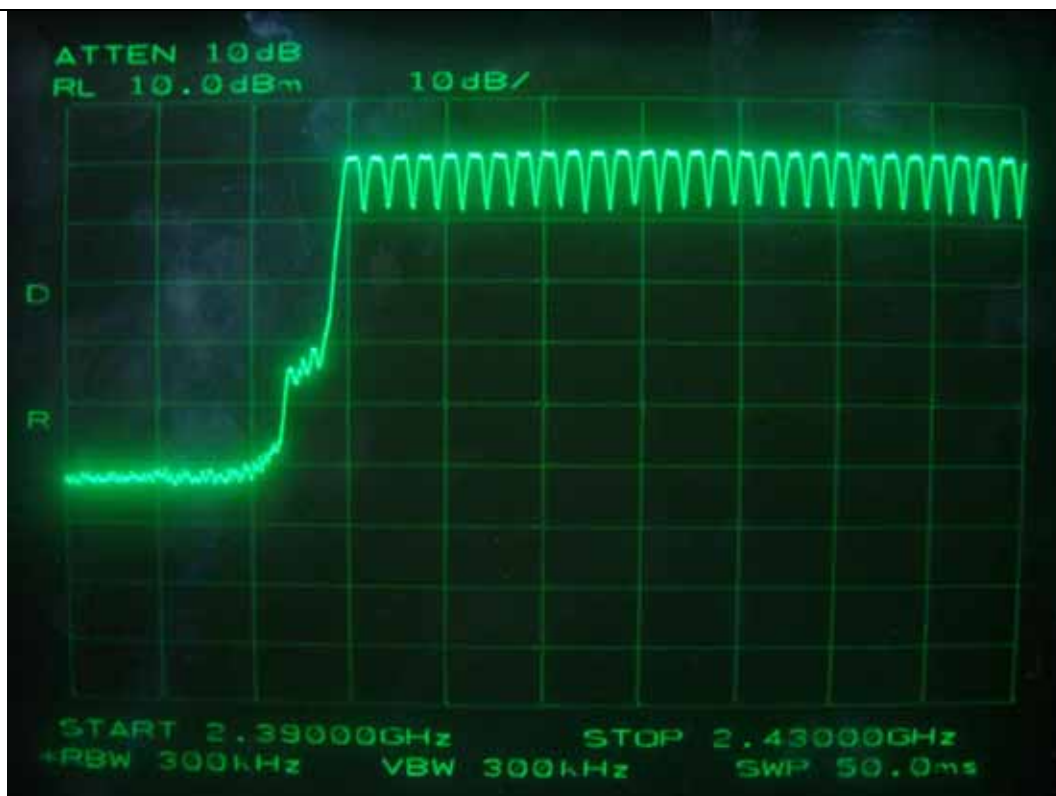
MEASURED VLAUE (Number)	LIMIT (Number)	MARGIN (Number)
79	Minimum of 15	64



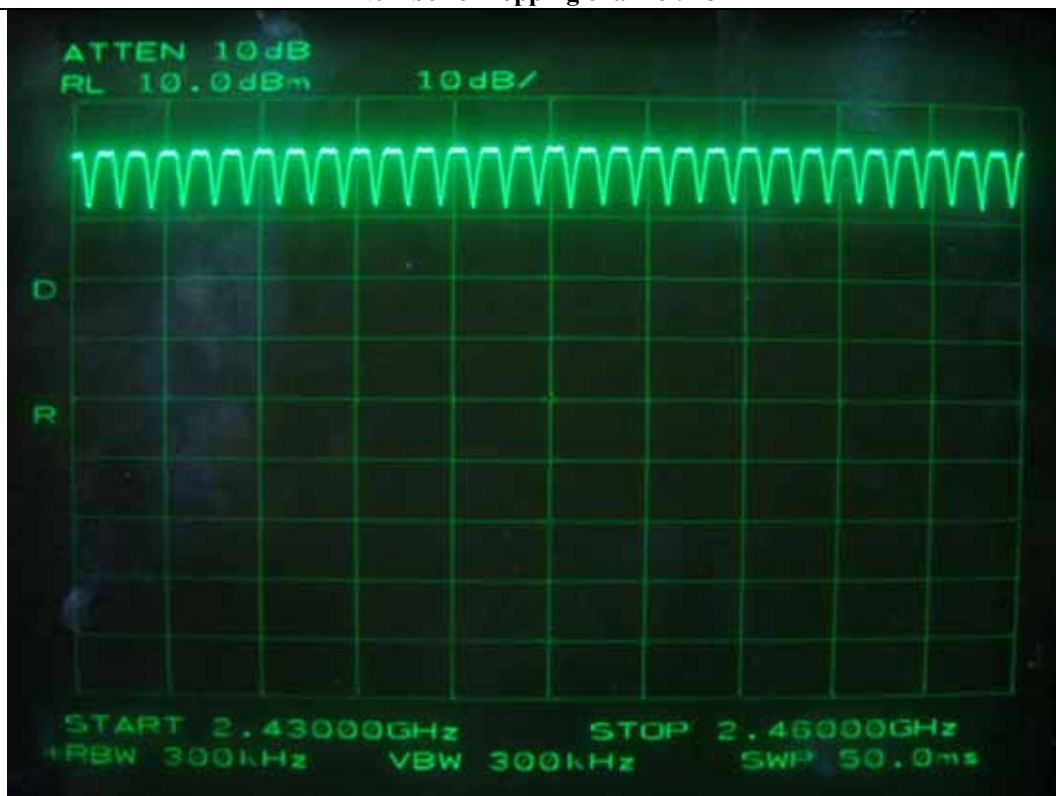
Tested by: Ki-Hong, Nam / Project Engineer



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



Number of hopping channel: 28



Number of hopping channel: 30





Number of hopping channel: 21



## 10. TIME OF OCCUPANCY

### 10.1 Operating environment

Temperature : 26 °C  
Relative humidity : 50 %R.H.

### 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	Last Cal.
■ -	8564E	HP	Spectrum Analyzer	3650A00756	June 16, 2008

All test equipment used is calibrated on a regular basis.

#### 10.4 Test data

- Test Date : September 16, 2008

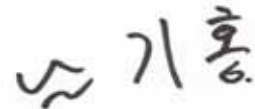
The system makes worst case 1 600 hops per second or 1 time slot has a length of 625  $\mu$ s with 79 channels.

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 ( $=1\ 600/2/79$ ) for DH1, and 5.06 times ( $=1\ 600/4/79$ ) for DH3, and 3.38 times ( $=1\ 600/6/79$ ) for DH5.

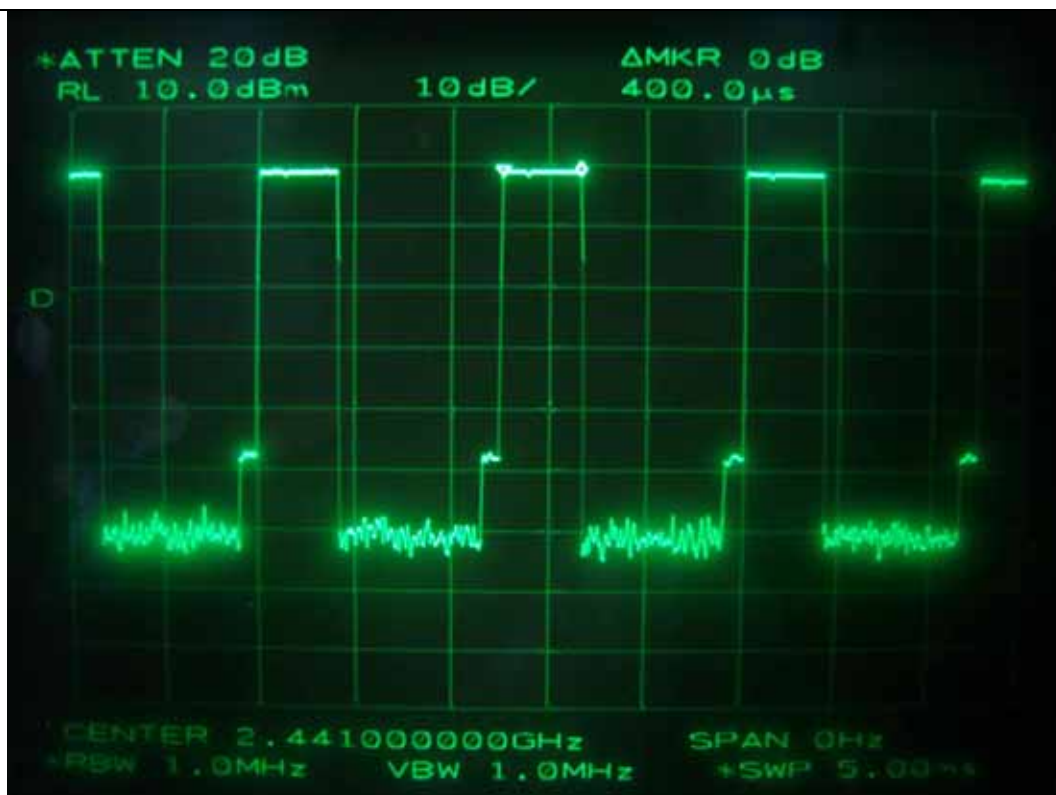
Packet Type	Pulse Time (ms)	Hops per second with channels	Period Time (ms)	Total Dwell Time (ms)	Limit (ms)	Test Result
DH1	0.400 0	10.13	31.6	128.04	400	PASS
DH3	1.650 0	5.06	31.6	263.83	400	PASS
DH5	2.900 0	3.38	31.6	309.74	400	PASS

Total dwell time is calculated as following.

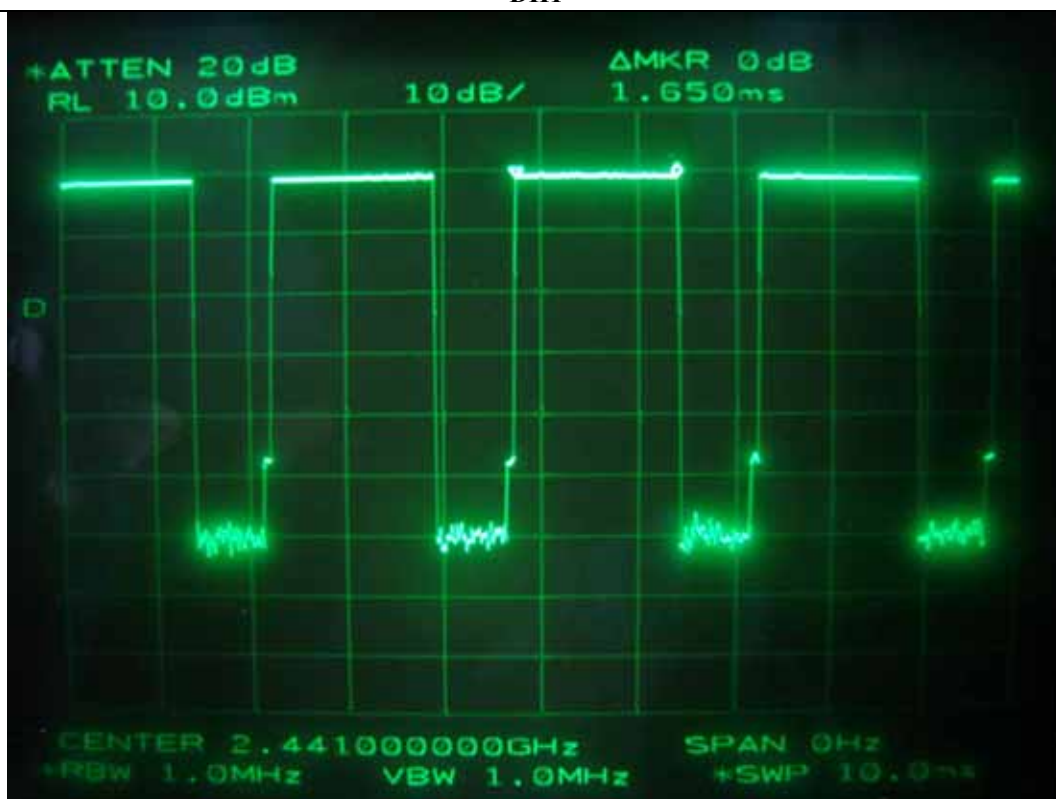
Total Dwell Time = Pulse time \* Hops per second with channels \* period time



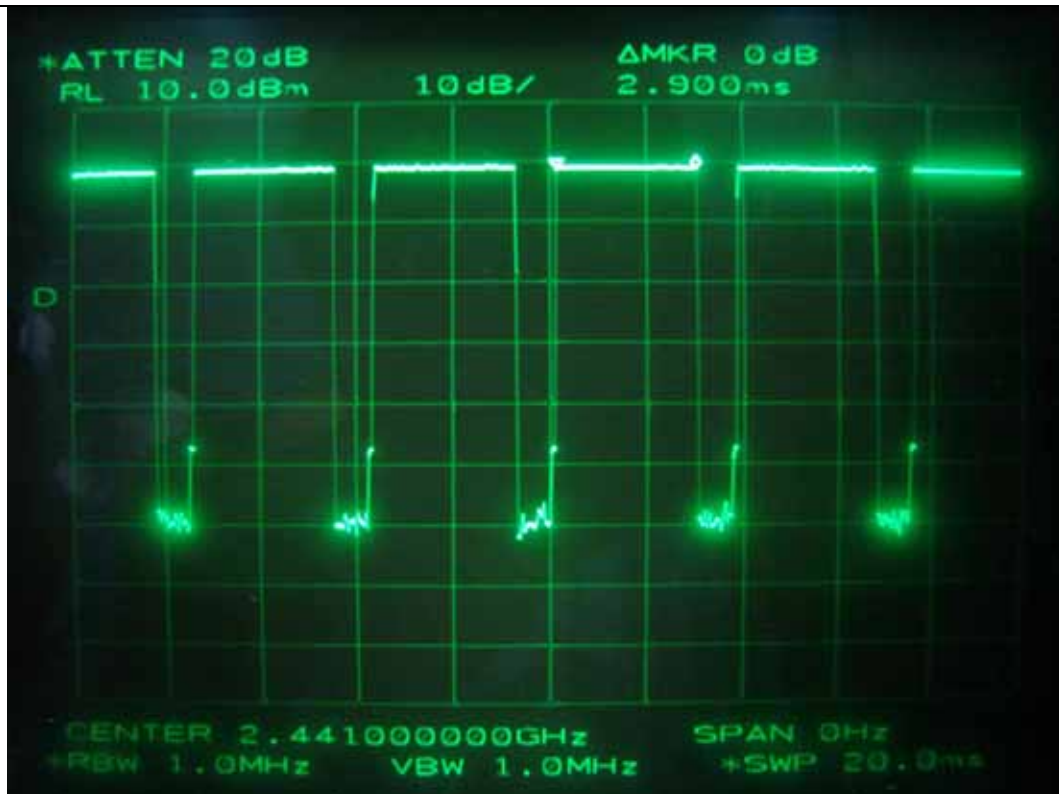
Tested by: Ki-Hong, Nam / Project Engineer



DH1



DH3



DH5

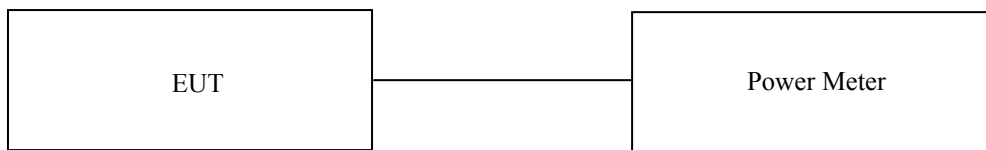
## 11. MAXIMUM PEAK OUTPUT POWER

### 11.1 Operating environment

Temperature : 26 °C  
Relative humidity : 50 %R.H.

### 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	Last Cal.
■ -	8564E	HP	Spectrum Analyzer	3650A00756	June 16, 2008

All test equipment used is calibrated on a regular basis.

#### 11.4 Test data

- Test Date : September 16, 2008  
- Test Result : Pass

##### 11.4.1 Test result at GFSK Modulation

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402	1.17	30.0	-28.83
Middle	2 441	1.83	30.0	-28.17
High	2 480	3.00	30.0	-27.00

##### 11.4.2 Test result at DQPSK Modulation

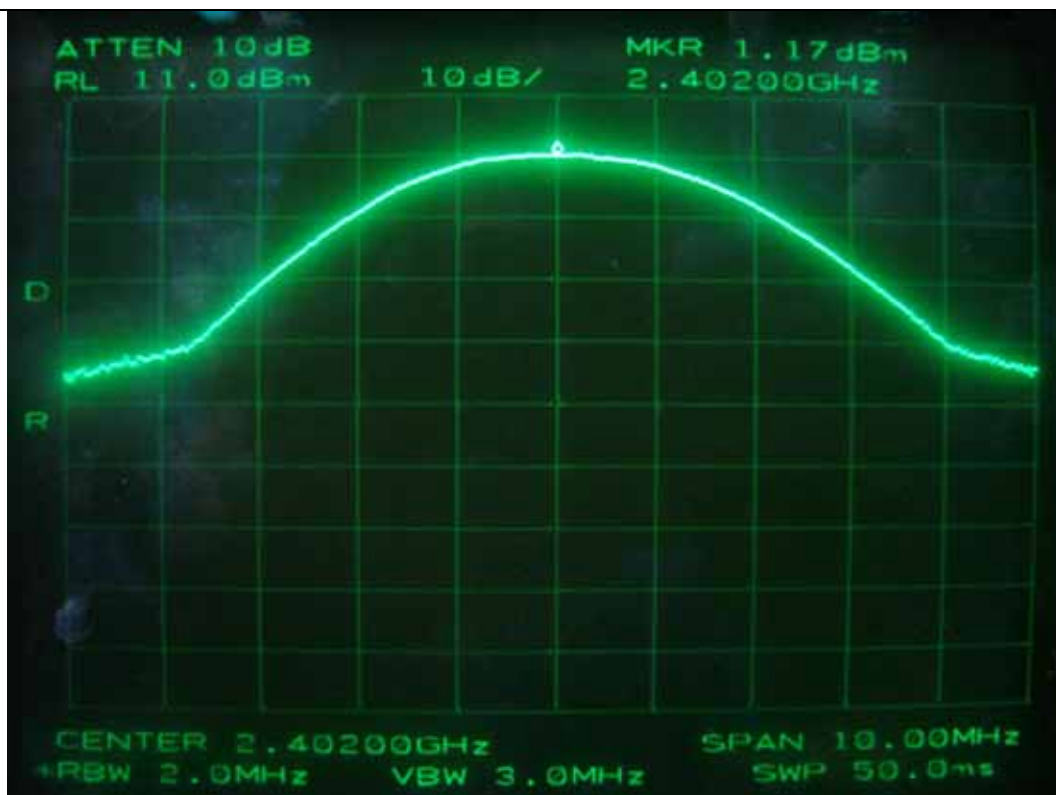
CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402	0.83	30.0	-29.17
Middle	2 441	1.00	30.0	-29.00
High	2 480	1.67	30.0	-28.33

##### 11.4.3 Test result at 8DPSK Modulation

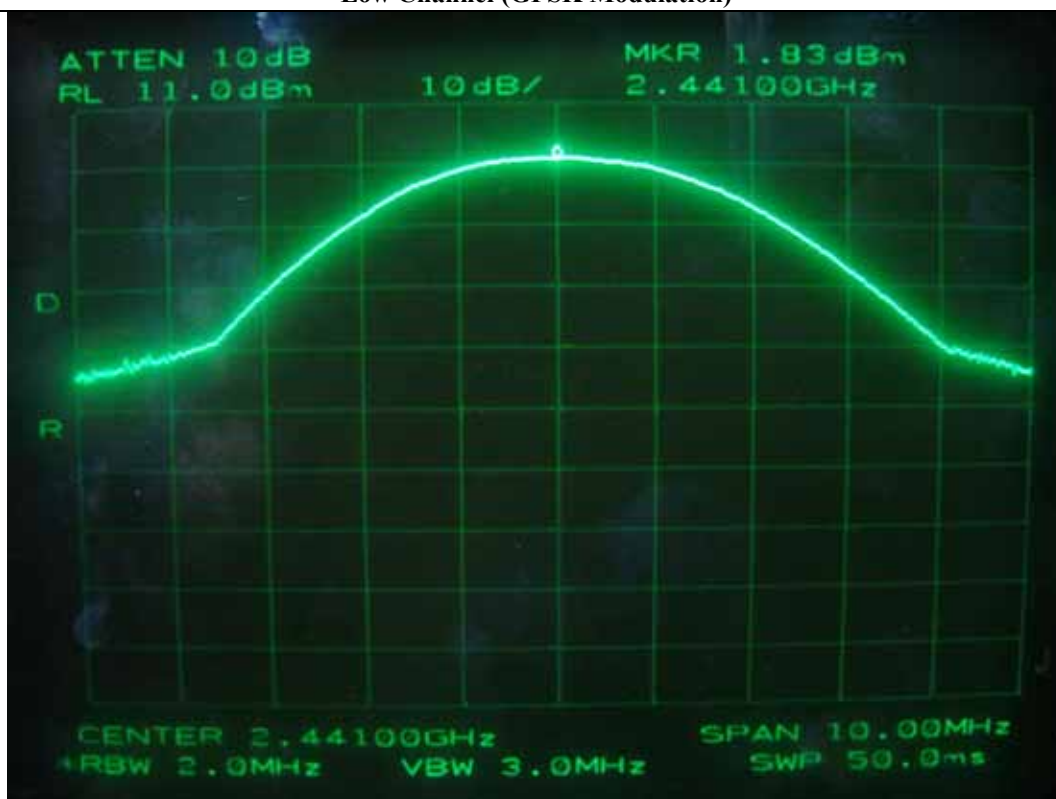
CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402	0.67	30.0	-29.33
Middle	2 441	1.00	30.0	-29.00
High	2 480	1.83	30.0	-28.17

기홍

Tested by: Ki-Hong, Nam / Project Engineer

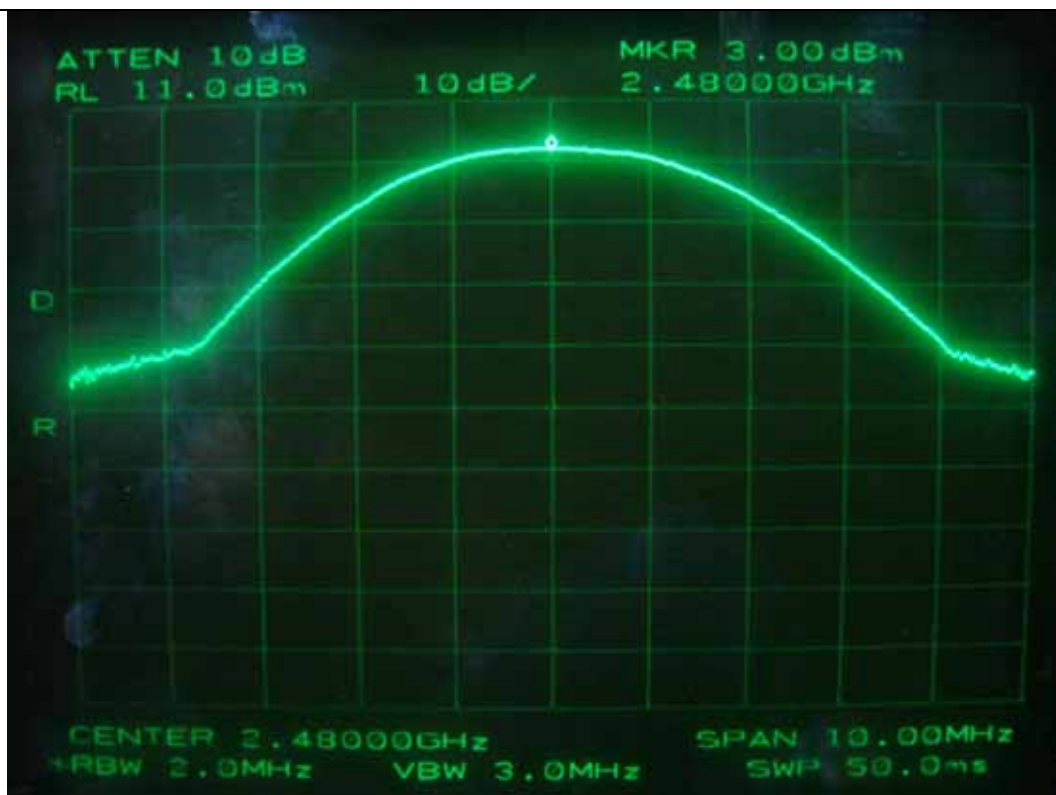


Low Channel (GFSK Modulation)

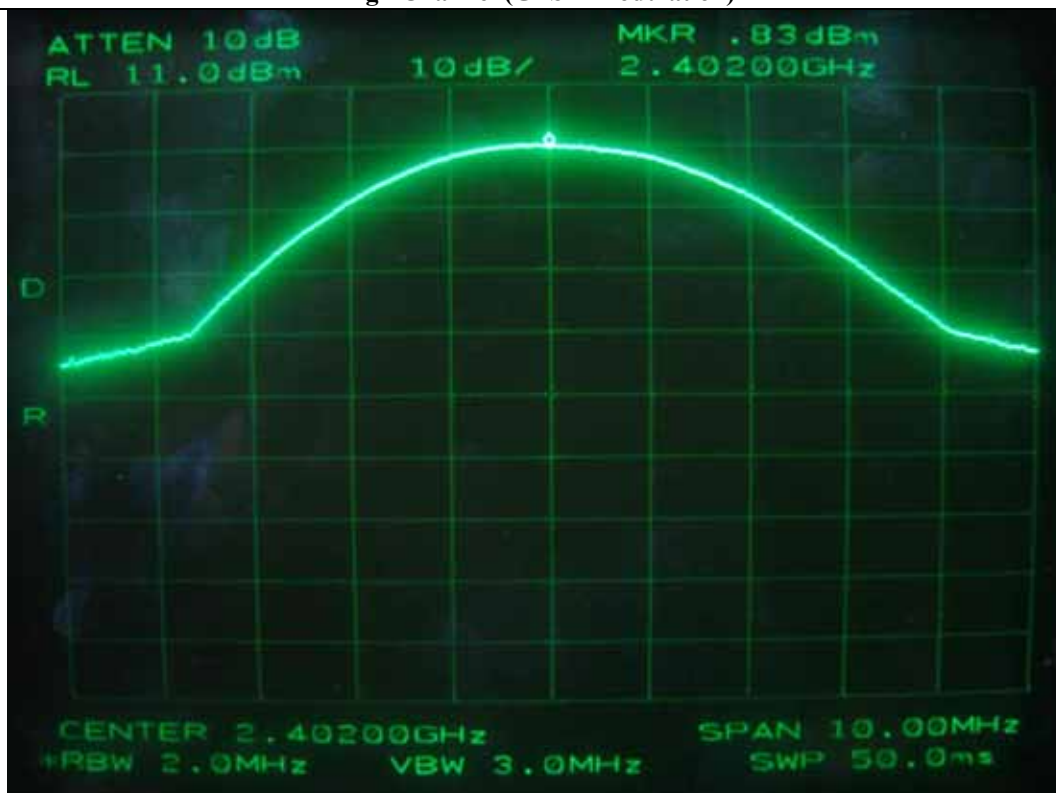


Middle Channel (GFSK Modulation)





High Channel (GFSK Modulation)



Low Channel (DQPSK Modulation)

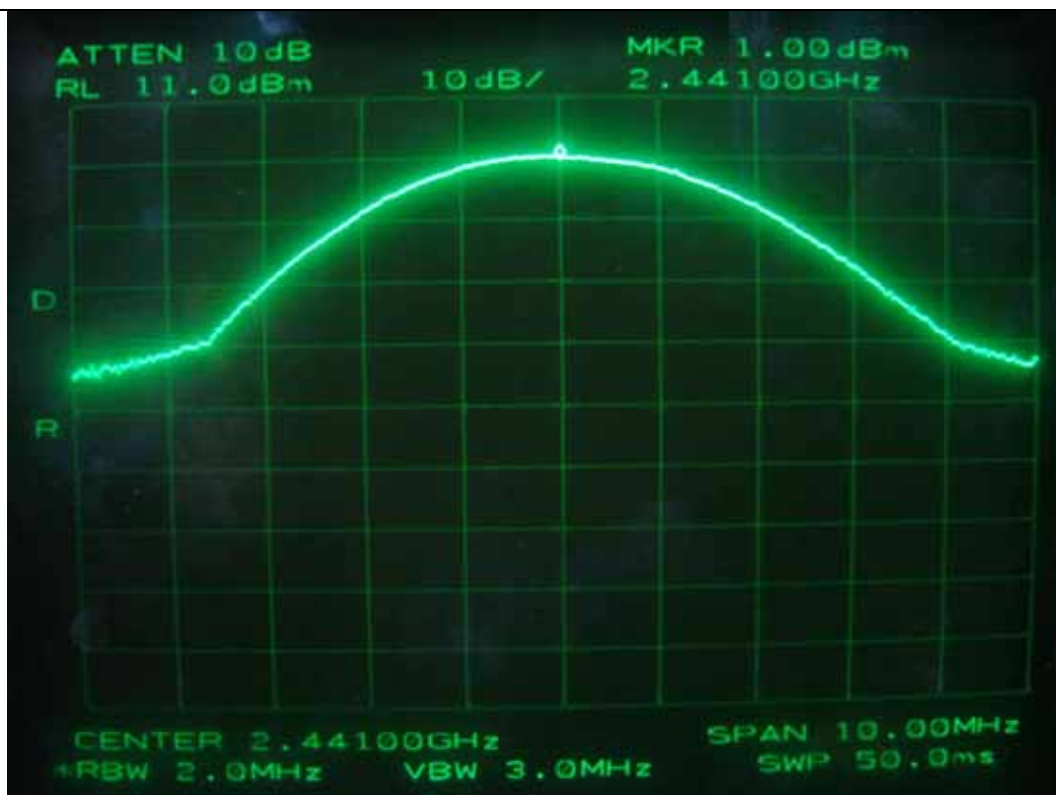
It should not be reproduced except in full, without the written approval of ONETECH.

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)

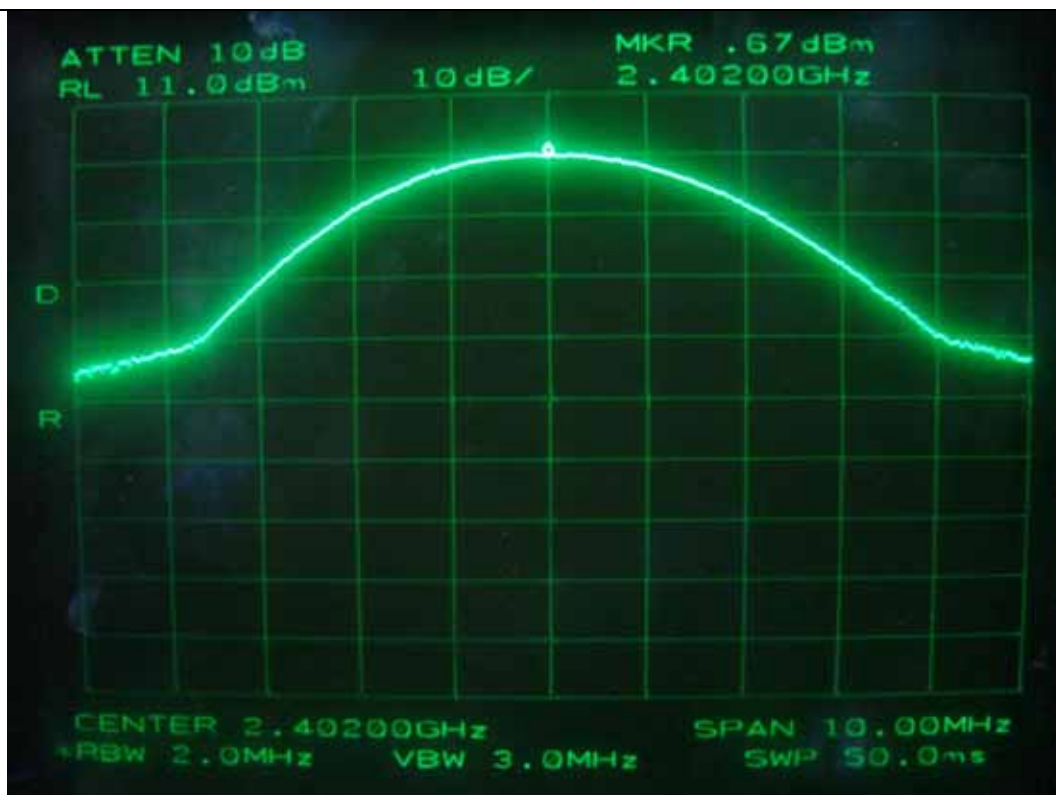




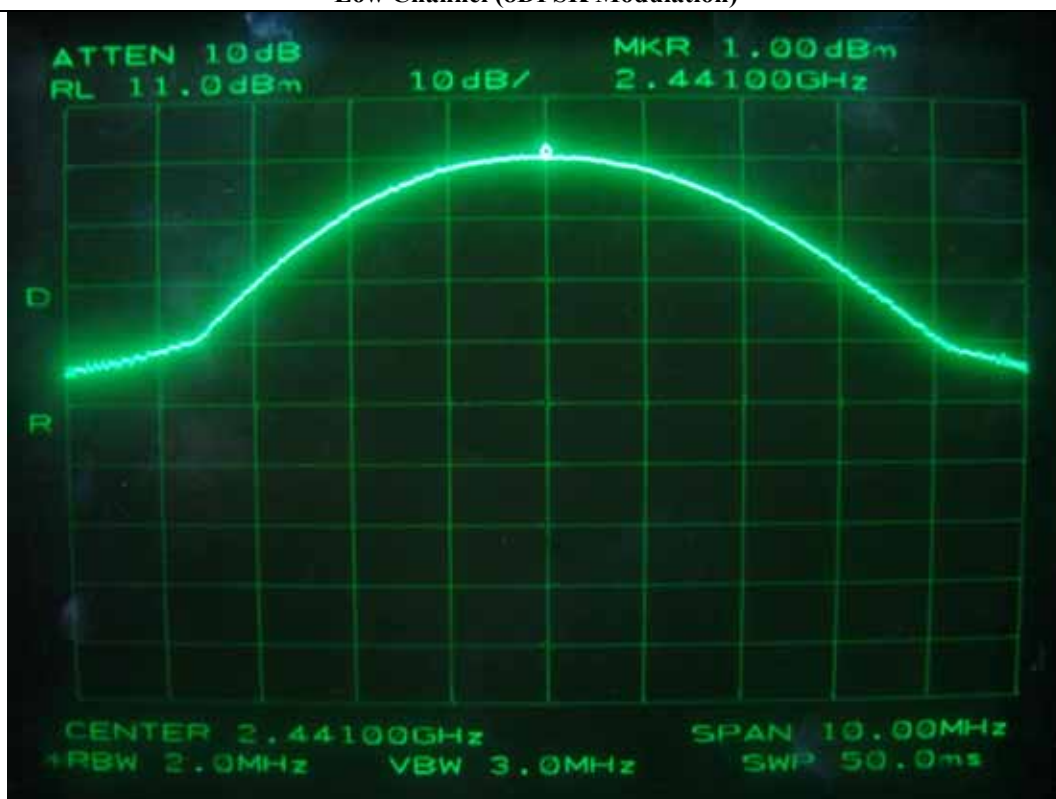
Middle Channel (DQPSK Modulation)



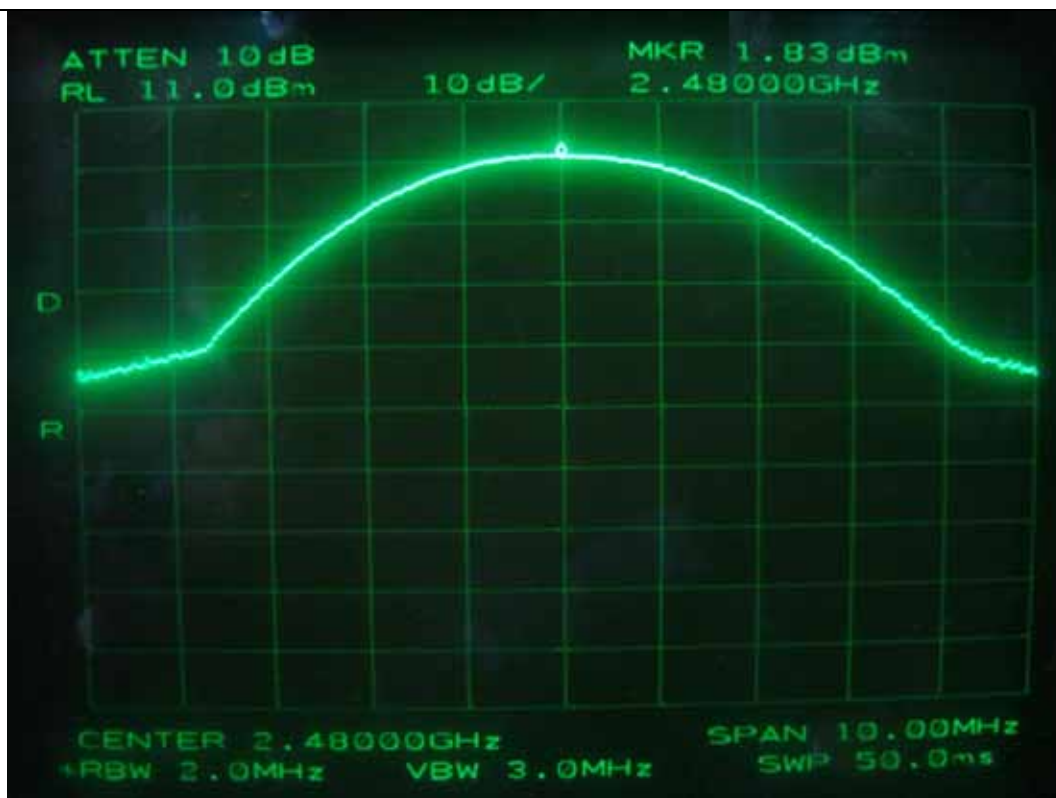
High Channel (DQPSK Modulation)



Low Channel (8DPSK Modulation)



Middle Channel (8DPSK Modulation)



High Channel (8DPSK Modulation)

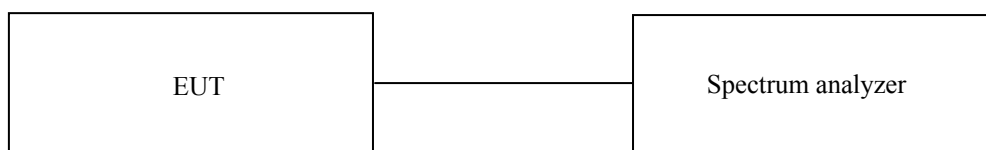
## 12. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

### 12.1 Operating environment

Temperature : 26 °C  
Relative humidity : 50 %R.H.

### 12.2 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.



### 12.3 Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3 meters, 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 30 MHz to 25 GHz 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.

### 12.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	8564E	Hewlett-Packard	Spectrum Analyzer	3650A00756	June 16, 2008
■ -	8447D	Hewlett-Packard	Amplifier	2727A04987	June 16, 2008
□ -	83051A	Agilent	Preamplifier	3950M00201	June 16, 2008
■ -	F-40-5000-RF	RLC Electronics	Highpass Filter	0425	July 13, 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(4Y)
■ -	YSE 500B	YoungShin Eng.	Frequency Converter	950413001	N/A
■ -	ETCR-10	DaeHa	Automatic Voltage Com.	N/A	N/A

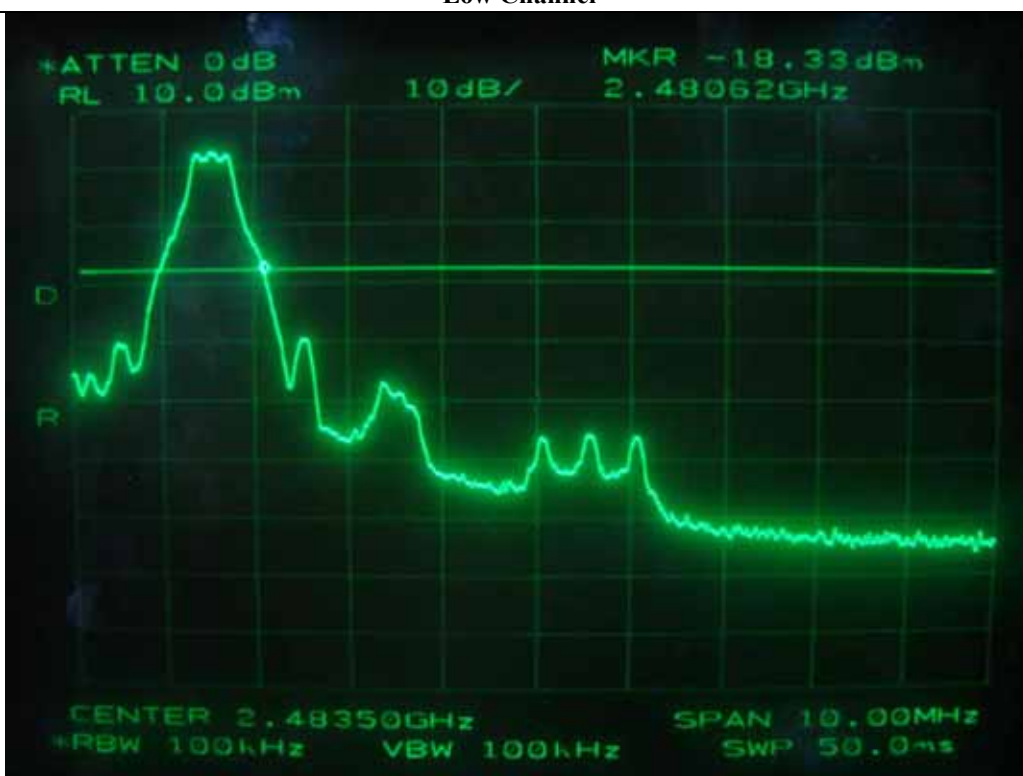
All test equipment used is calibrated on a regular basis.

## 12.5. Test data for conducted emission

### 12.5.1. Test result at GFSK Modulation



Low Channel



High Channel

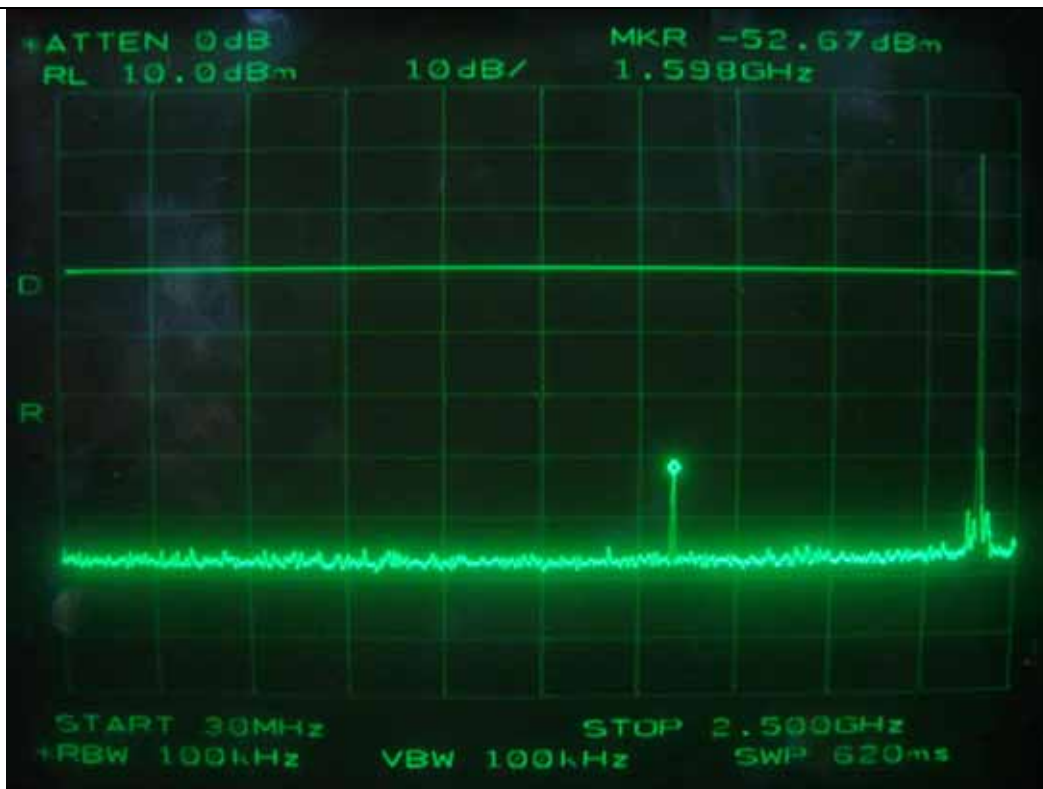
It should not be reproduced except in full, without the written approval of ONETECH.

EMC-003 (Rev.1)

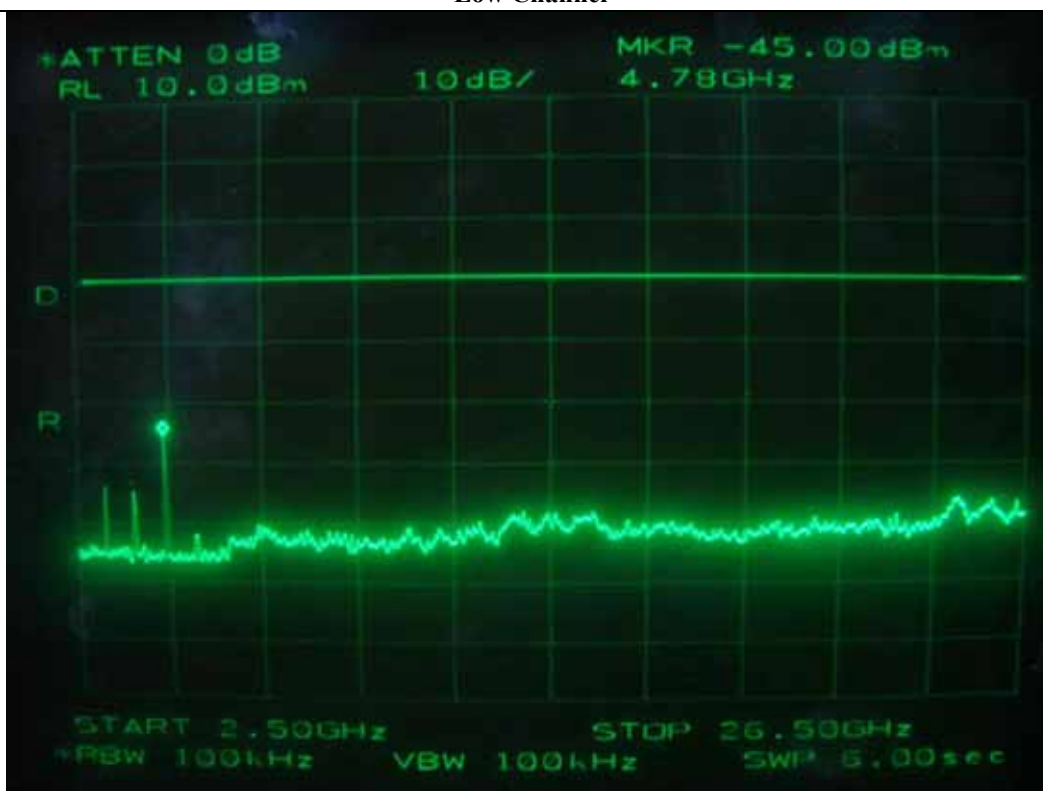
**HEAD OFFICE** : #505 SK Apt. Factory 223-28, Sangdaewon1-dong, Jungwon-gu, Seongnam-si, Gyeonggi-do 462-705 Korea  
(TEL: +82-31-746-8500, FAX: +82-31-746-8700)

**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)

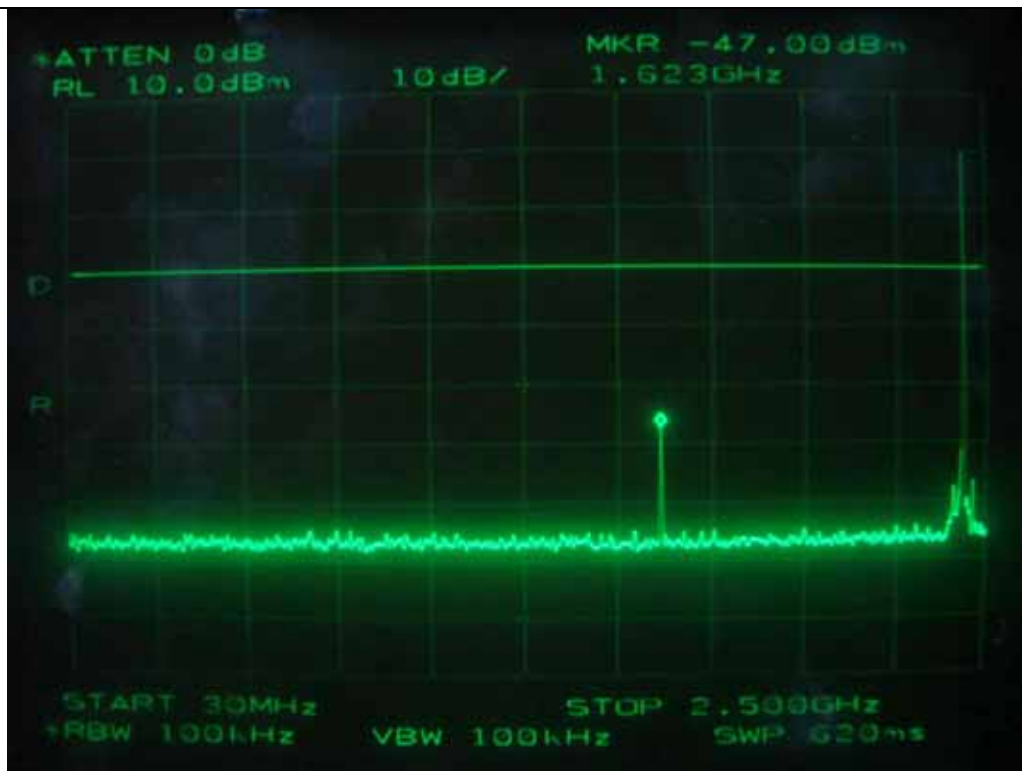




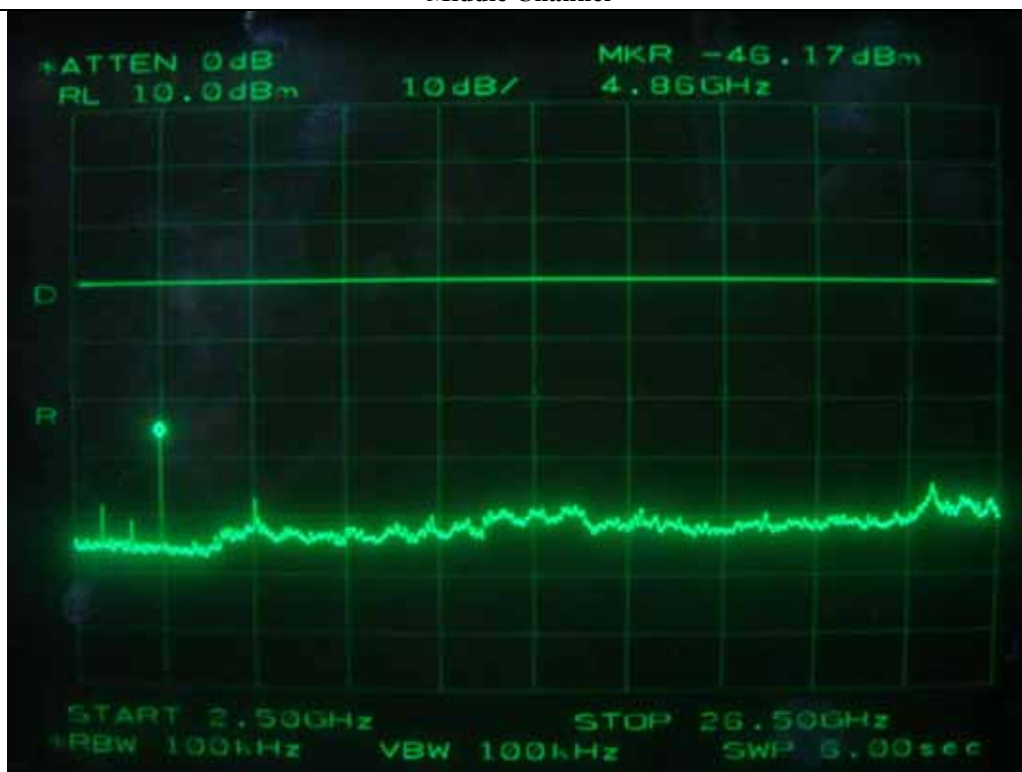
Low Channel



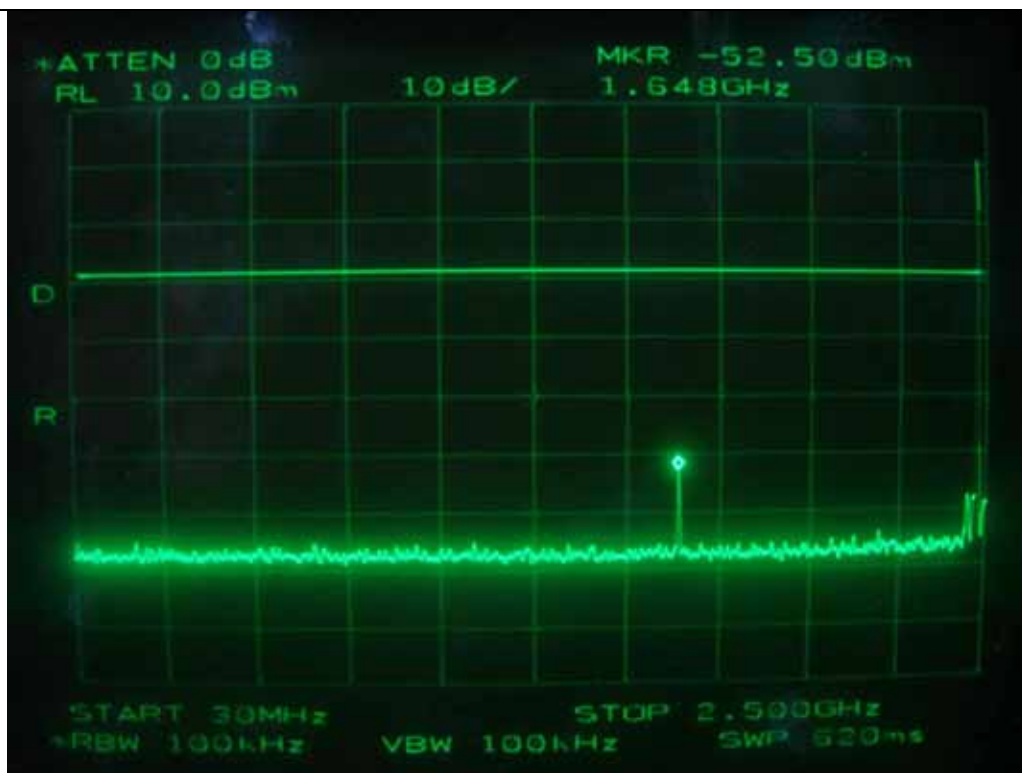
Low Channel



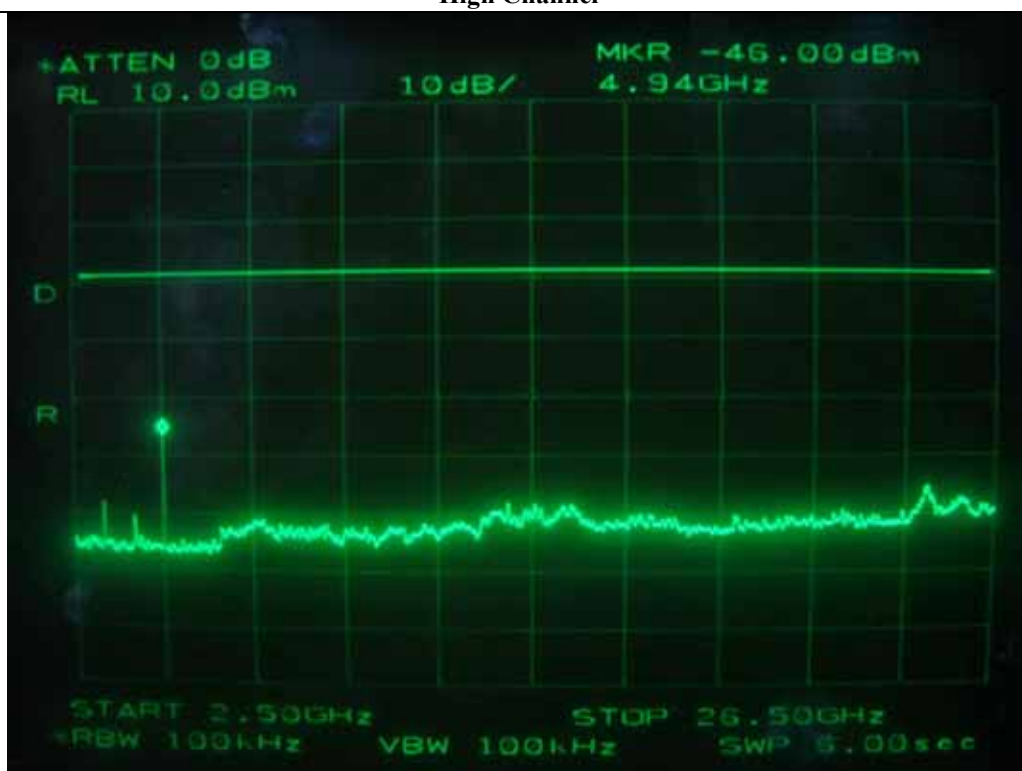
Middle Channel



Middle Channel



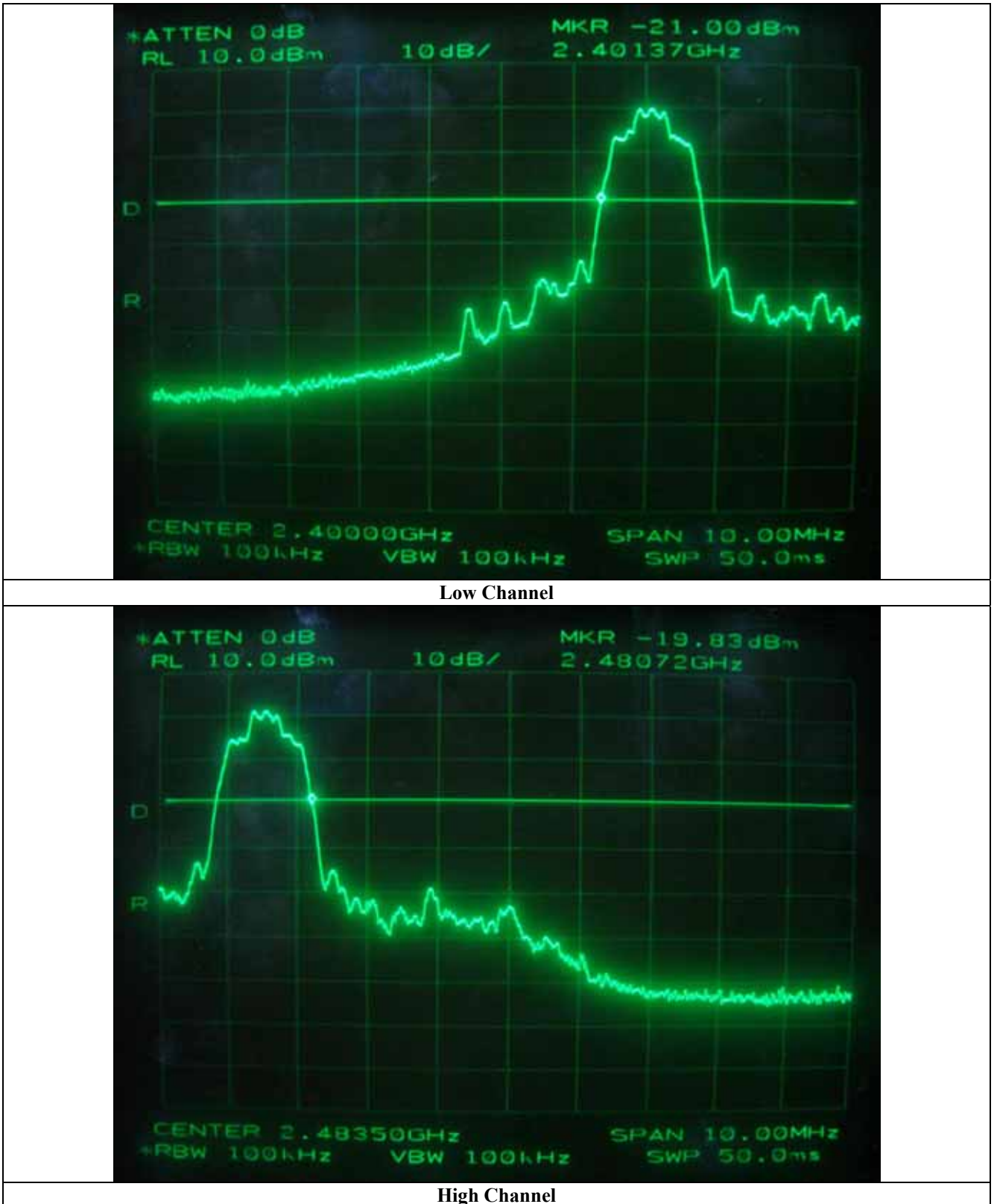
High Channel



High Channel



### 12.5.2. Test result at DQPSK Modulation

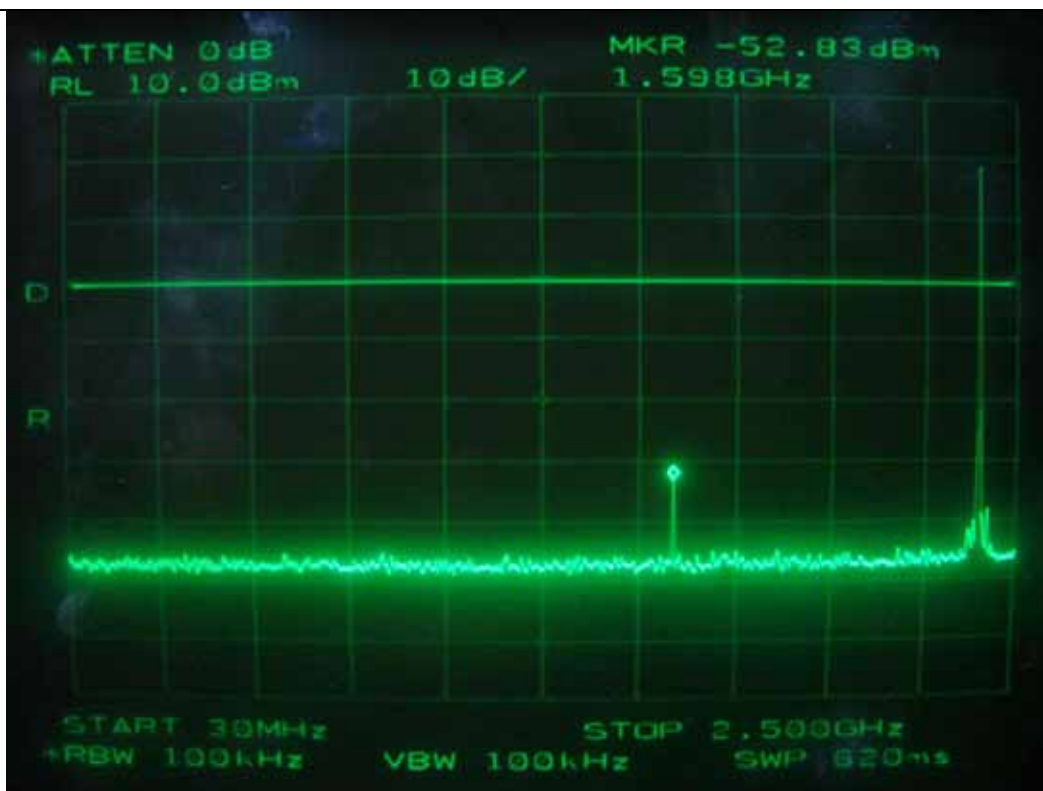


It should not be reproduced except in full, without the written approval of ONETECH.

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



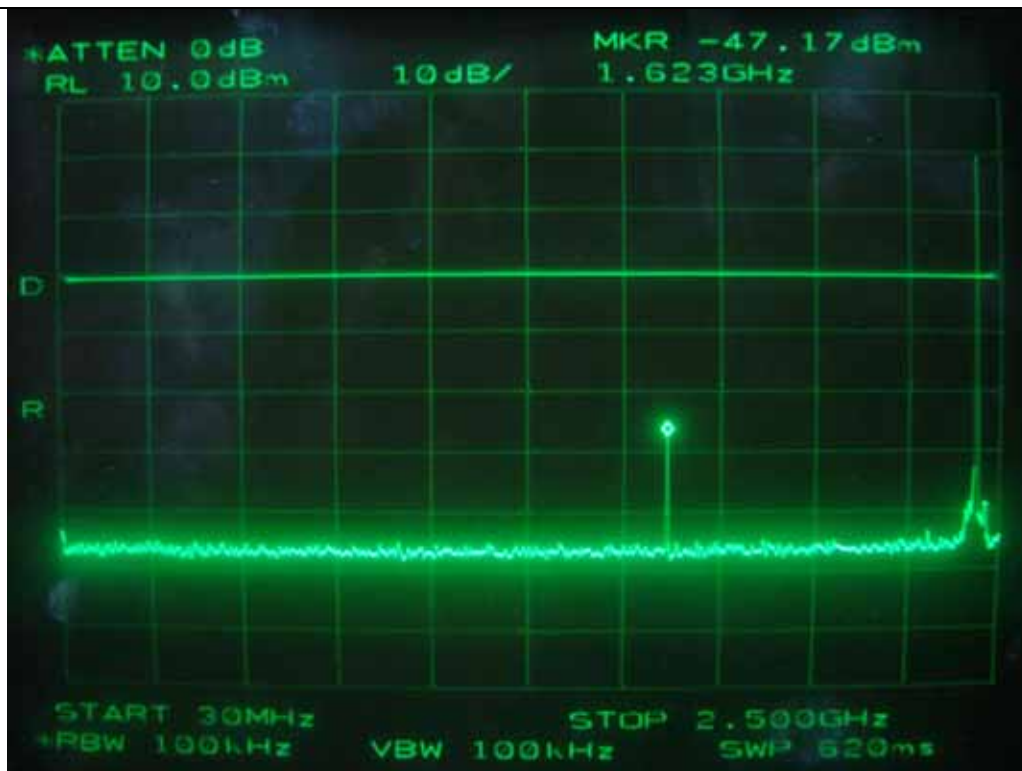
Low Channel

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

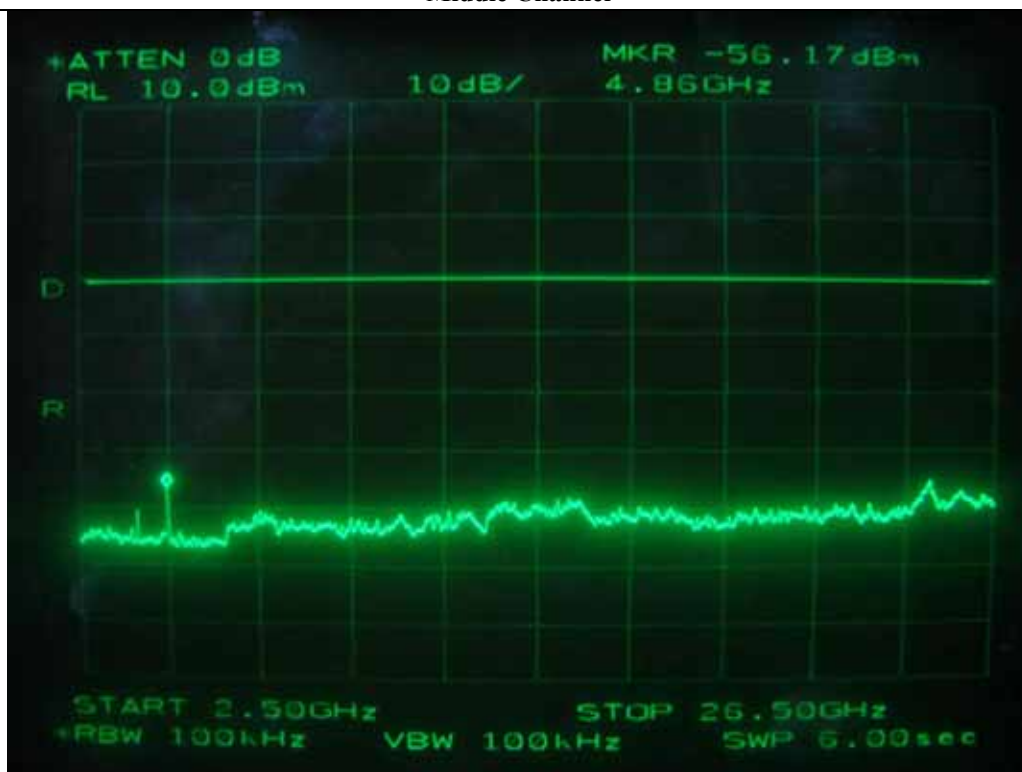
EMC-003 (Rev.1)

**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)

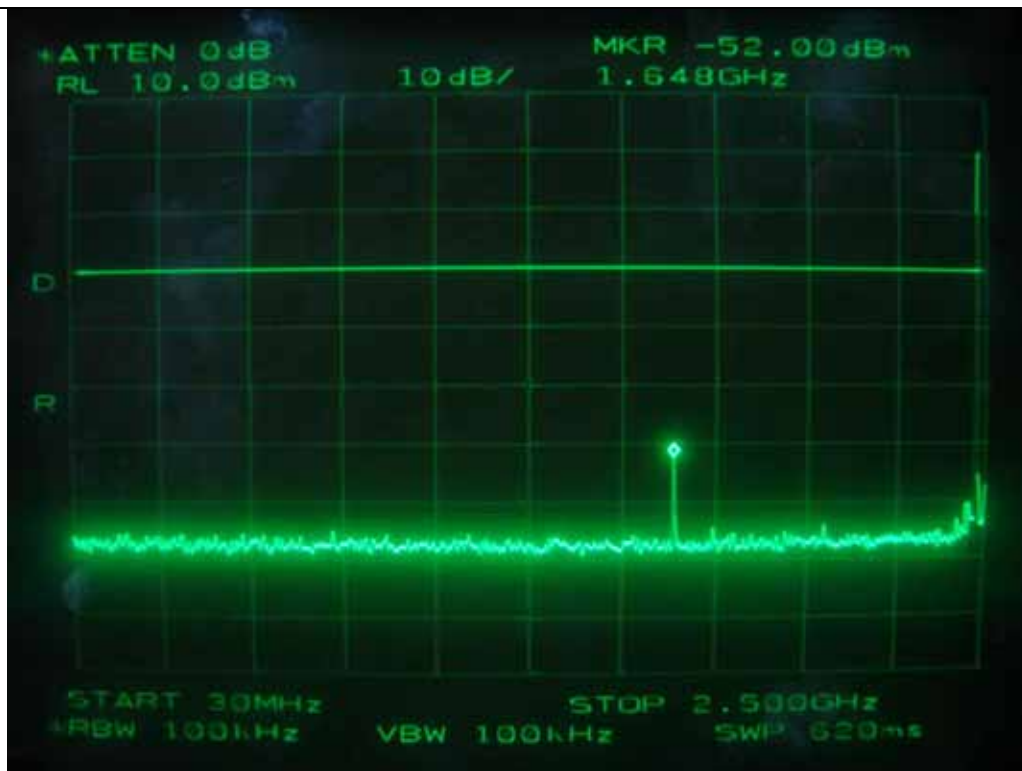
**EMC Testing Dept** : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea. (TEL: +82-31-765-8289, FAX: +82-31-766-2904)



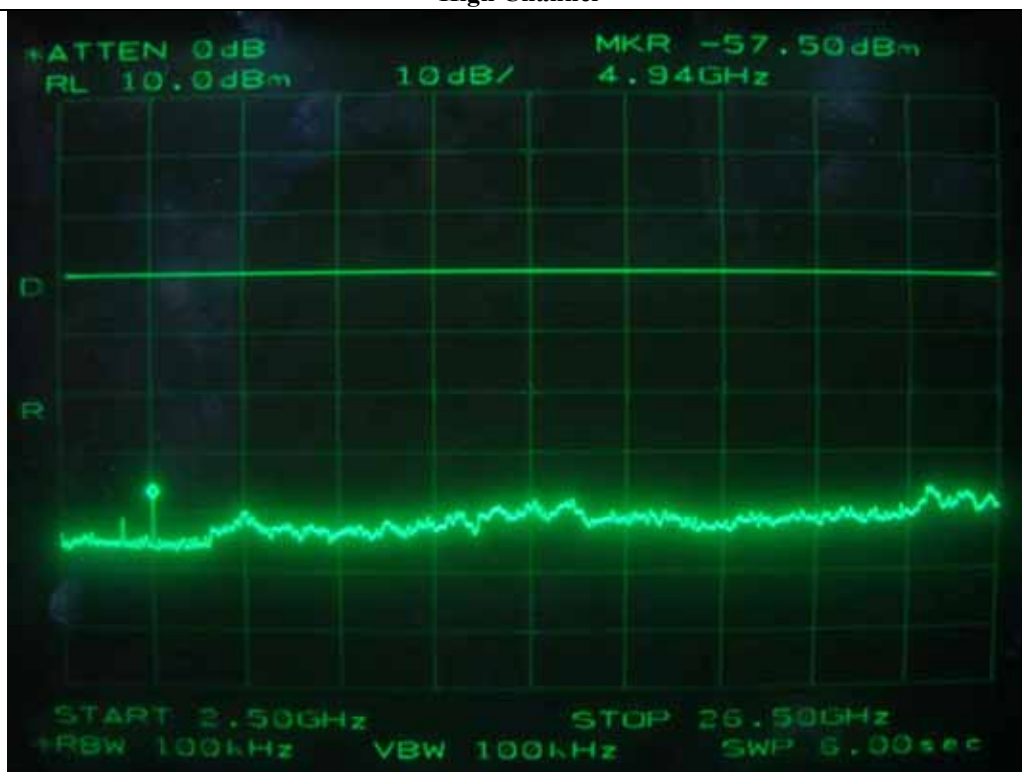
Middle Channel



Middle Channel



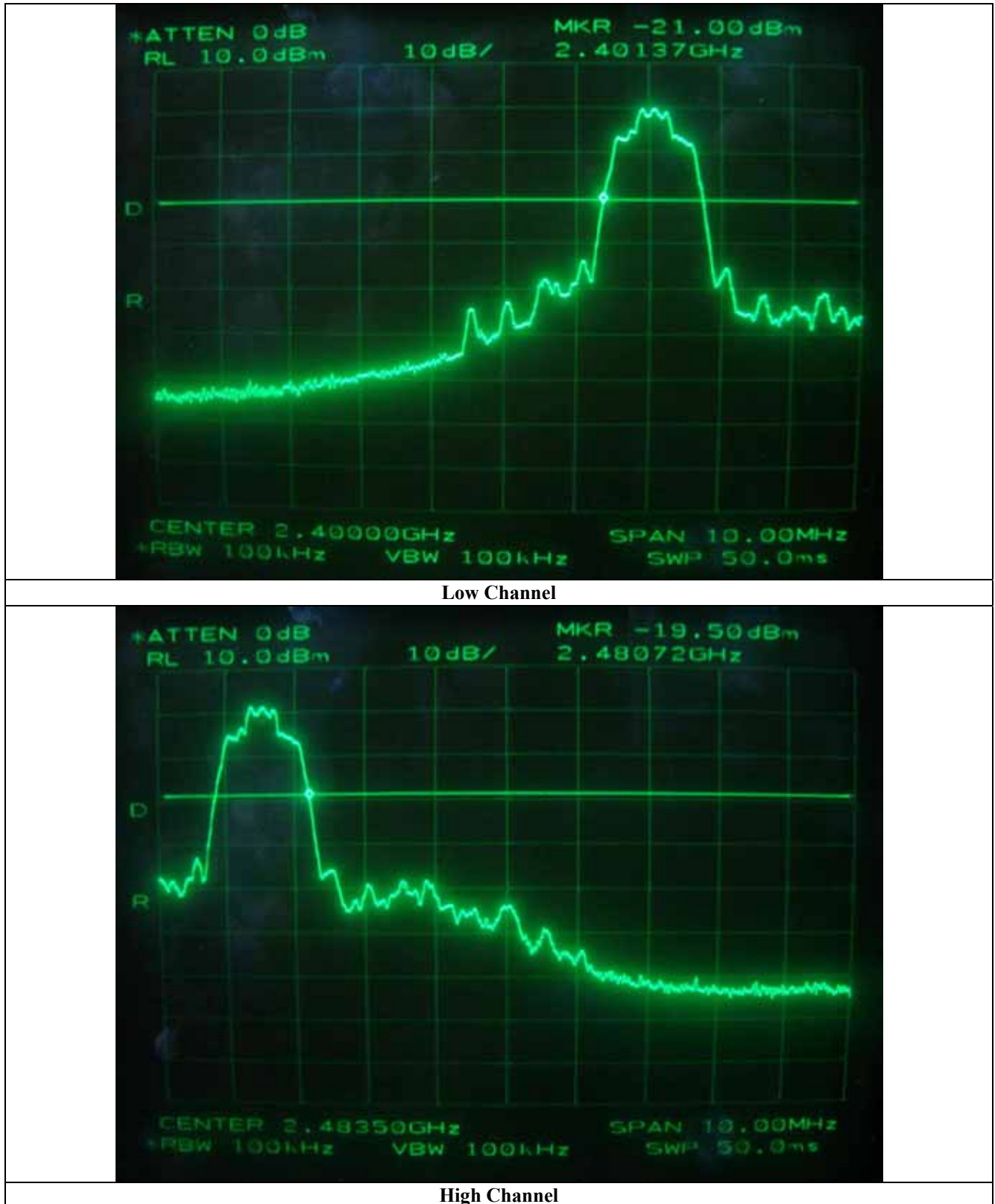
High Channel



High Channel



### 12.5.3. Test result at 8DPSK Modulation

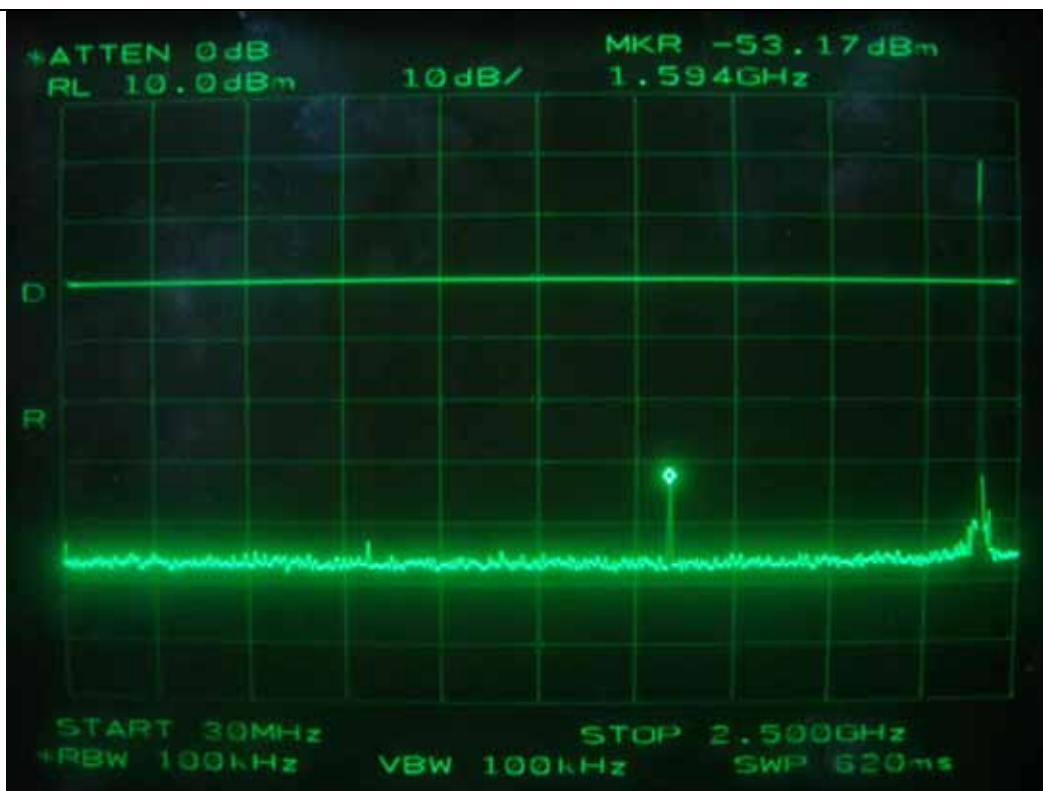


It should not be reproduced except in full, without the written approval of ONETECH.

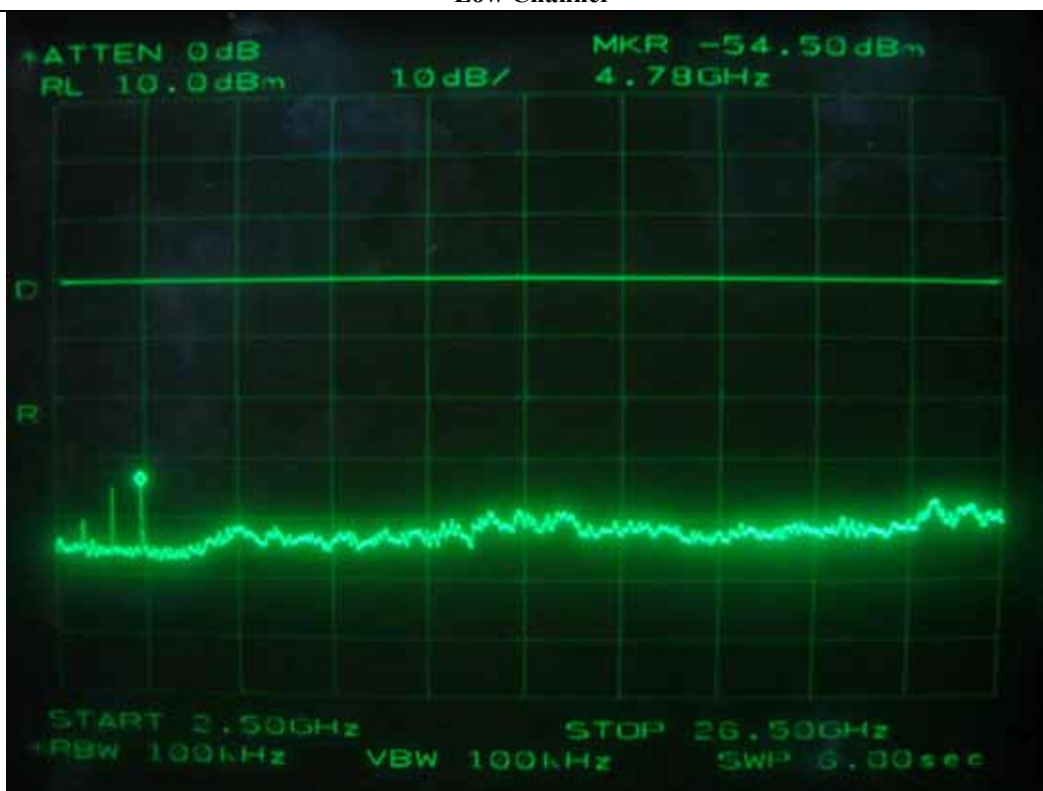
EMC-003 (Rev.1)

**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)

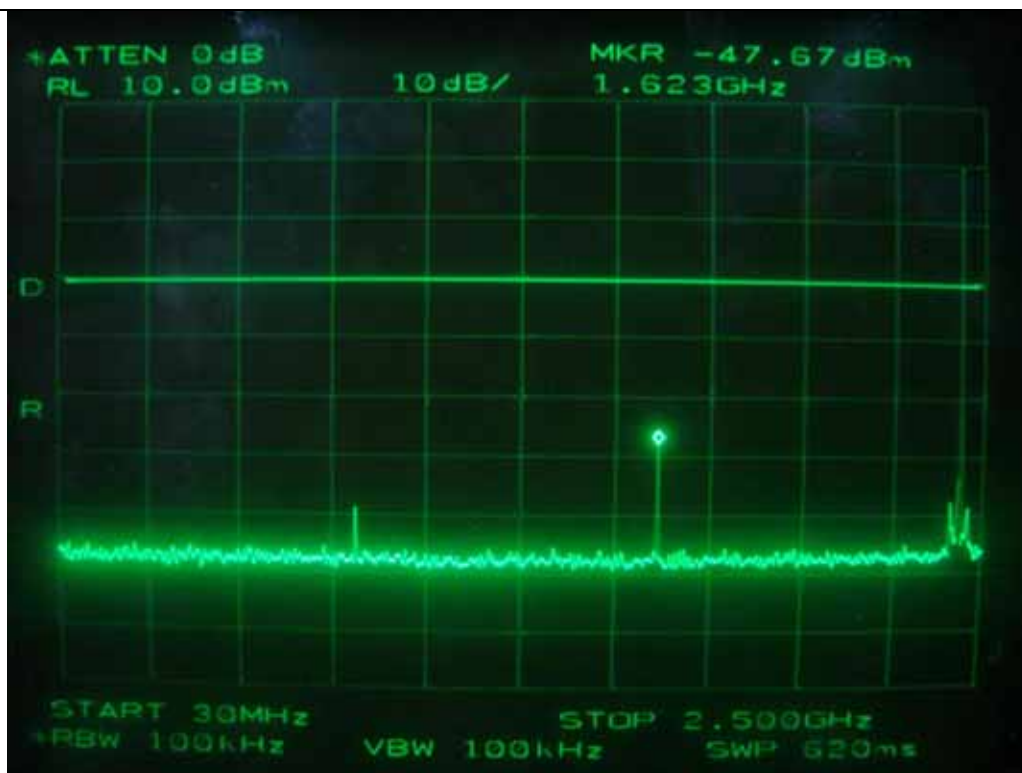
**EMC Testing Dept** : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea. (TEL: +82-31-765-8289, FAX: +82-31-766-2904)



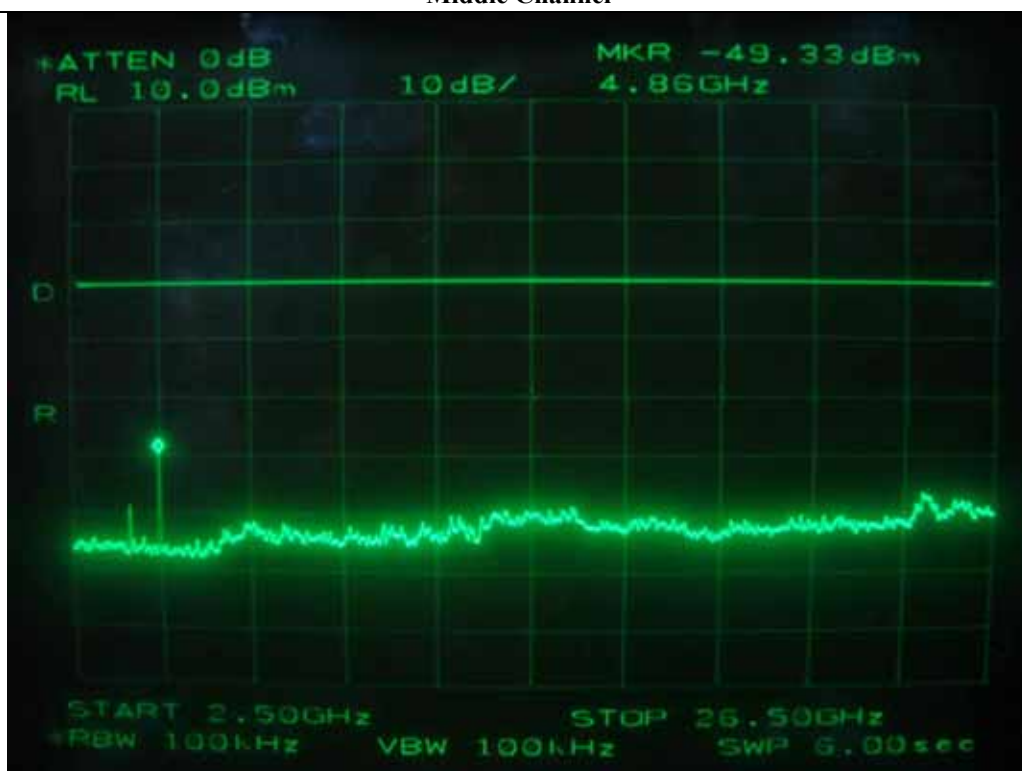
Low Channel



Low Channel

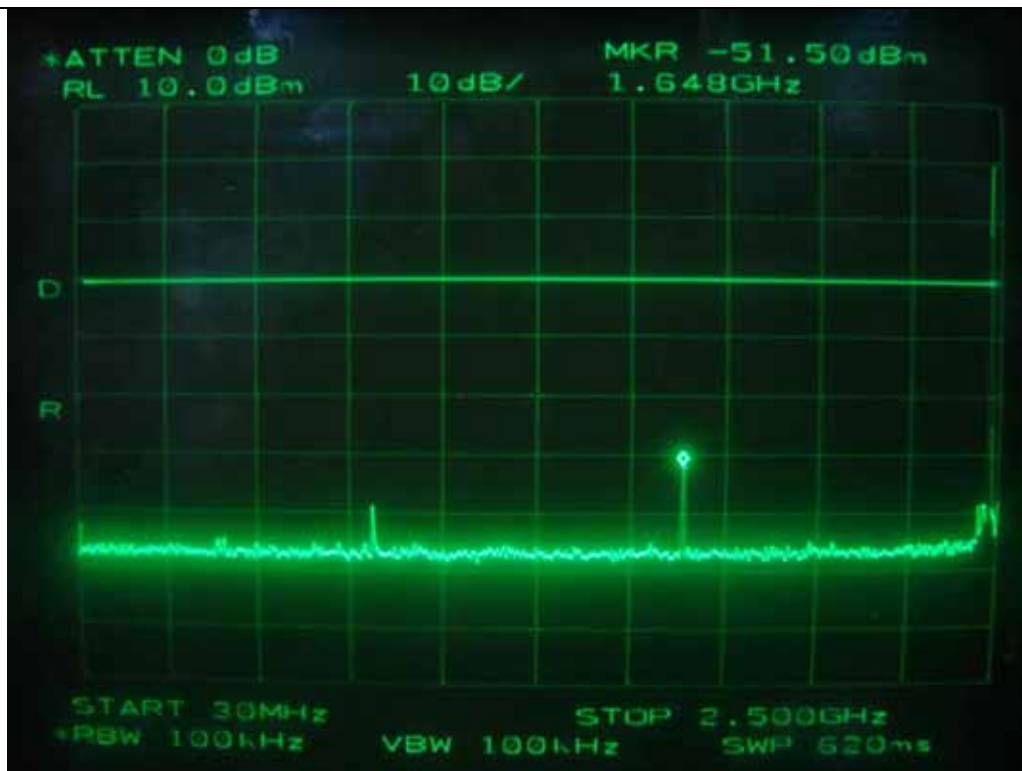


Middle Channel

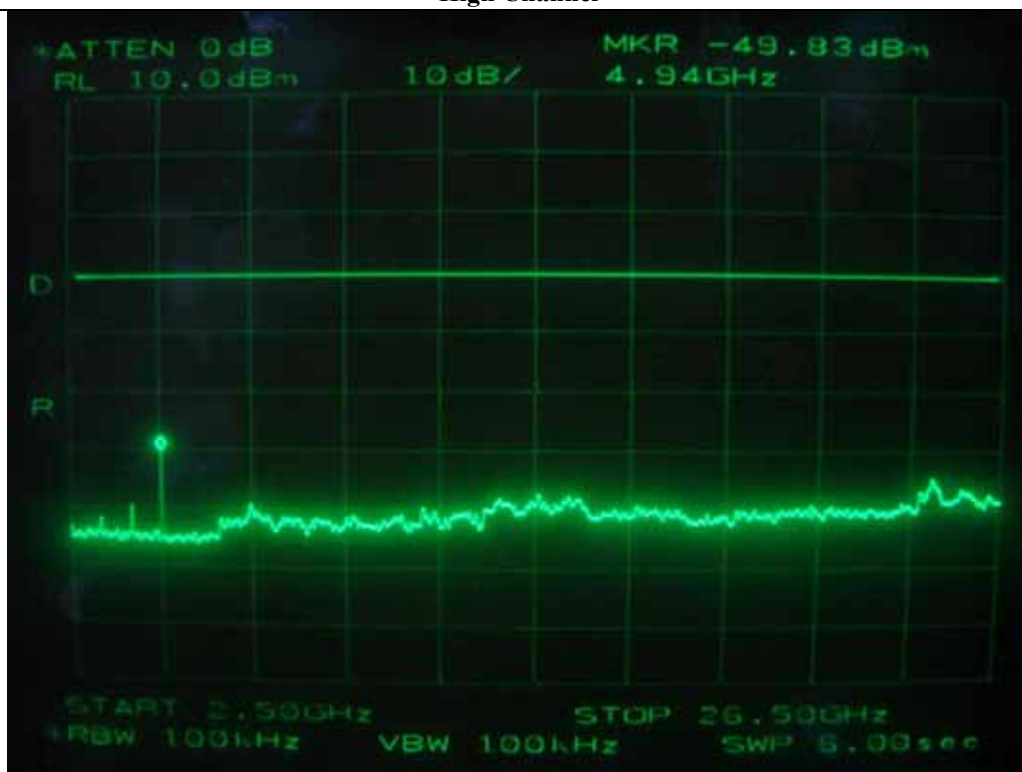


Middle Channel





High Channel



High Channel

## 12.6. Test data for radiated emission

### 12.6.1. Radiated Emission which fall in the Restricted Band (GFSK Modulation)

- Test Date : September 18, 2008
- Temperature : 23 °C
- Relative humidity : 45.2 %R.H.
- 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 : 3 m
- Operating Condition : Low / High Channel
- Result : Pass

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 390.00	36.00	Peak	H	27.26	3.83	26.1	40.99	74.0	-33.01
	25.50	Average	H				30.49	54.0	-23.51
	36.33	Peak	V				41.32	74.0	-32.68
	25.67	Average	V				30.66	54.0	-23.34
Test Data for High Channel									
2 483.50	38.50	Peak	H	27.55	3.83	26.1	43.78	74.0	-30.23
	26.83	Average	H				32.11	54.0	-21.90
	37.83	Peak	V				43.11	74.0	-30.90
	26.50	Average	V				31.78	54.0	-22.23

Tabulated test data for Restricted Band

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

기홍

Tested by: Ki-Hong, Nam / Project Engineer

### 12.6.2. Radiated Emission which fall in the Restricted Band (DQPSK Modulation)

- Test Date : September 18, 2008
- Temperature : 23 °C
- Relative humidity : 45.2 %R.H.
- 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 : 3 m
- Operating Condition : Low / High Channel
- Result : Pass

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 390.00	36.17	Peak	H	27.26	3.83	26.1	41.16	74.0	-32.84
	25.50	Average	H				30.49	54.0	-23.51
	36.50	Peak	V				41.49	74.0	-32.51
	25.83	Average	V				30.82	54.0	-23.18
Test Data for High Channel									
2 483.50	38.83	Peak	H	27.55	3.83	26.1	44.11	74.0	-29.90
	26.83	Average	H				32.11	54.0	-21.90
	38.00	Peak	V				43.28	74.0	-30.73
	26.67	Average	V				31.95	54.0	-22.06

Tabulated test data for Restricted Band

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



Tested by: Ki-Hong, Nam / Project Engineer

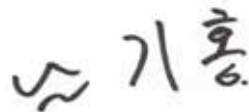
### 12.6.3. Radiated Emission which fall in the Restricted Band (8DPSK Modulation)

- Test Date : September 18, 2008
- Temperature : 23 °C
- Relative humidity : 45.2 %R.H.
- 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 : 3 m
- Operating Condition : Low / High Channel
- Result : Pass

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 390.00	35.83	Peak	H	27.26	3.83	26.1	40.82	74.0	-33.18
	25.33	Average	H				30.32	54.0	-23.68
	36.00	Peak	V				40.99	74.0	-33.01
	25.67	Average	V				30.66	54.0	-23.34
Test Data for High Channel									
2 483.50	38.72	Peak	H	27.55	3.83	26.1	44.00	74.0	-30.01
	26.67	Average	H				31.95	54.0	-22.06
	38.17	Peak	V				43.45	74.0	-30.56
	26.50	Average	V				31.78	54.0	-22.23

Tabulated test data for Restricted Band

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



Tested by: Ki-Hong, Nam / Project Engineer

#### 12.6.4. Spurious & Harmonic Radiated Emission (GFSK Modulation)

- Test Date : September 18, 2008
- Temperature : 23 °C
- Relative humidity : 45.2 %R.H.
- 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 : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 402.00	59.50	Peak	H	27.30	3.83		90.63	-	-
	62.80	Peak	V				93.93	-	-
4 804.00*	37.67	Peak	H	31.60	6.54	26.10	49.71	74.00	-24.29
	26.67	Average	H				38.71	54.00	-15.29
	36.50	Peak	V				48.54	74.00	-25.46
	26.00	Average	V				38.04	54.00	-15.96
Test Data for Middle Channel									
2 441.00	60.30	Peak	H	27.42	3.83		91.55	-	-
	63.10	Peak	V				94.35	-	-
4 882.00*	37.50	Peak	H	31.74	6.59	26.10	49.73	74.00	-24.27
	26.50	Average	H				38.73	54.00	-15.27
	36.33	Peak	V				48.56	74.00	-25.44
	26.00	Average	V				38.23	54.00	-15.77

Tabulated test data for Restricted Band

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

-Continued

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for High Channel</b>									
2 480.00	60.80	Peak	H	27.53	3.83		92.16	-	-
	63.50	Peak	V				94.86	-	-
4 960.00*	37.17	Peak	H	31.87	6.64	26.10	49.58	74.00	-24.42
	26.33	Average	H				38.74	54.00	-15.26
	36.33	Peak	V				48.74	74.00	-25.26
	25.83	Average	V				38.24	54.00	-15.76

Tabulated test data for Restricted Band

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

기홍

Tested by: Ki-Hong, Nam / Project Engineer

### 12.6.5. Spurious & Harmonic Radiated Emission (DQPSK Modulation)

- Test Date : September 18, 2008
- Temperature : 23 °C
- Relative humidity : 45.2 %R.H.
- 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 : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 402.00	57.80	Peak	H	27.30	3.83		88.93	-	-
	60.90	Peak	V				92.03	-	-
4 804.00*	37.83	Peak	H	31.60	6.54	26.10	49.87	74.00	-24.13
	26.67	Average	H				38.71	54.00	-15.29
	36.33	Peak	V				48.37	74.00	-25.63
	25.83	Average	V				37.87	54.00	-16.13
Test Data for Middle Channel									
2 441.00	58.90	Peak	H	27.42	3.83		90.15	-	-
	62.00	Peak	V				93.25	-	-
4 882.00*	37.33	Peak	H	31.74	6.59	26.10	49.56	74.00	-24.44
	26.83	Average	H				39.06	54.00	-14.94
	36.50	Peak	V				48.73	74.00	-25.27
	26.00	Average	V				38.23	54.00	-15.77

Tabulated test data for Restricted Band

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



-Continued

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for High Channel</b>									
2 480.00	59.50	Peak	H	27.53	3.83		90.86	-	-
	62.30	Peak	V				93.66	-	-
4 960.00*	37.00	Peak	H	31.87	6.64	26.10	49.41	74.00	-24.59
	26.67	Average	H				39.08	54.00	-14.92
	36.33	Peak	V				48.74	74.00	-25.26
	26.00	Average	V				38.41	54.00	-15.59

Tabulated test data for Restricted Band

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

기홍

Tested by: Ki-Hong, Nam / Project Engineer

### 12.6.6. Spurious & Harmonic Radiated Emission (8DPSK Modulation)

- . Test Date : September 18, 2008
- . Temperature : 23 °C
- . Relative humidity : 45.2 %R.H.
- . 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 : 3 m
- . Result : Pass

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 402.00	56.50	Peak	H	27.30	3.83		87.63	-	-
	59.30	Peak	V				90.43	-	-
4 804.00*	37.50	Peak	H	31.60	6.54	26.10	49.54	74.00	-24.46
	26.50	Average	H				38.54	54.00	-15.46
	36.50	Peak	V				48.54	74.00	-25.46
	25.92	Average	V				37.96	54.00	-16.04
Test Data for Middle Channel									
2 441.00	58.00	Peak	H	27.42	3.83		89.25	-	-
	60.80	Peak	V				92.05	-	-
4 882.00*	37.67	Peak	H	31.74	6.59	26.10	49.90	74.00	-24.10
	26.67	Average	H				38.90	54.00	-15.10
	36.33	Peak	V				48.56	74.00	-25.44
	25.83	Average	V				38.06	54.00	-15.94

Tabulated test data for Restricted Band

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

-Continued

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for High Channel</b>									
2 480.00	58.80	Peak	H	27.53	3.83		90.16	-	-
	61.20	Peak	V				92.56	-	-
4 960.00*	37.50	Peak	H	31.87	6.64	26.10	49.91	74.00	-24.09
	26.50	Average	H				38.91	54.00	-15.09
	36.17	Peak	V				48.58	74.00	-25.42
	25.67	Average	V				38.08	54.00	-15.92

Tabulated test data for Restricted Band

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



Tested by: Ki-Hong, Nam / Project Engineer

### 13. PEAK POWER SPECTRUL DENSITY

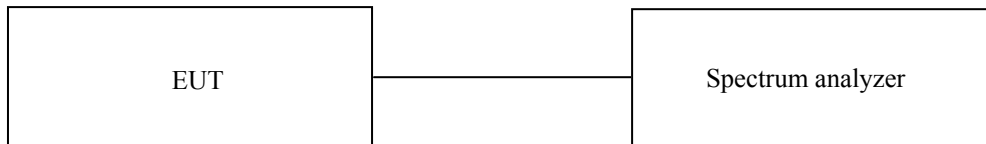
#### 13.1 Operating environment

Temperature : 26 °C  
Relative humidity : 50 %R.H.

#### 13.2 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.



#### 13.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - 8564E	HP	Spectrum Analyzer	3650A00756	June 16, 2008

All test equipment used is calibrated on a regular basis.

### 13.4 Test data

-. Test Date : September 16, 2008

-. Result : Pass

#### 13.4.1 Test result at GFSK Modulation

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402	-11.17	8.00	-19.17
Middle	2 441	-10.33	8.00	-18.33
High	2 480	-9.33	8.00	-17.33

#### 13.4.2 Test result at DQPSK Modulation

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402	-12.50	8.00	-20.50
Middle	2 441	-12.00	8.00	-20.00
High	2 480	-11.33	8.00	-19.33

#### 13.4.3 Test result at 8DPSK Modulation

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402	-13.67	8.00	-21.67
Middle	2 441	-13.17	8.00	-21.17
High	2 480	-12.17	8.00	-20.17

Tabulated test data for Peak Power Spectral Density.

Remark: See next page for measurement data.

기홍

Tested by: Ki-Hong, Nam / Project Engineer



Low Channel (GFSK Modulation)



Middle Channel (GFSK Modulation)



High Channel (GFSK Modulation)



Low Channel (DQPSK Modulation)

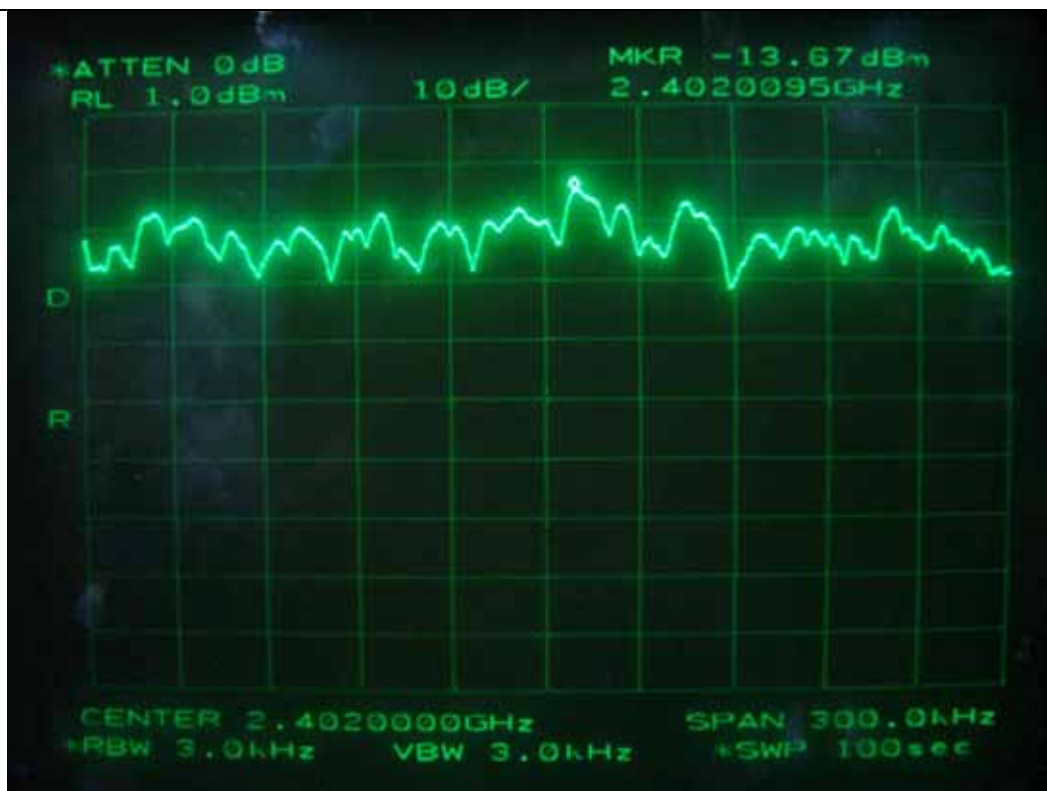




Middle Channel (DQPSK Modulation)



High Channel (DQPSK Modulation)



Low Channel (8DPSK Modulation)



Middle Channel (8DPSK Modulation)



High Channel (8DPSK Modulation)

## 14. RADIO FREQUENCY EXPOSURE

### 14.1 RF Exposure Limit

According to the FCC rule §1.1310, the limit for General Population/Uncontrolled exposure is 1 mW/cm<sup>2</sup> for the device operating 1 500 MHz ~ 100 000 MHz.

### 14.2 EUT Description

Kind of EUT	Portable GPS Navigation Device
Operating Frequency Band	<input type="checkbox"/> WLAN: 2 400 MHz ~ 2 483.5 MHz <input type="checkbox"/> WLAN: 5 180 MHz ~ 5 320 MHz / 5 500 MHz ~ 5700 MHz <input type="checkbox"/> WLAN: 5 745 MHz ~ 5 825 MHz <input checked="" type="checkbox"/> Bluetooth: 2 400 MHz ~ 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	3.00 dBm (1.995 mW)
Used Antenna	Dielectric Chip Antenna
Used Antenna Gain	2.79 dBi
Exposure Evaluation Applied	<input type="checkbox"/> MPE <input type="checkbox"/> SAR <input checked="" type="checkbox"/> N/A

### 14.3 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.

## 15. RADIATED EMISSION TEST

### 15.1 Operating environment

Temperature : 23 °C  
Relative humidity : 45.2 %R.H.

### 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 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.

### 15.3 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	2516A01677	June 17, 2008
■ - 8447D	Hewlett Packard	Amplifier	2727A04987	June 16, 2008
■ - 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.

## 15.4 Test data

- Test Date : September 18, 2008
- Resolution bandwidth : 120 kHz
- Frequency range : 30 MHz ~ 1 000 MHz
- Measurement distance : 3 m
- Result : PASSED BY -5.21 dB at 65.4 MHz under GFSK Modulation (High Channel)
- Channel : Low

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
65.40	26.30	H	6.46	1.91	34.67	40.00	-5.33
114.20	21.20	H	12.27	2.16	35.63	43.52	-7.89
137.80	18.30	H	14.46	2.50	35.26	43.52	-8.26
146.90	18.20	H	14.83	2.64	35.67	43.52	-7.85
208.80	16.10	H	16.54	3.11	35.75	43.52	-7.77
305.10	21.80	H	13.99	3.33	39.12	46.02	-6.90

Tabulated test data for Radiated Electromagnetic Field

- Channel : Middle

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
65.40	26.17	H	6.46	1.91	34.54	40.00	-5.46
114.20	22.00	H	12.27	2.16	36.43	43.52	-7.09
137.80	18.50	H	14.46	2.50	35.46	43.52	-8.06
146.90	18.00	H	14.83	2.64	35.47	43.52	-8.05
208.80	15.83	H	16.54	3.11	35.48	43.52	-8.04
305.10	22.00	H	13.99	3.33	39.32	46.02	-6.70

Tabulated test data for Radiated Electromagnetic Field



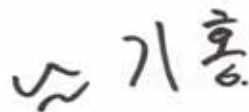
-. Channel : High

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
65.40	26.42	H	6.46	1.91	34.79	40.00	-5.21
114.20	22.00	H	12.27	2.16	36.43	43.52	-7.09
137.80	18.10	H	14.46	2.50	35.06	43.52	-8.46
146.90	18.00	H	14.83	2.64	35.47	43.52	-8.05
208.80	16.33	H	16.54	3.11	35.98	43.52	-7.54
305.10	21.50	H	13.99	3.33	38.82	46.02	-7.20

Tabulated test data for Radiated Electromagnetic Field

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

The EUT was tested at each GFSK, DQPSK and 8DPSK modulation, but the worst case data recorded in above table.



Tested by: Ki-Hong, Nam / Project Engineer

## 16. CONDUCTED EMISSION TEST

### 16.1 Operating environment

Temperature : 26 °C  
Relative humidity : 62 %R.H.

### 16.2 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  $\Omega$ / 50  $\mu$ H + 5  $\Omega$  Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

### 16.3 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	June 16, 2008
■ -	3825/2	EMCO	AMN	9109-1867	June 16, 2008

All test equipment used is calibrated on a regular basis.

#### 16.4 Test data

- Test Date : September 10, 2008
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Test Result : PASSED BY -9.14 dB at 1.30 MHz under GFSK Modulation

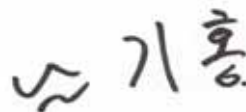
Frequency (MHz)	Line	Peak (dBμV)		Margin (dB)
		Emission level	Q.P Limits	
0.72	H	43.73	56.00	-12.27
1.00	H	46.72	56.00	-9.28
1.27	N	42.28	56.00	-13.72
1.30	H	46.86	56.00	-9.14
3.62	H	42.60	56.00	-13.40
3.69	N	41.71	56.00	-14.29
Frequency (MHz)	Line	Average (dBμV)		Margin (dB)
		Emission level	Limits	
0.72	H	27.05	46.00	-18.95
1.00	H	29.24	46.00	-16.76
1.30	H	29.87	46.00	-16.13
3.62	H	28.22	46.00	-17.78

Line Conducted Emissions Tabulated Data

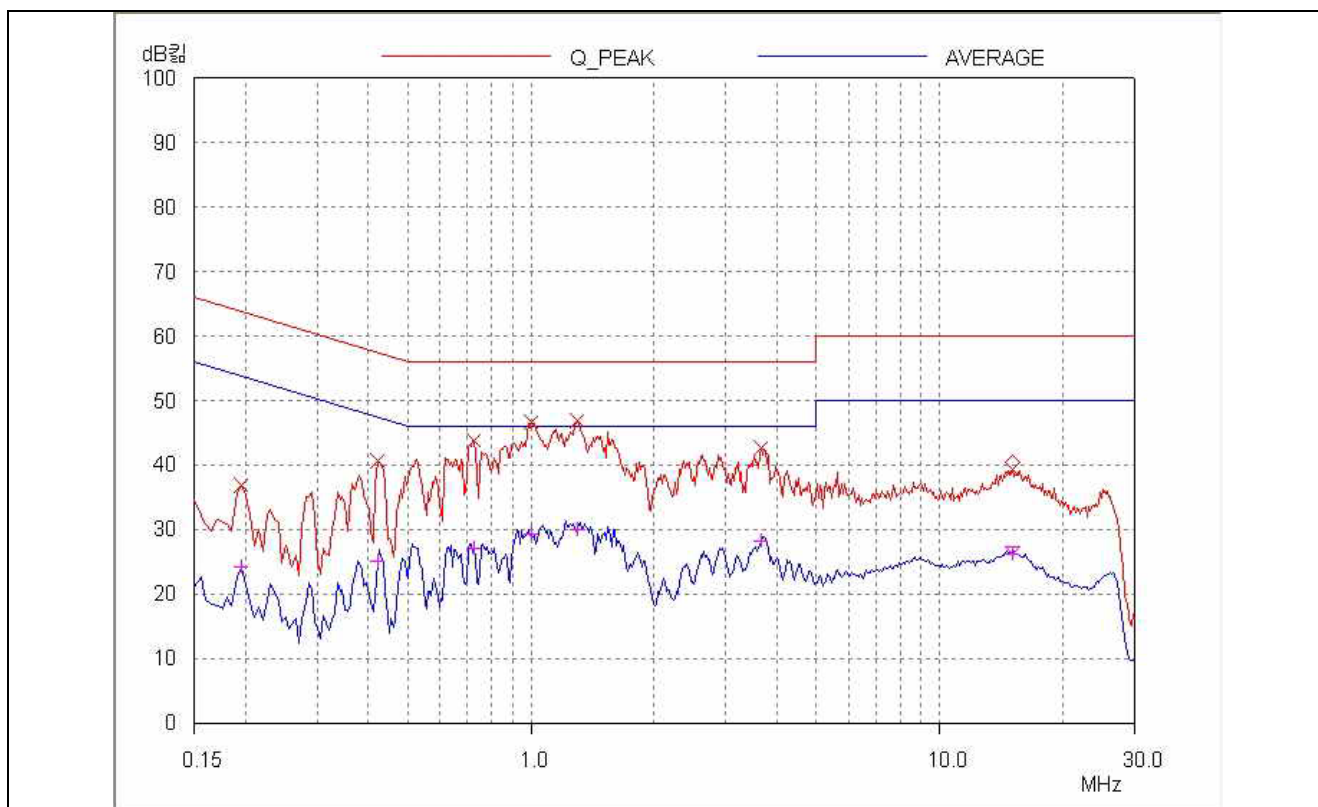
Remark : “H”: Hot Line, “N”: Neutral line

The EUT was tested at each GFSK, DQPSK and 8DPSK modulation, but the worst case data recorded in above table.

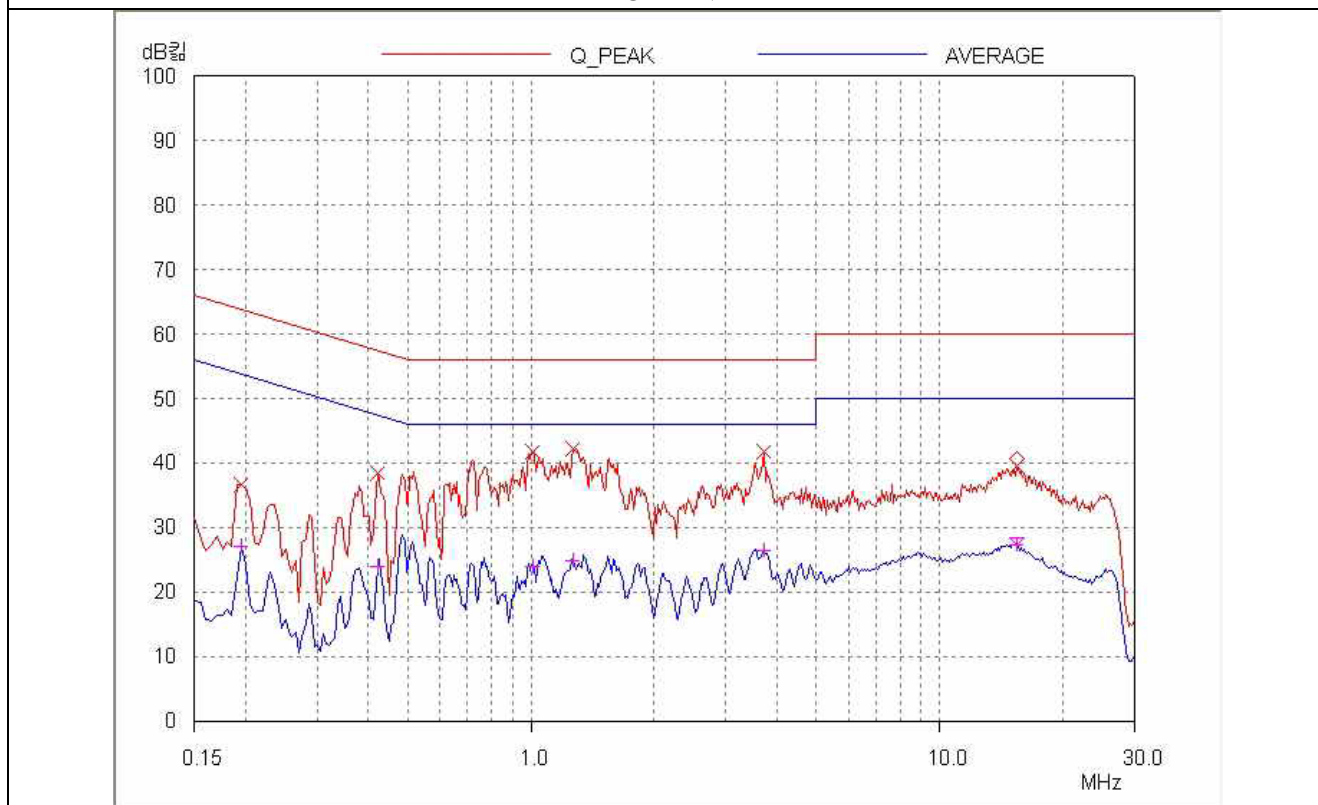
See next page for an overview sweep performed with peak and average detector modes.



Tested by: Ki-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)