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

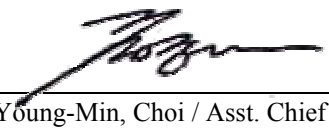
Test Report No.	**: E086R-008**
AGR No	**: A083A-119R**
Applicant	**: Digifi Co., Ltd.**
Address	**: 12F, Gyeonggi Venture Bldg., Anyang Center, 572-5, Anyang-8dong, Manan-gu, Anyang-si, Gyeonggi-do, Korea**
Manufacturer	**: Digifi Co., Ltd.**
Address	**: 12F, Gyeonggi Venture Bldg., Anyang Center, 572-5, Anyang-8dong, Manan-gu, Anyang-si, Gyeonggi-do, Korea**
Type of Equipment	**: Dongle of Wireless Earphone set**
FCC ID.	**: V9F-OPERAS1D**
Model Name	**: Opera s1d**
Multiple Model Name	**: Opera s2d**
Serial number	**: None**
Total page of Report	**: 22 pages (including this page)**
Date of Incoming	**: April 03, 2008**
Date of issue	**: June 04, 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.

Prepared by: 

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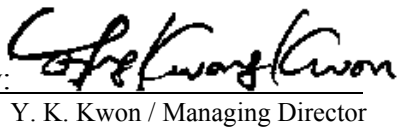
ONETECH Corp.

Reviewed by: 

Y. K. Kwon / Managing Director
EMC Div.
ONETECH Corp.

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CONTENTS

PAGE

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1. VERIFICATION OF COMPLIANCE

APPLICANT	: Digifi Co., Ltd.
ADDRESS	: 12F, Gyeonggi Venture Bldg., Anyang Center, 572-5, Anyang-8dong, Manan-gu, Anyang-si, Gyeonggi-do, Korea
CONTACT PERSON	: Mr. Harry, Park / Managing Director
TELEPHONE NO	: +82-31-446-2345
FCC ID	: V9F-OPERAS1D
MODEL NO/NAME	: Opera s1d
SERIAL NUMBER	: N/A
DATE	: June 04, 2008

EQUIPMENT CLASS	***DXX - Part 15 Low Power Communication Device Transmitter***
KIND OF EQUIPMENT	Dongle of Wireless Earphone set
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.

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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 1 000 MHz	Met the Limit / PASS
15.209	Radiated Emission Limits, General Requirement	Met the Limit / PASS
15.207	Conducted Limits	Met the Limit / PASS
15.203	Antenna Requirement	Met the Requirement / PASS

2.2 Additions, deviations, exclusions from standards

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

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

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

2.5 Test Methodology

Radiated testing was performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at a distance of 3 meters from EUT to the antenna.

2.6 Test Facility

The Electromagnetic compatibility measurement facilities are located on at 307-51 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 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.

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3. GENERAL INFORMATION

3.1 Product Description

The Digifi Co., Ltd., Model: Opera s1d (referred to as the EUT in this report) is a Dongle of Wireless Earphone set. The associated Earset of Wireless Earphone Set is manufactured by Digifi Co., Ltd., Model No. Opera s1e with FCC ID. V9F-OPERAS1E. Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Portable Device
OPERATING FREQUENCY	2 403 MHz ~ 2 478 MHz
RATED RF OUTPUT POWER	-5 dBm
USED ANTENNA	Mfr.: AMOTECH / Model No.: ALA931C5 (Gain 0.75 dBi)
ANTENNA	Chip Antenna
CHANNEL	16 Channels
MODULATION METHOD	MSK
Tx DATA SPEED	2.37 Mb/s
USED RF CHIP	Kleer, KLR3012
LIST OF EACH OSC. OR CRY. FREQ.(FREQ.>=1MHz)	22.576 649 MHz
NUMBER OF LAYER	4 Layers
POWER REQUIREMENT	DC 3.7 V Lithium Polymer Rechargeable Battery
EXTERNAL CONNECTOR	USB cable for only charging

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	Opera s1d	-
Multiple Model	Opera s2d	Only model designation, except for the color.

4. EUT MODIFICATIONS

-. None

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5. SYSTEM TEST CONFIGURATION

5.1 Justification

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

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	Digifi Co., Ltd.	N/A	N/A

5.3 Peripheral equipment

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

Model	Manufacturer	FCC ID	Description	Connected to
Opera s1d	Digifi Co., Ltd.	V9F-OPERAS1D	Dongle of Wireless Earphone set (EUT)	Notebook PC
N/A	N/A	N/A	Jig Board	EUT and Notebook PC
PP04X	Dell Computer	DoC	Notebook PC (For Charging Mode)	-
3453C	U.S. Robotics	CJE-0263	Modem (For Charging Mode)	Notebook PC
PP01L	Dell Computer	DoC	Notebook PC (For Tx Mode)	-
MO56UOA	Dell Computer	DoC	Mouse (For Tx Mode)	Notebook PC

5.4 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, the EUT was set at Low Channel (2 403 MHz), Middle Channel (2 438 MHz), and High Channel (2 478 MHz). To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes. The EUT operated with charging mode during the test.

5.5 Configuration of Test System

Line Conducted Test: The EUT was connected to notebook PC and the power line of notebook PC was connected to LISN. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was 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 3 m 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.

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5.6 Antenna Requirement

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

6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Tests, the following operating mode was investigated

Operation Mode	The Worse operating condition
Charging Mode	X

6.2 General Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

Operation Mode	The Worse operating condition
Stand-by Mode	-
Charging Mode	X
Continuous Transmitting Mode	X

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7. CONDUCTED EMISSION TEST

7.1 Operating environment

Temperature : 24 °C

Relative humidity : 35.4 %R.H.

7.2 Test set-up

The EUT was placed on a wooden table, 0.1 meters height above the floor. Power was fed to the EUT through a 50 ohm / 50 μH + 5 ohm Artificial Main Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

The test set-up photos are included in appendix I.

7.3 Measurement uncertainty

Conducted emission, quasi-peak detection : ± 2.93 dB

Conducted emission, average detection : ± 2.93 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.

7.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	ESHS10	Rohde & Schwarz	EMI Test Receiver	834467/007	May 11, 2007
■ -	NSLK 8128	Schwarzbeck	AMN	8128-216	July 04, 2007
■ -	3825/2	EMCO	AMN	9109-1867	June 21, 2007

All test equipment used is calibrated on a regular basis.

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7.5 Test data

-. Test Date : April 22, 2008

-. Resolution bandwidth : 9 kHz

-. Frequency range : 0.15 MHz ~ 30 MHz

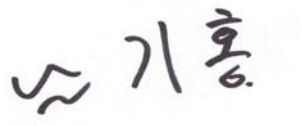
-. Operating Condition : Charging mode

Frequency (MHz)	Line	Peak (dBμV)		Margin (dB)
		Emission level	Q.P Limits	
0.16	N	56.25	65.46	-9.21
0.18	H	57.93	64.49	-6.56
1.94	N	46.29	56.00	-9.71
3.70	N	51.70	56.00	-4.30
3.93	H	47.68	56.00	-8.32
4.23	N	47.89	56.00	-8.11
Frequency (MHz)	**Line**	**Average (dBμV)**		**Margin (dB)**
		Emission level	**Limits**	
1.94	N	41.66	46.00	-4.34
2.20	H	39.43	46.00	-6.57
3.70	N	39.29	46.00	-6.71
3.93	H	38.54	46.00	-7.46
4.23	N	34.07	46.00	-11.93
10.28	N	38.42	50.00	-11.58

Tabulated test data for Mains Terminal Continuous Disturbance Voltage

Remark : "H": Hot Line, "N": Neutral line.

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



Tested by: Ki-Hong, Nam / Project Engineer

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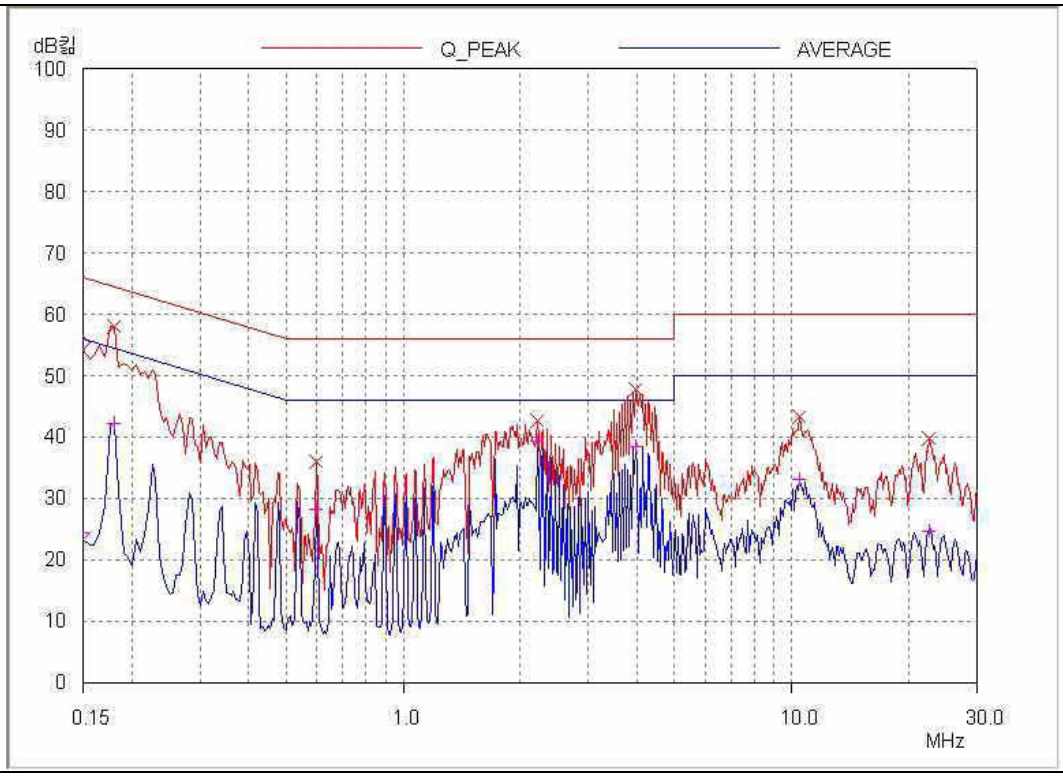
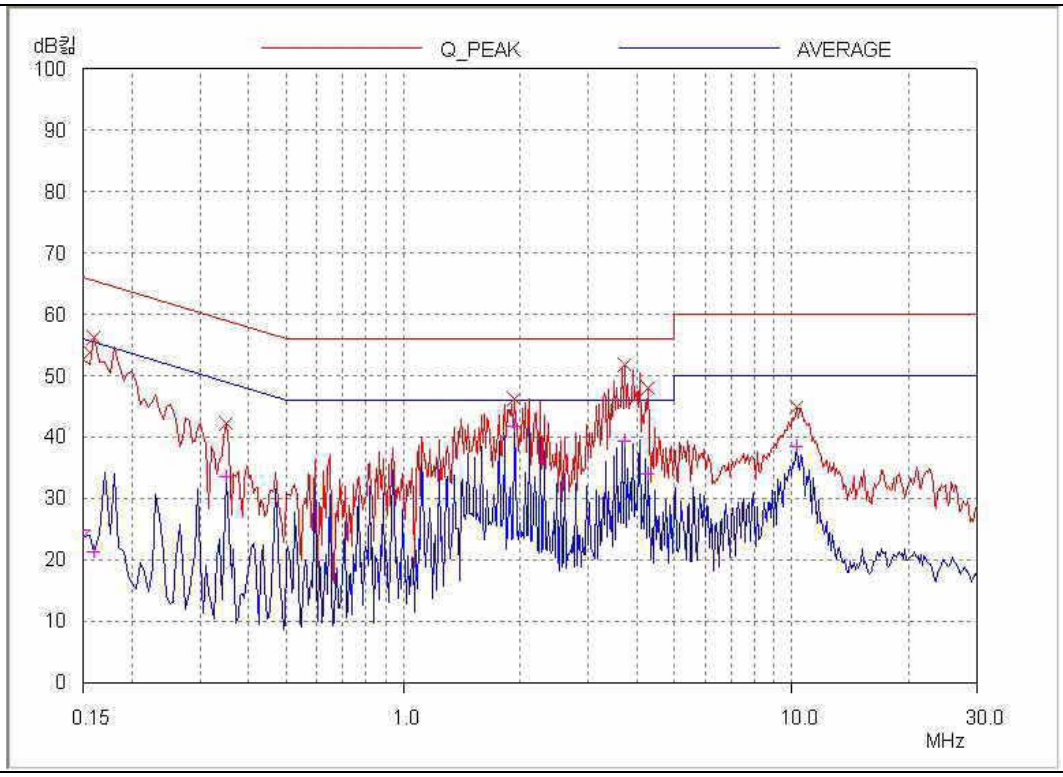


HOT LINE



NEUTRAL LINE

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8. RADIATED EMISSION TEST

8.1 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 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.

Test set-up photos are included in appendix VI.

8.2 Measurement uncertainty

Radiated emission electric field intensity, 30 MHz ~ 300 MHz : ± 4.43 dB

Radiated emission electric field intensity, 300 MHz ~ 1 000 MHz : ± 3.80 dB

Radiated emission electric field intensity, 1 000 MHz ~ 3 000 MHz: ± 4.4 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.

8.3 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
■ -	3110	EMCO	Biconical Antenna	9003-1121	Jan. 18, 2008
■ -	3146	EMCO	Log Periodic Antenna	9001-2614	Jan. 18, 2008
■ -	8564E	Hewlett-Packard	Spectrum Analyzer	3650A00756	June 19, 2007
■ -	83051A	Hewlett-Packard	Microwave Preamplifier	3950M00201	June 20, 2007
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	July 04, 2006(2Y)

All test equipment used is calibrated on a regular basis.

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8.4 Final Result of Measurement

8.4.1 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 : 45 %R.H. Temperature: 22 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(a)

Result : PASSED BY –15.89 dB at 2 478.00 MHz

EUT : Dongle of Wireless Earphone set Date: May 07, 2008

Operating Condition : TX mode

Distance : 3 meters

Channel	Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
	Carrier Freq. (MHz)	Amplitude (dBμV)	Detect Mode	Pol.	Antenna (dB/m)	Cable (dB)	Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Low	2 403.00	53.67	Peak	H	27.19	3.83	84.69	113.98	-29.29
		45.50	Average	H			76.52	93.98	-17.46
		55.00	Peak	V			86.02	113.98	-27.96
		46.33	Average	V			77.35	93.98	-16.63
Middle	2 438.00	53.50	Peak	H	27.30	3.83	84.63	113.98	-29.35
		45.33	Average	H			76.46	93.98	-17.52
		54.67	Peak	V			85.80	113.98	-28.18
		45.50	Average	V			76.63	93.98	-17.35
High	2 478.00	54.00	Peak	H	27.43	3.83	85.26	113.98	-28.72
		45.83	Average	H			77.09	93.98	-16.89
		55.50	Peak	V			86.76	113.98	-27.22
		46.83	Average	V			78.09	93.98	-15.89

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

Tested by: Ki-Hong, Nam / Project Engineer

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6.4.2 Emissions Conducted Outside of the Specified Frequency Bands

Humidity Level : 45 %R.H. Temperature: 22 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(d)

Result : PASS

EUT : 2.4 GHz Band Low-Power Data Communication System Transmitter Date: May 07, 2008

Operating Condition : TX mode

Distance : 3 meters

Channel	Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
	Carrier Freq. (MHz)	Amplitude (dBμV)	Detect Mode	Pol.	Antenna (dB/m)	Cable (dB)	Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Low	Spurious frequencies except harmonics have margin more than 50 dB, 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 / Project Engineer

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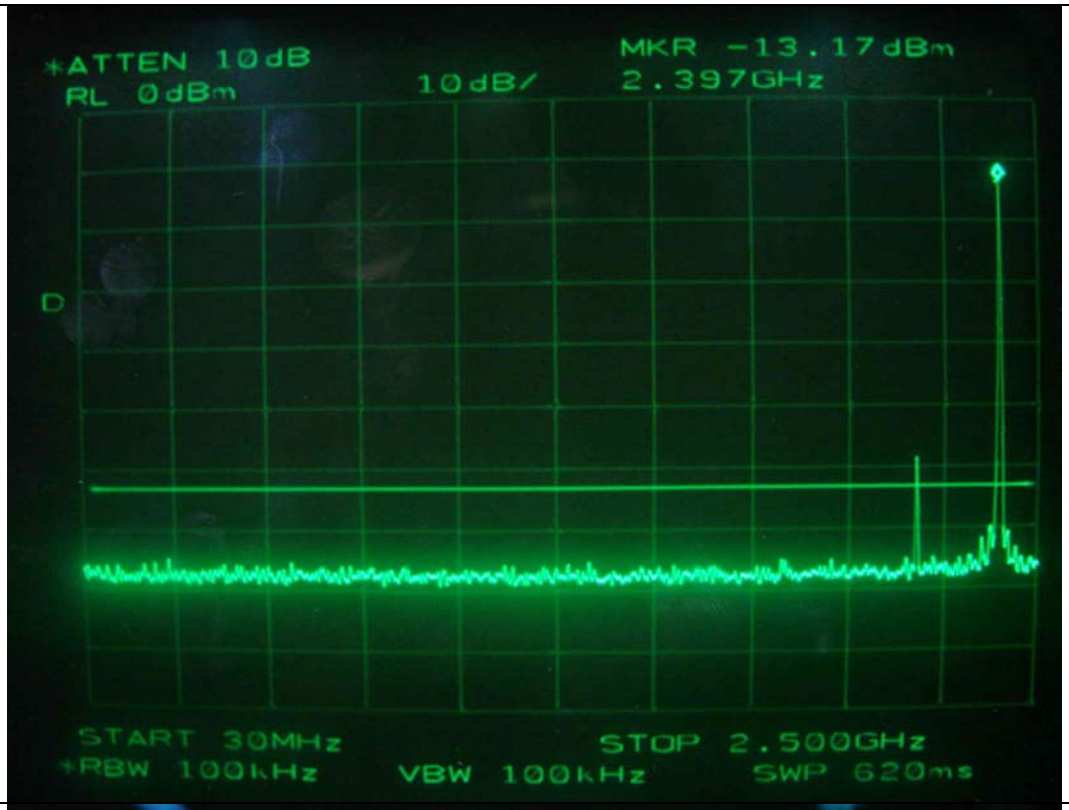
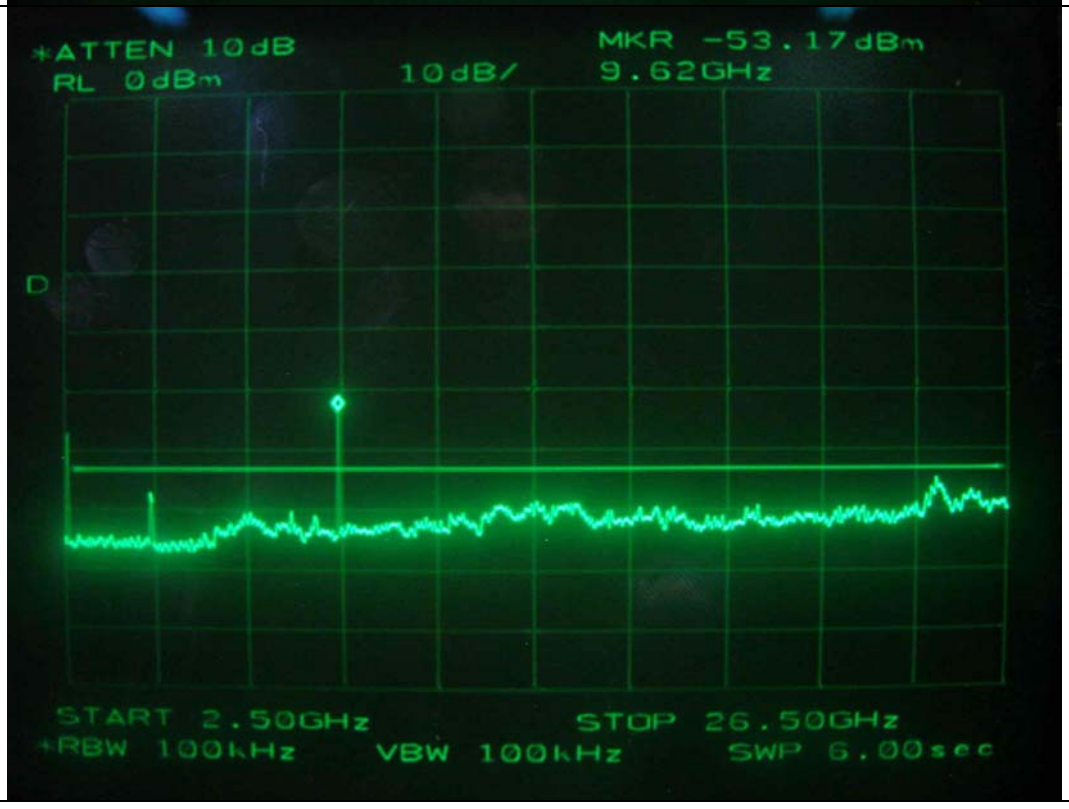
Low Channel





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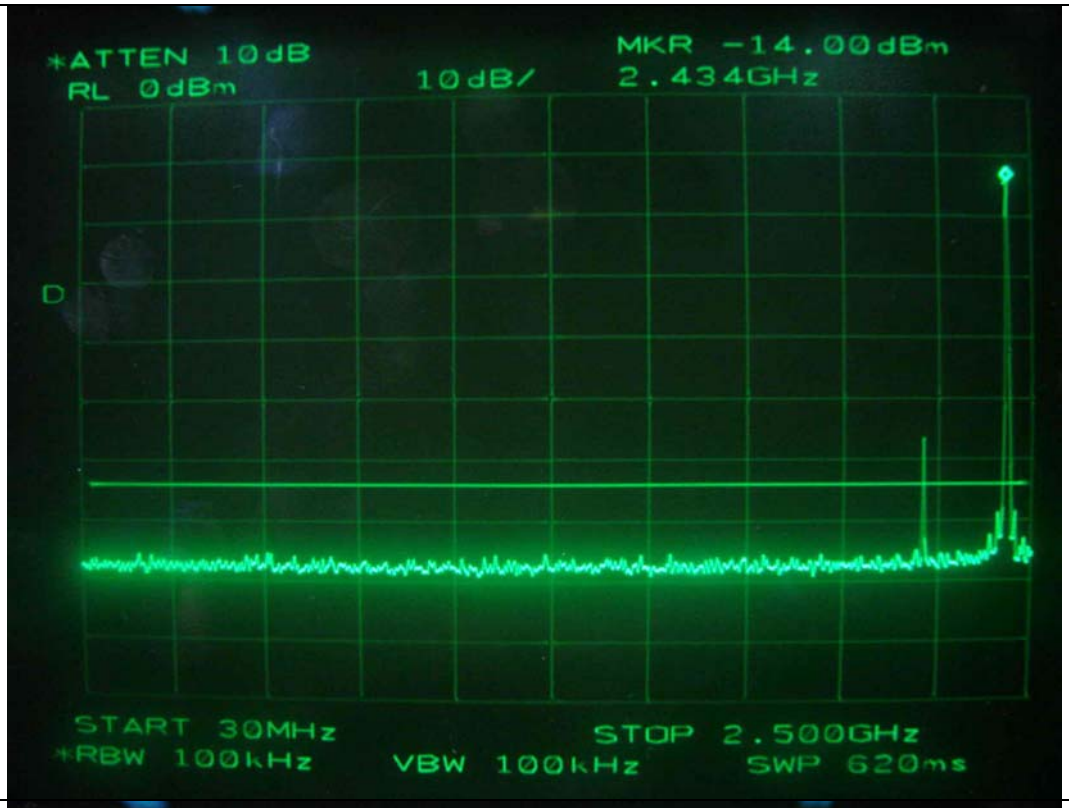
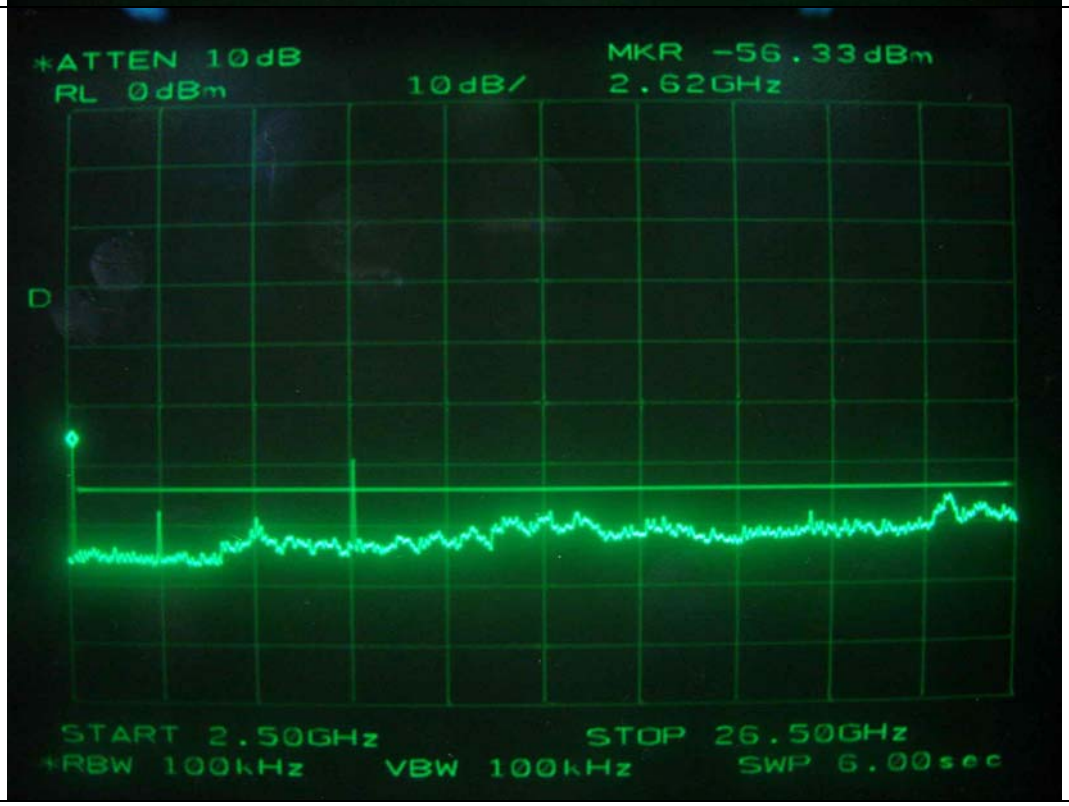
Middle Channel





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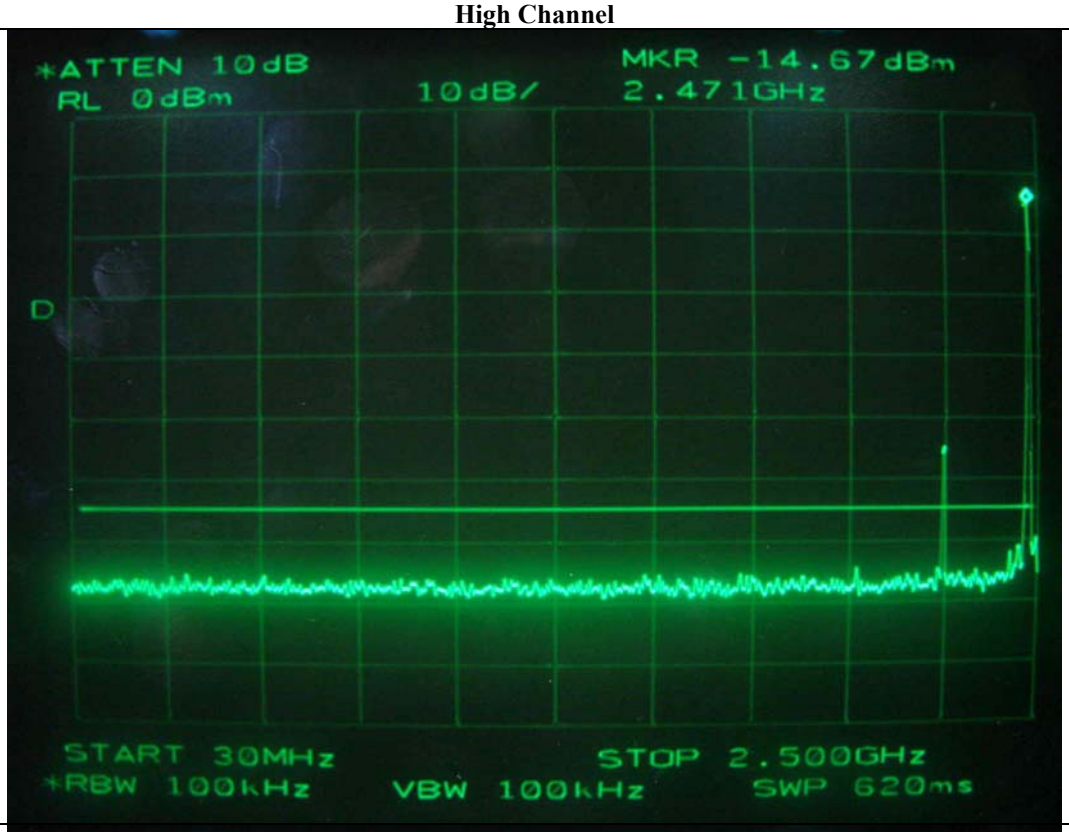
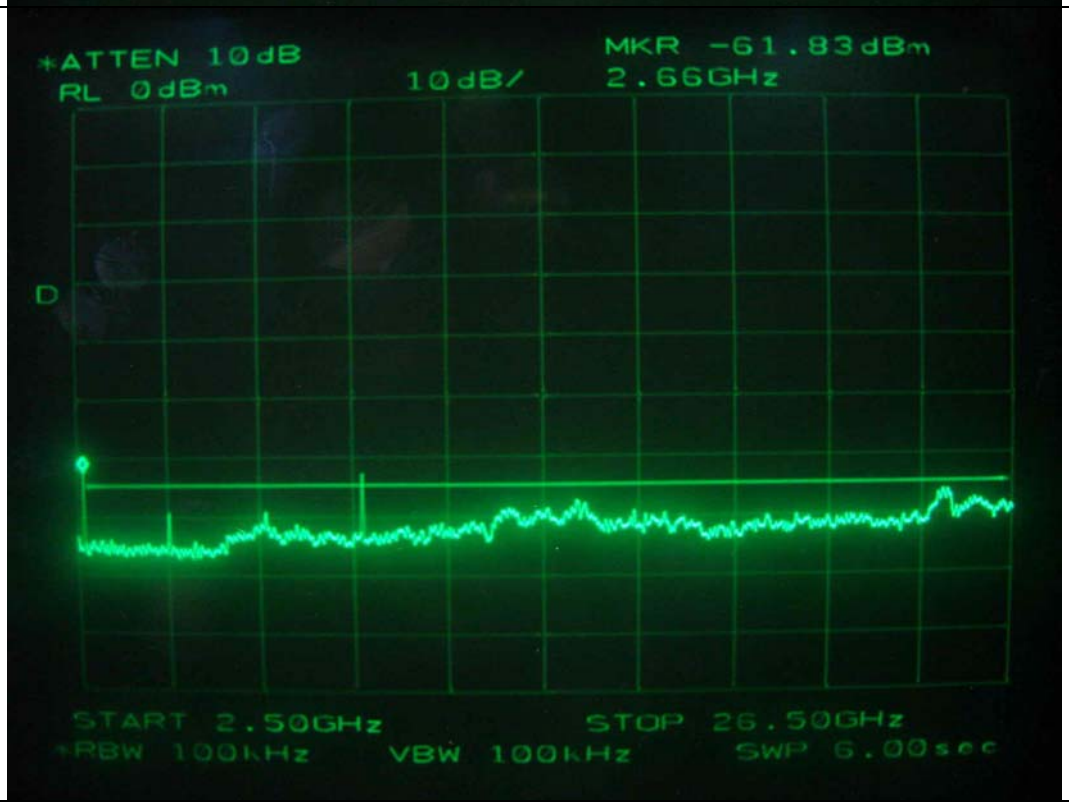
High Channel





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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 1 000 MHz

Humidity Level : 45 %R.H. Temperature: 22 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(d)

Result : PASSED BY –17.68 dB at 2 484.00

EUT : 2.4 GHz Band Low-Power Data Communication System Transmitter Date: May 07, 2008

Operating Condition : TX mode

Distance : 3 meters

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Dist. Factor	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel										
2 389.50*	39.67	Peak	H	27.15	3.85	28.98	N/A	41.69	73.98	-32.29
	31.33	Average	H					33.35	53.98	-20.63
	43.50	Peak	V					45.52	73.98	-28.46
	34.00	Average	V					36.02	53.98	-17.96
Test Data for High Channel										
2 484.00*	39.83	Peak	H	27.45	3.83	28.81	N/A	42.30	73.98	-31.68
	31.50	Average	H					33.97	53.98	-20.01
	43.33	Peak	V					45.80	73.98	-28.18
	33.83	Average	V					36.30	53.98	-17.68

Tabulated test data for Restricted Band

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

Tested by: Ki-Hong, Nam / Project Engineer

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6.4.3.2 Test Data for Harmonic

Humidity Level : 45 %R.H. Temperature: 22 °C
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(a)
Result : PASSED BY –10.29 dB at 4 956.00 MHz

EUT : 2.4 GHz Band Low-Power Data Communication System Transmitter Date: May 07, 2008
Operating Condition : TX mode
Distance : 3 meters

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Dist. Factor	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel										
4 806.00*	39.17	Peak	H	31.58	6.54	28.75	N/A	48.54	73.98	-25.44
	30.33	Average	H					39.70	53.98	-14.28
	42.50	Peak	V					51.87	73.98	-22.11
	33.17	Average	V					42.54	53.98	-11.44
Other frequencies were not found up to 26.5GHz.										
Test Data for Middle Channel										
4 876.00*	39.25	Peak	H	31.71	6.59	28.69	N/A	48.86	73.98	-25.12
	30.50	Average	H					40.11	53.98	-13.87
	42.17	Peak	V					51.78	73.98	-22.20
	33.00	Average	V					42.61	53.98	-11.37
Other frequencies were not found up to 26.5GHz.										
Test Data for High Channel										
4 956.00*	40.33	Peak	H	31.84	6.64	28.62	N/A	50.19	73.98	-23.79
	31.50	Average	H					41.36	53.98	-12.62
	43.00	Peak	V					52.86	73.98	-21.12
	33.83	Average	V					43.69	53.98	-10.29
Other frequencies were not found up to 26.5 GHz.										

Tabulated test data for Restricted Band

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

Tested by: Ki-Hong, Nam / Project Engineer

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6.4.3.3 Test Data for Spurious except for Harmonic below 1 000 MHz

Humidity Level : 45 %R.H. Temperature: 22 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(d)

Result : PASS

EUT : 2.4 GHz Band Low-Power Data Communication System Transmitter Date: May 07, 2008

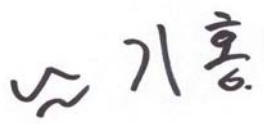
Operating Condition : TX mode

Distance : 3 meters

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/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 / Project Engineer

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6.4.3.4 Test Data for other frequency (Tx Mode)

Humidity Level : 45 %R.H. Temperature: 22 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209 (a)

Result : PASSED BY –9.54 dB at 350.75 MHz under middle and high channels

EUT : Dongle of Wireless Earphone set Date: May 07, 2008

Frequency range : 30 MHz ~ 1 000 MHz

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel							
180.20	10.00	H	15.78	3.09	28.87	43.52	-14.65
259.66	13.50	H	17.71	3.04	34.25	46.02	-11.77
281.95	11.67	H	19.11	3.16	33.94	46.02	-12.08
316.83	15.50	H	14.49	3.40	33.39	46.02	-12.63
350.75	16.83	H	15.87	3.61	36.31	46.02	-9.71
384.67	17.50	H	14.72	3.95	36.17	46.02	-9.85
Middle Channel							
180.20	10.05	H	15.78	3.09	28.92	43.52	-14.60
259.66	13.67	H	17.71	3.04	34.42	46.02	-11.60
281.95	11.50	H	19.11	3.16	33.77	46.02	-12.25
316.83	15.83	H	14.49	3.40	33.72	46.02	-12.30
350.75	17.00	H	15.87	3.61	36.48	46.02	-9.54
384.67	17.33	H	14.72	3.95	36.00	46.02	-10.02
High Channel							
180.20	10.33	H	15.78	3.09	29.20	43.52	-14.32
259.66	13.00	H	17.71	3.04	33.75	46.02	-12.27
281.95	11.33	H	19.11	3.16	33.60	46.02	-12.42
316.83	15.83	H	14.49	3.40	33.72	46.02	-12.30
350.75	17.00	H	15.87	3.61	36.48	46.02	-9.54
384.67	17.33	H	14.72	3.95	36.00	46.02	-10.02

Tested by: Ki-Hong, Nam / Project Engineer

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6.4.3.5 Test Data for other frequency (Charging Mode)

Humidity Level : 45 %R.H. Temperature: 22 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209 (a)

Result : PASSED BY –9.06 dB at 477.69 MHz

EUT : Dongle of Wireless Earphone set Date: May 07, 2008

Frequency range : 30 MHz ~ 1 000 MHz

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
51.39	12.50	V	10.53	1.64	24.67	40.00	-15.33
69.73	13.72	V	5.68	1.99	21.39	40.00	-18.61
118.18	10.98	V	12.78	2.12	25.88	43.52	-17.64
359.47	15.00	V	15.58	3.69	34.27	46.02	-11.75
398.23	16.17	H	14.26	4.08	34.51	46.02	-11.51
477.69	13.33	H	19.12	4.51	36.96	46.02	-9.06

Tested by: Ki-Hong, Nam / Project Engineer

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