

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

Test Report No. : E081R-043

AGR No : A081A-094

Applicant : GAON-INT CO., LTD.

Address : Daelim Bldg., Suite 1501, Dohwa 1-dong, Nam-gu, Incheon, Korea

Manufacturer : Founder Telecommunication Corp. Ltd.

Address : FOUNDER TECHNOLOGY GARDEN, NO.2 LONGSHENG ROAD, XINCHENG DISTRICT, SHILONG TOWN, DONGGUAN, CHINA

Type of Equipment : 2.4GHz Band Low-Power Data Communication System Transmitter

FCC ID. : UP4SP-400T

Model Name : SP-400T

Serial number : None

Total page of Report : 17 pages (including this page)

Date of Incoming : January 02, 2008

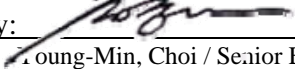
Date of issue : January 25, 2008

## SUMMARY

The equipment complies with the regulation; **FCC Part 15 Subpart C Section 15.249.**

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

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

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EMC-003(Rev.0)

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**1. VERIFICATION OF COMPLIANCE**

APPLICANT : GAON-INT CO., LTD.  
 ADDRESS : Daelim Bldg., Suite 1501, Dohwa 1-dong, Nam-gu, Incheon, Korea  
 CONTACT PERSON : Mr. Taejun, Kim / Director  
 TELEPHONE NO : +82-32-246-1800  
 FCC ID : UP4SP-400T  
 MODEL NAME : SP-400T  
 BRAND NAME : i-pointer  
 SERIAL NUMBER : N/A  
 DATE : January 25, 2008

EQUIPMENT CLASS	<b>DXS - Part 15 Low Power Communication Device Transmitter</b>
KIND OF EQUIPMENT	2.4GHz Band Low-Power Data Communication System Transmitter
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 15.249
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	No
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
15.249 (a)	Field Strength of Emission	Met the Limit / PASS
15.249 (c)	Measurement distance	Met the Requirement / PASS
15.249 (d)	Emissions Radiated Outside of the Specified Frequency Band	Met the Limit / PASS
15.249 (e)	Radiated Emissions above 1000MHz	Met the Limit / PASS
15.209	Radiated Emission Limits, General Requirement	Met the Limit / PASS
15.207	Conducted Limits	Not Applicable (See Note)
15.203	Antenna Requirement	Met the Requirement / PASS

Note. The Equipment under Test shall be operated by DC 1.5V (DC 1.5V Battery).

### 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 Daessangryung-ri, Chowol-eup, Gwangju-si, Gyeonggi-do, 464-080, Korea. Description details of test facilities were submitted to the Federal Communications Commission on August 30, 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 GAON-INT CO., LTD., Model: SP-400T (referred to as the EUT in this report) is a 2.4GHz Band Low-Power Data Communication System Transmitter. The EUT has function for Remote controller, Laser Pointer and an associated receiver is manufactured by Founder Telecommunication Corp. Ltd., Model Nos.: SP-400R and SP-400R2G with DoC applications. The associated receivers shall be issued another test report number. Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Portable Device
OPERATING FREQUENCY	2421 ~2460 MHz
RATED RF OUTPUT POWER	Less than 0dBm
RATED OCCUPIED BANDWIDTH	Less than 1MHz
DATA TRANSFER RATE	250kbps
USED RF CHIEF	Nordic, nRF2402
ANTENNA	Inserted into the main board (Pattern Antenna)
CHANNEL	40 Channels
MODULATION	GFSK (Gaussian Frequency Shift Keying)
LIST OF EACH OSC. OR CRY. FREQ.(FREQ.>=1MHz)	12 MHz
NUMBER OF LAYER	2 Layers
POWER REQUIREMENT	DC 1.5V from a battery
EXTERNAL CONNECTOR	None

#### 3.2 Model Differences

-. None

#### 3.3. EUT MODIFICATIONS

-. None

## 4. SYSTEM TEST CONFIGURATION

### 4.1 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	SP-400T Ver-W2	N/A

### 4.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested: None

### 4.3 Mode of operation during the test

To get a maximum radiated emission from the EUT, the button on the EUT was continuously pressed to transmit the signal.

To activate continuous transmission, place a small plastic block between rubber band and the push button on the EUT.

To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes.

### 4.4 Configuration of Test System

**Line Conducted Test:** It is not need to test this requirement, because the EUT shall be operated by DC battery.

**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.

### 4.5 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 a pattern antenna on the main board in the EUT, so no consideration of replacement by the user.

## 5. PRELIMINARY TEST

### 5.1 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)
It is not need to test this requirement, because the power of the EUT is supplied from a DC battery.	

### 5.2 General Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

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

## 6. RADIATED EMISSION TEST, GENERAL REQUIREMENT

### 6.1 Test set-up

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

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

### 6.2 Measurement uncertainty

Radiated emission electric field intensity, 30 MHz ~ 300 MHz :  $\pm 4.43$  dB

Radiated emission electric field intensity, 300 MHz ~ 1000 MHz :  $\pm 3.80$  dB

Measurement uncertainty is calculated in accordance with WECC 19-1990. The measurement uncertainty is given with a confidence of 95% with the coverage factor, k=2.

### 6.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	ESVS10	Rohde & Schwarz	EMI Test Receiver	827864/005	Dec 21, 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 08, 2007
■ -	9108-A(494)	Schwarzbeck	Log Periodic Antenna	62281001	Feb 08, 2007
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D294	July 03, 2006(2Y)

All test equipment used is calibrated on a regular basis.



## 6.4 Final Result of Measurement

### 6.4.1 Field Strength of the Fundamental Frequency

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : 48 % Temperature: 10 °C  
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(a)  
 Result : PASSED BY -16.98 dB at 2421.00 MHz

EUT : 2.4GHz Band Low-Power Data Date: January 14, 2008  
 Communication System Transmitter  
 Operating Condition : TX mode  
 Distance : 3 meters

Channel	Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
	Carrier Freq. (MHz)	Amplitude (dBuV)	Detect Mode	Pol.	Antenna (dB/m)	Cable (dB)	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Low	2421.00	51.50	Peak	H	27.25	3.83	82.58	113.98	-31.40
		43.17	Average	H			74.25	93.98	-19.73
		57.00	Peak	V			88.08	113.98	-25.90
		45.92	Average	V			77.00	93.98	-16.98
Middle	2440.00	50.67	Peak	H	27.31	3.83	81.81	113.98	-32.17
		42.83	Average	H			73.97	93.98	-20.01
		56.25	Peak	V			87.39	113.98	-26.59
		45.33	Average	V			76.47	93.98	-17.51
High	2460.00	50.83	Peak	H	27.37	3.83	82.03	113.98	-31.95
		42.50	Average	H			73.70	93.98	-20.28
		57.00	Peak	V			88.20	113.98	-25.78
		45.50	Average	V			76.70	93.98	-17.28

\*Remark: To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes.

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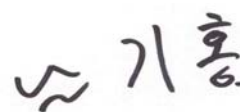
Tested by: Ki-Hong, Nam / Test Engineer

**6.4.2 Emissions Conducted Outside of the Specified Frequency Bands**

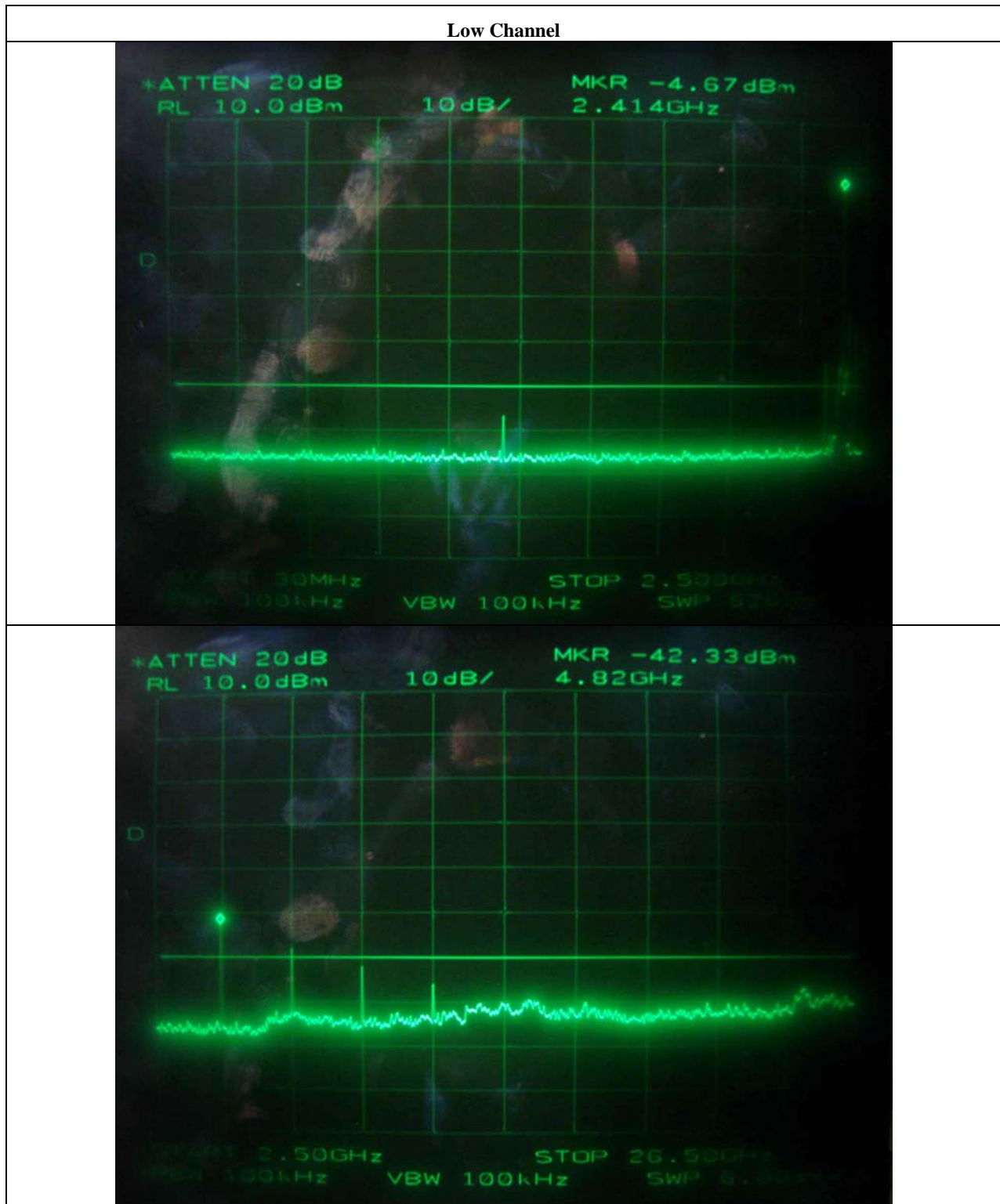
Humidity Level : 48 % Temperature: 10 °C  
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(d)  
 Result : PASS

EUT : 2.4GHz Band Low-Power Data Date: January 14, 2008  
 Communication System Transmitter  
 Operating Condition : TX mode  
 Distance : 3 meters

Channel	Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
	Carrier Freq. (MHz)	Amplitude (dBuV)	Detect Mode	Pol.	Antenna (dB/m)	Cable (dB)	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Low	Spurious frequencies except harmonics have margin more than 50dB, and were scanned up to 26.5 GHz. See next page for graph data, which was obtained by conducted measurement.								
Middle									
High									



Tested by: Ki-Hong, Nam / Test Engineer

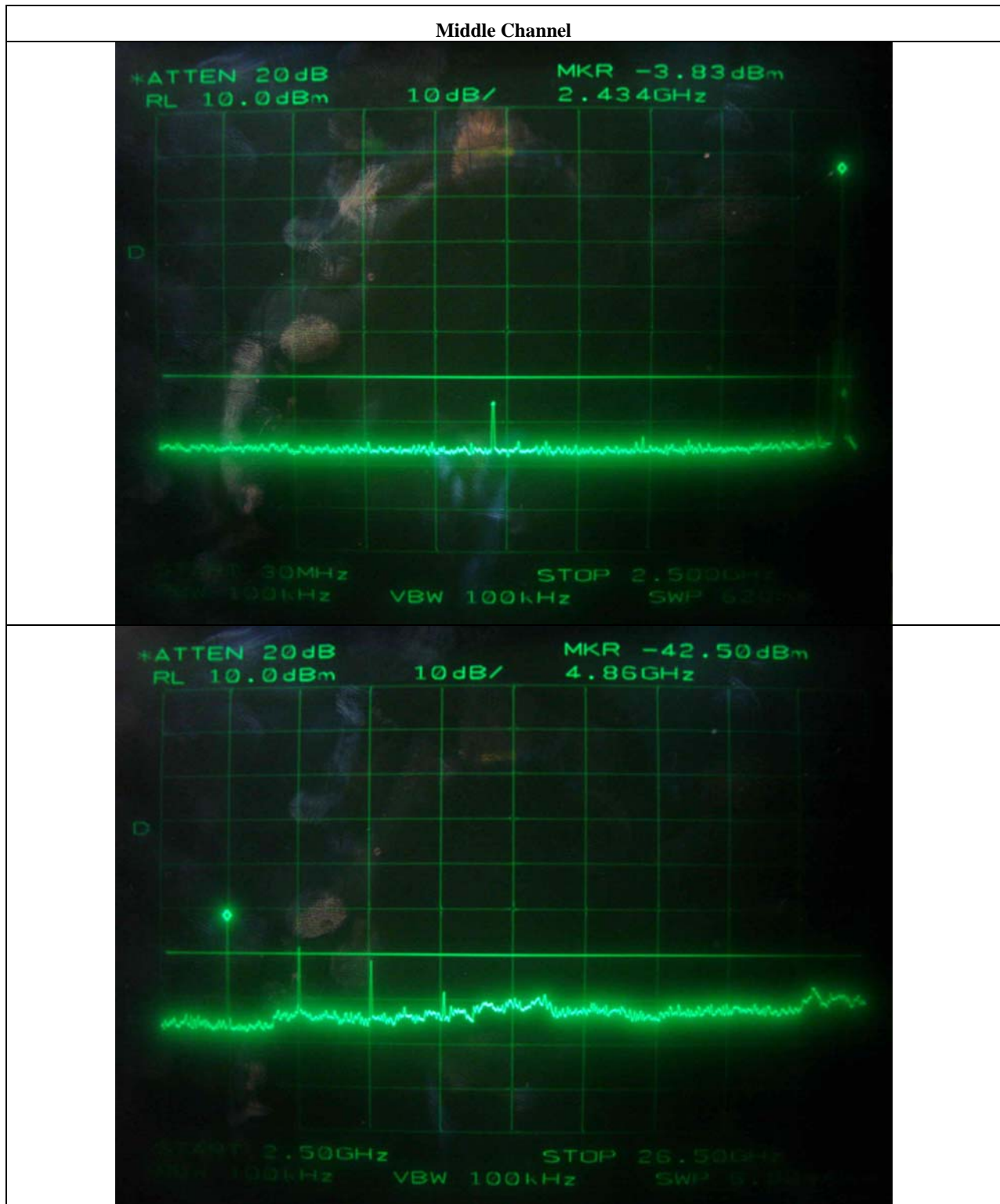


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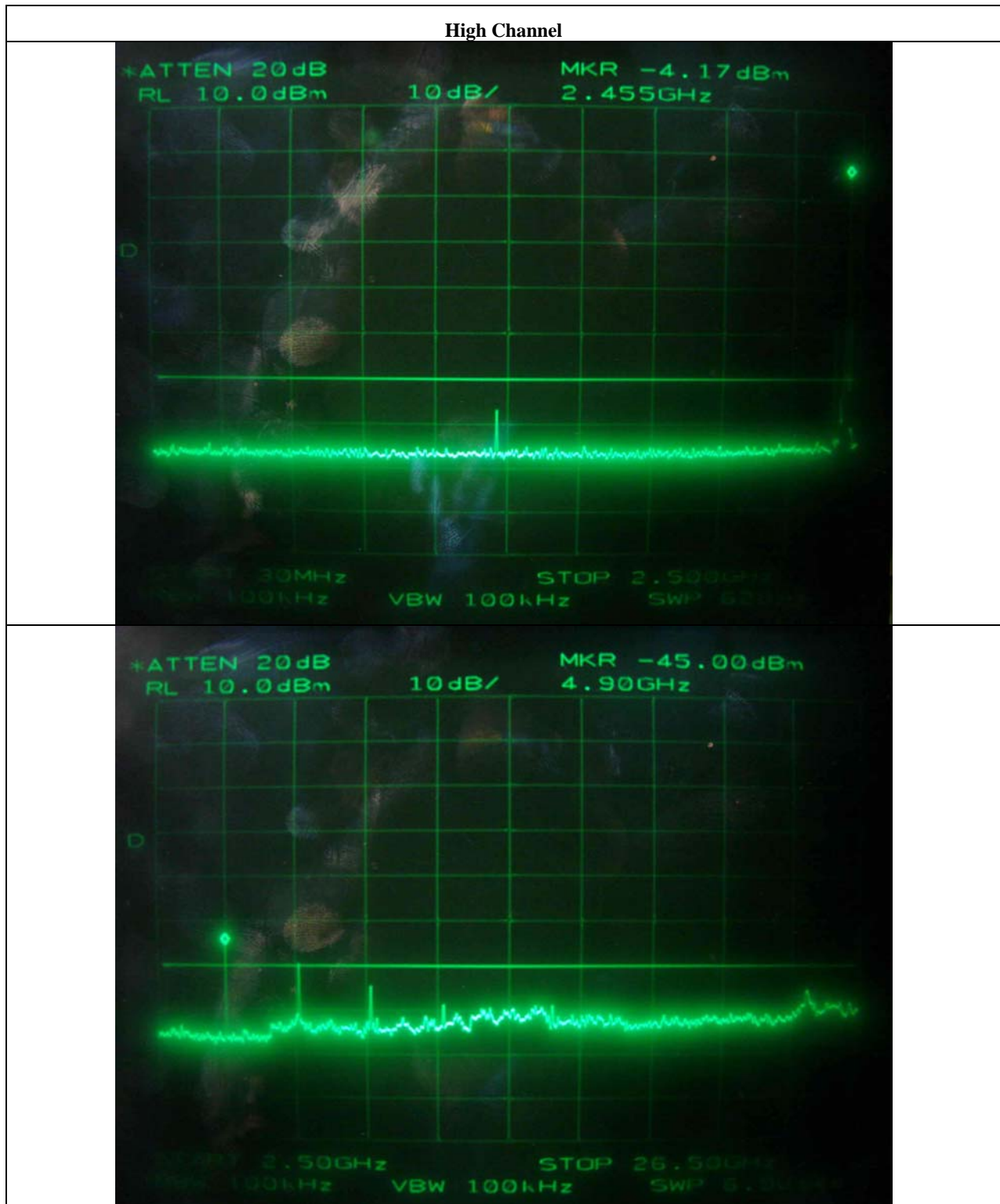


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### 6.4.3 Emissions Radiated Outside of the Specified Frequency Bands

#### 6.4.3.1 Test Data for Spurious except for Harmonic above 1000MHz

Humidity Level : 48 % Temperature: 10 °C  
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(d)  
 Result : PASSED BY -15.19 dB at 2575.61

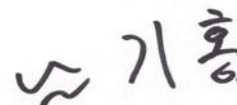
EUT : 2.4GHz Band Low-Power Data Date: January 14, 2008  
 Communication System Transmitter  
 Operating Condition : TX mode  
 Distance : 3 meters

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Dist. Factor	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Test Data for Low Channel										
2333.63*	39.83	Peak	H	26.97	3.34	25.60	N/A	44.54	73.98	-29.44
	31.50	Average	H					36.21	53.98	-17.77
	41.50	Peak	V					46.21	73.98	-27.77
	31.00	Average	V					35.71	53.98	-18.27
2387.48*	41.67	Peak	H	27.14	3.85	25.60	N/A	47.06	73.98	-26.92
	31.50	Average	H					36.89	53.98	-17.09
	40.83	Peak	V					46.22	73.98	-27.76
	31.27	Average	V					36.66	53.98	-17.32
Test Data for Middle Channel										
2333.88*	39.25	Peak	H	26.98	3.39	25.60	N/A	44.01	73.98	-29.97
	31.50	Average	H					36.26	53.98	-17.72
	42.17	Peak	V					46.93	73.98	-27.05
	32.67	Average	V					37.43	53.98	-16.55
2387.48*	40.83	Peak	H	27.14	3.85	25.60	N/A	46.22	73.98	-27.76
	32.00	Average	H					37.39	53.98	-16.59
	42.50	Peak	V					47.89	73.98	-26.09
	32.50	Average	V					37.89	53.98	-16.09

Test Data for High Channel										
2387.48*	40.33	Peak	H	27.14	3.85	25.60	N/A	45.72	73.98	-28.26
	32.10	Average	H					37.49	53.98	-16.49
	41.67	Peak	V					47.06	73.98	-26.92
	32.00	Average	V					37.39	53.98	-16.59
2575.61*	41.00	Peak	H	27.73	3.83	25.60	N/A	46.96	73.98	-27.02
	32.83	Average	H					38.79	53.98	-15.19
	41.92	Peak	V					47.88	73.98	-26.10
	32.00	Average	V					37.96	53.98	-16.02

Tabulated test data for Restricted Band

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



Tested by: Ki-Hong, Nam / Test Engineer

## 6.4.3.2 Test Data for Harmonic

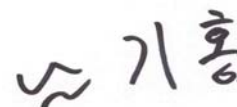
Humidity Level : 48 % Temperature: 10 °C  
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(a)  
 Result : PASSED BY -9.51dB at 4920.00 MHz

EUT : 2.4GHz Band Low-Power Data Date: January 14, 2008  
 Communication System Transmitter  
 Operating Condition : TX mode  
 Distance : 3 meters

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Dist. Factor	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Test Data for Low Channel										
4842.00*	36.83	Peak	H	31.65	6.63	25.50	N/A	49.60	73.98	-24.38
	29.50	Average	H					42.27	53.98	-11.71
	40.83	Peak	V					53.60	73.98	-20.38
	31.33	Average	V					44.10	53.98	-9.88
Other frequencies were not found up to 26.5GHz.										
Test Data for Middle Channel										
4880.00*	36.92	Peak	H	31.71	6.66	25.50	N/A	49.79	73.98	-24.19
	29.33	Average	H					42.20	53.98	-11.78
	40.50	Peak	V					53.37	73.98	-20.61
	31.00	Average	V					43.87	53.98	-10.11
Other frequencies were not found up to 26.5GHz.										
Test Data for High Channel										
4920.00*	37.00	Peak	H	31.78	6.69	25.50	N/A	49.98	73.98	-24.01
	29.67	Average	H					42.65	53.98	-11.34
	40.83	Peak	V					53.81	73.98	-20.18
	31.50	Average	V					44.48	53.98	-9.51
Other frequencies were not found up to 26.5GHz.										

Tabulated test data for Restricted Band

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



Tested by: Ki-Hong, Nam / Test Engineer

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**6.4.3.3 Test Data for Spurious except for Harmonic below 1000MHz**

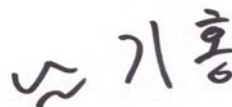
Humidity Level : 48 % Temperature: 10 °C  
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(d)  
 Result : PASS

EUT : 2.4GHz Band Low-Power Data Date: January 14, 2008  
 Communication System Transmitter  
 Operating Condition : TX mode  
 Distance : 3 meters

Frequency (MHz)	Reading (dBuV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
It was not observed any emissions from the EUT.							

Tabulated test data for Radiated Electromagnetic Field

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



Tested by: Ki-Hong, Nam / Test Engineer