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

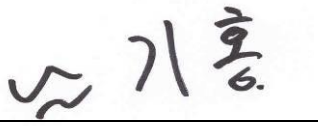
Test Report No.	**: E151R-014**
AGR No.	**: A14NA-044**
Applicant	**: Golfzon Co., Ltd.**
Address	**: 898, Taprip-dong, Yuseong-gu, Daejeon, South Korea**
Manufacturer	**: Golfzon Co., Ltd.**
Address	**: 898, Taprip-dong, Yuseong-gu, Daejeon, South Korea**
Type of Equipment	**: Kinetic Chain Analyzer Sensor**
FCC ID.	**: N5Y-KNCS01**
IC Certification No.	**: 10324A-KNCS01**
Model Name	**: KNCS01**
Serial number	**: N/A**
Total page of Report	**: 48 pages (including this page)**
Date of Incoming	**: January 07, 2014**
Date of issue	**: December 01, 2014**

SUMMARY

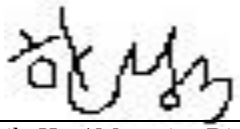
The equipment complies with the regulation; ***FCC PART 15 SUBPART C Section 15.247 and IC RSS-Gen Issue 4, November 2014 and RSS 210 Issue 8, December 2010***

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: 

Ki-Hong, Nam / Senior Engineer
ONETECH Corp.

Approved by: 

Sung-ik, Han/ Managing Director
ONETECH Corp.

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

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Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
E151R-014	December 01, 2014	Initial Issue	All

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1. VERIFICATION OF COMPLIANCE

Applicant	: Golfzon Co., Ltd.
Address	: 898, Taprip-dong, Yuseong-gu, Daejeon, South Korea
Contact Person	: Jaewoo Lee / Senior Research Engineer
Telephone No.	: +82-70-8660-4076
FCC ID	: N5Y-KNCS01
IC CERTIFICATION NO.	: 10324A-KNCS01
Model Name	: KNCS01
Serial Number	: N/A
Date	: December 01, 2014

EQUIPMENT CLASS	**FCC: DTS – DIGITAL TRNSMISSION SYSTEM** **IC: Low Power License-Exempt Radio-communication Device**
E.U.T. DESCRIPTION	Kinetic Chain Analyzer Sensor
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
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 and RSS 210 Issue 8 December 2010, RSS-Gen Issue 4 November.
Modifications on the Equipment to Achieve Compliance	None
Final Test was Conducted On	3 m, Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC& IC 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
15.247 (a) (2)	RSS-210, A8.2(a)	Minimum 6 dB Bandwidth	Met the Limit / PASS
15.247 (b) (3)	RSS-210, A8.4(4)	Maximum Peak Conducted Output Power	Met the Limit / PASS
15.247 (d)	RSS-210, A8.5	100 kHz Bandwidth Outside the Frequency Band	Met the Limit / PASS
15.247 (d)	RSS-210, A8.5	Radiated Emission which fall in the Restricted Band	Met the Limit / PASS
15.247 (e)	RSS-210, A8.2(b)	Peak Power Spectral Density	Met the Limit / PASS
15.209	RSS-210, A8.5	Radiated Emission Limits	Met the Limit / PASS
15.207	RSS-Gen, Section 7.2.4	Conducted Limits	Met the Limit / PASS
15.203	RSS-Gen, Section 7.1.2	Antenna Requirement	Met requirement / PASS

2.2 Additions, deviations, exclusions from standards

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

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.247 and IC RSS-Gen Issue 4 and RSS 210 Issue 8

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 301-14, Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do, 464-862 Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-4617/ G-666/ T-1842 IC (Industry Canada) – Registration No. Site# 3736-3

-. Site Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation No. 85

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

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3. GENERAL INFORMATION

3.1 Product Description

The Golfzon Co., Ltd., Model KNCS01 (referred to as the EUT in this report) is a Kinetic Chain Analyzer Sensor. The product specification described herein was obtained from product data sheet or user's manual.

Device Type	Kinetic Chain Analyzer Sensor
Temperature Range	0 ℃ ~ + 55 ℃
Operating Frequency	2 402 MHz , 2 440 MHz , 2 478 MHz
RF Output Power	-1.09 dBm
Number of Channel	3 Channel
Modulation Type	GFSK
Antenna Type	Pattern Antenna
USED RF CHIP	Marker: NORDIC Model Name: nRF24L01+
Antenna Gain	-0.65 dBi
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	8 MHz, 16 MHz
EUT HW/SW version	FVIN : v2014072202
	HW version : v2.2

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

-. None

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	Golfzon Co., Ltd.	LAMI-SENSOR Rev2	N/A

5.2 Peripheral equipment

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

Model	Manufacturer	Description	Connected to
KNCS01	Golfzon Co., Ltd.	Kinetic Chain Analyzer Sensor (EUT)	Kinetic Chain Analyzer Receiver
KNCR01	Golfzon Co., Ltd.	Kinetic Chain Analyzer Receiver	EUT
SW10-05002000-W	SHENZHEN TOP-ASIA ELECTRONICS CO., LTD.	AC Adapter	Kinetic Chain Analyzer Receiver

5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting is programmed.

For final testing, the EUT was set at 2 402 MHz, 2 440 MHz, and 2 478 MHz to get a maximum emission levels from the EUT. To get a maximum radiated emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XZ” axis, but the worst data was recorded in this test report.

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5.4 Configuration of Test System

Line Conducted Test: The EUT was tested in a charging mode. The EUT was connected to USB and the power of USB was connected to Kinetic Chain Analyzer Receiver(KNCR01). All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter 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 a pattern antenna on the main board in the EUT, so no consideration of replacement by the user.

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6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Tests, the following operating mode was investigated

Operation Mode	The Worse operating condition (Please check one only)
Charge Mode	X

6.2 General Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

Operation Mode	The Worse operating condition (Please check one only)
Tx Mode	X
Charge Mode	

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7. MIMIMUM 6 dB BANDWIDTH & 99 % OCCUPIED BANDWIDTH

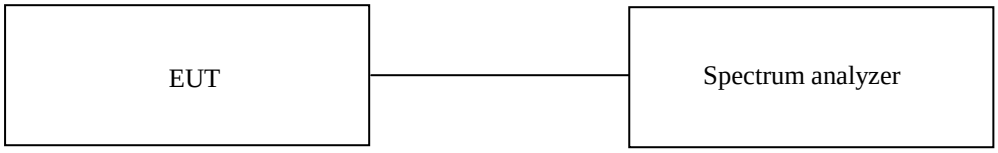
7.1 Operating environment

Temperature : 22.2 ℃

Relative humidity : 45 % 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 100 kHz, and peak detection was used. The 6 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 6 dB.



7.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2014(1Y)

All test equipment used is calibrated on a regular basis.

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7.4 Test data

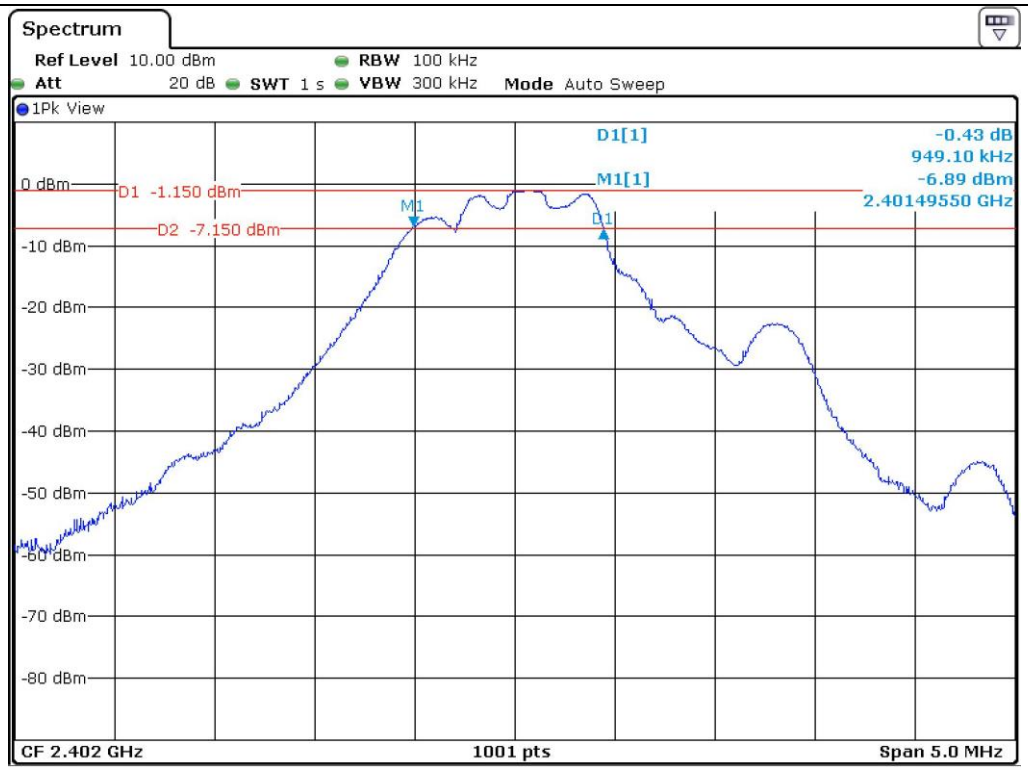
-. Test Date : December 16, 2014

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Limit (MHz)	Margin (MHz)
Low	2 402	0.95	1.47	0.5	-0.45
Middle	2 440	0.97	1.48	0.5	-0.47
High	2 478	0.97	1.48	0.5	-0.47

Remark. Margin = Measured Value - Limit

Tested by: Tae-Ho, Kim / Project Engineer



Low Channel

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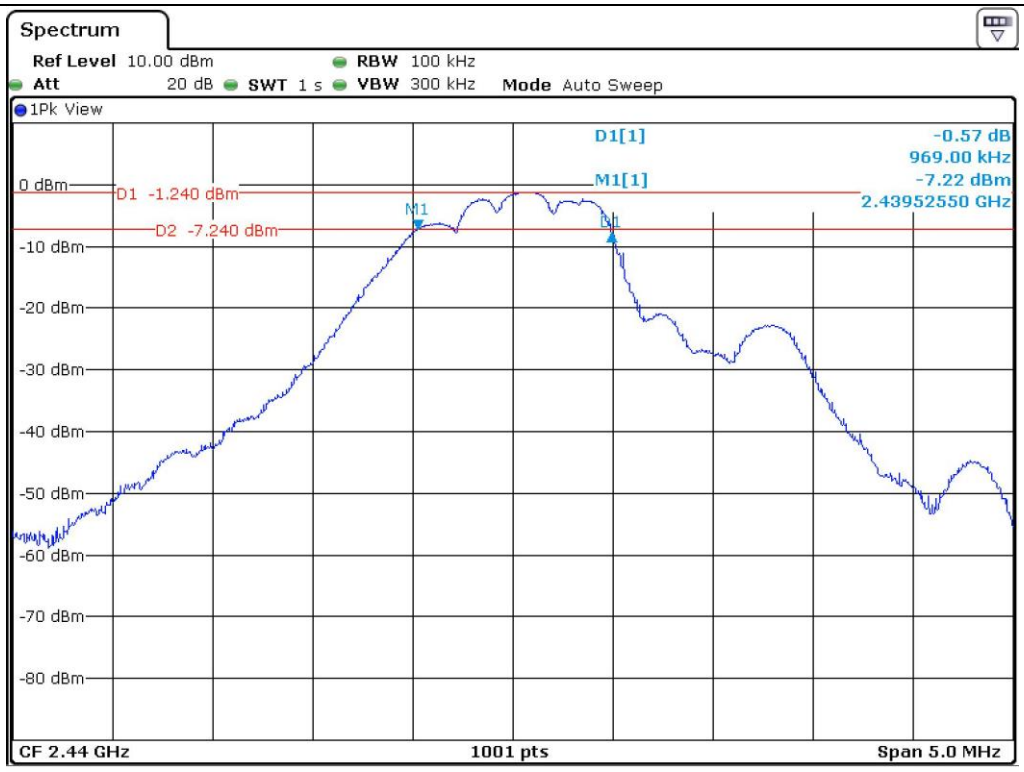
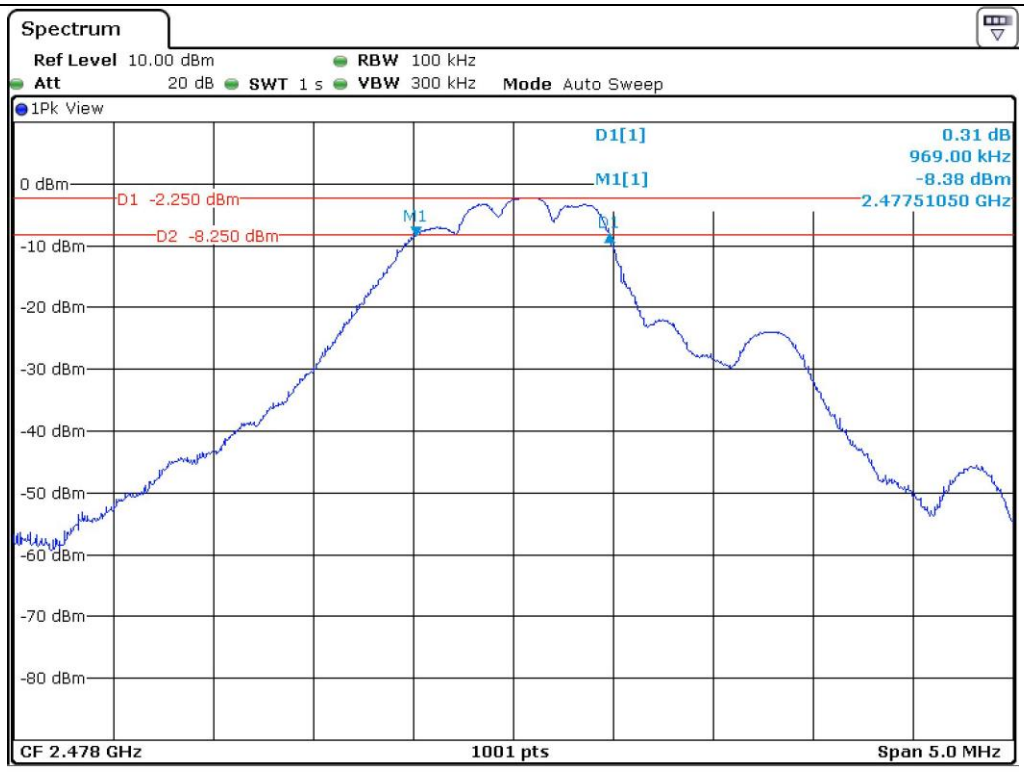


Middle Channel



High Channel

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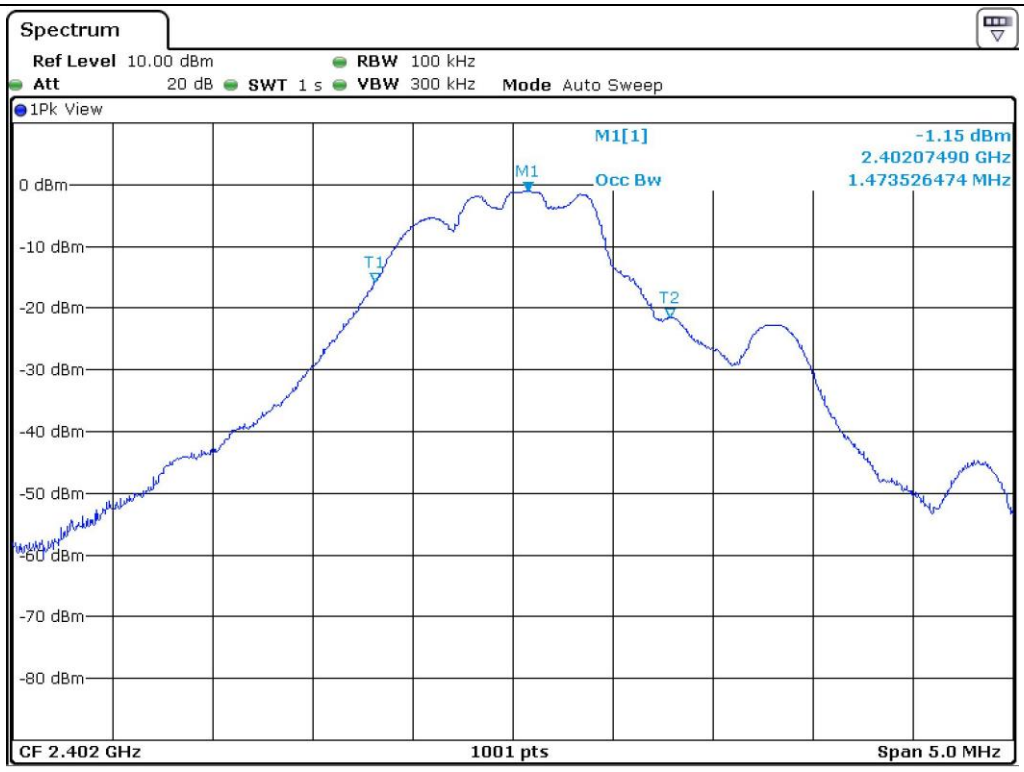
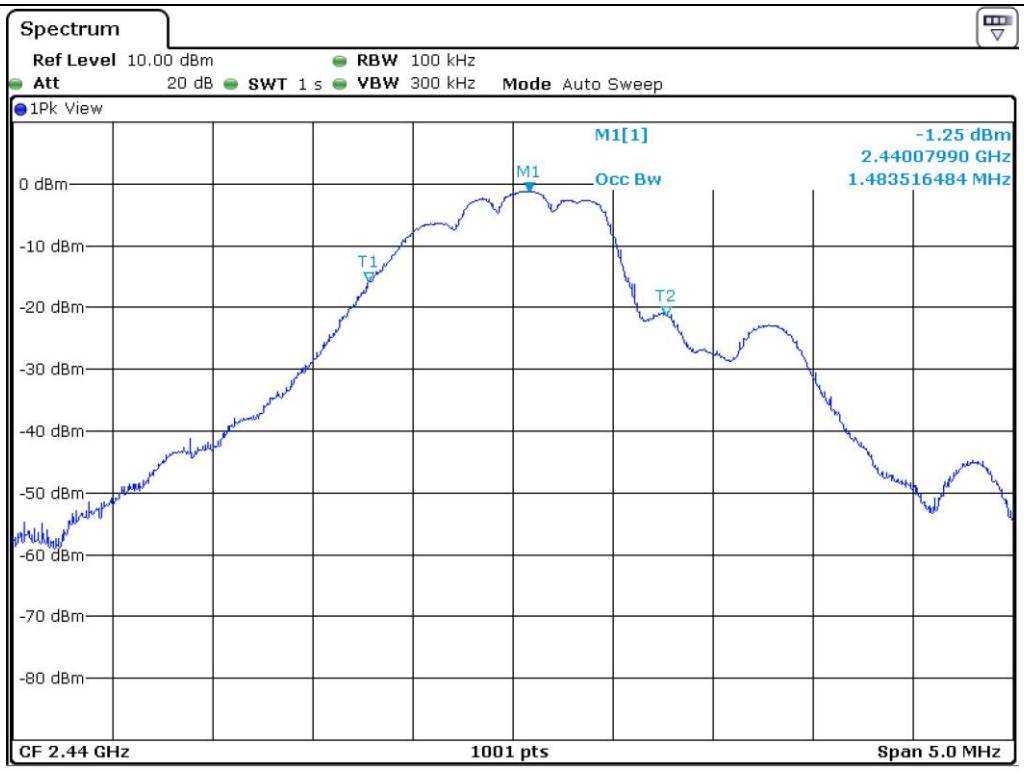


Low Channel



Middle Channel

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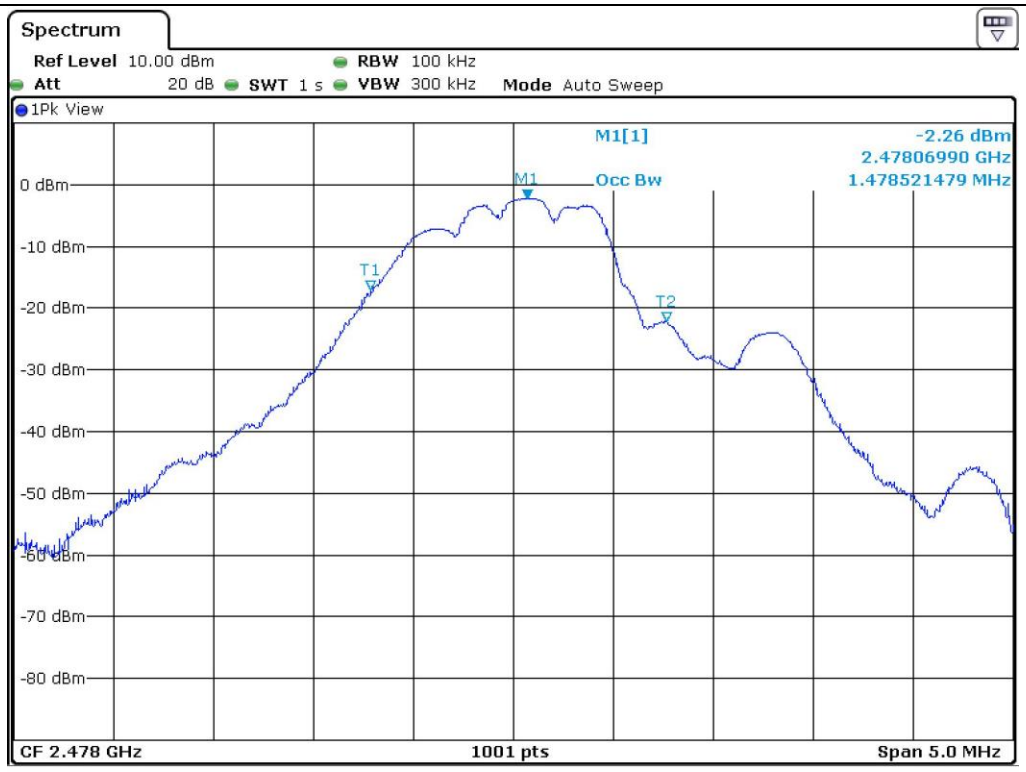

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8. MAXIMUM PEAK OUTPUT POWER

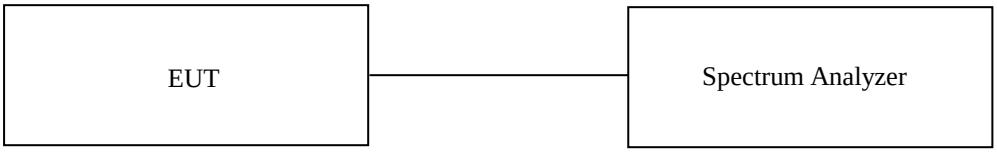
8.1 Operating environment

Temperature : 22.2 ℃

Relative humidity : 45 % R.H.

8.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz, the video bandwidth is set to 3 times the resolution bandwidth.



8.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2014(1Y)

All test equipment used is calibrated on a regular basis.

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8.4 Test data

-. Test Date : December 16, 2014

-. Test Result : Pass

- FCC Test data

CHANNEL	FREQUENCY (MHz)	DTS (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402	0.95	-1.09	30	31.09
MIDDLE	2 440	0.97	-1.16	30	31.16
HIGH	2 478	0.97	-2.17	30	32.17

Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

- IC Test data

CHANNEL	FREQUENCY (MHz)	DTS (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402	1.47	-1.09	30	31.09
MIDDLE	2 440	1.48	-1.16	30	31.16
HIGH	2 478	1.48	-2.17	30	32.17

Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

Tested by: Tae-Ho, Kim / Project Engineer

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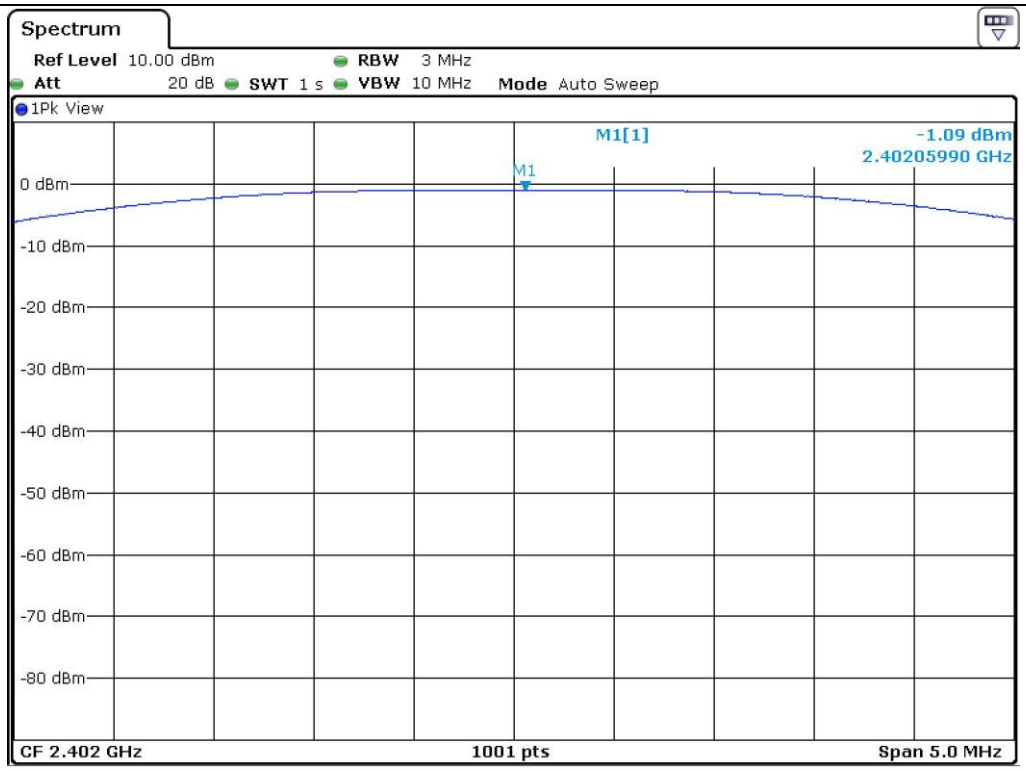
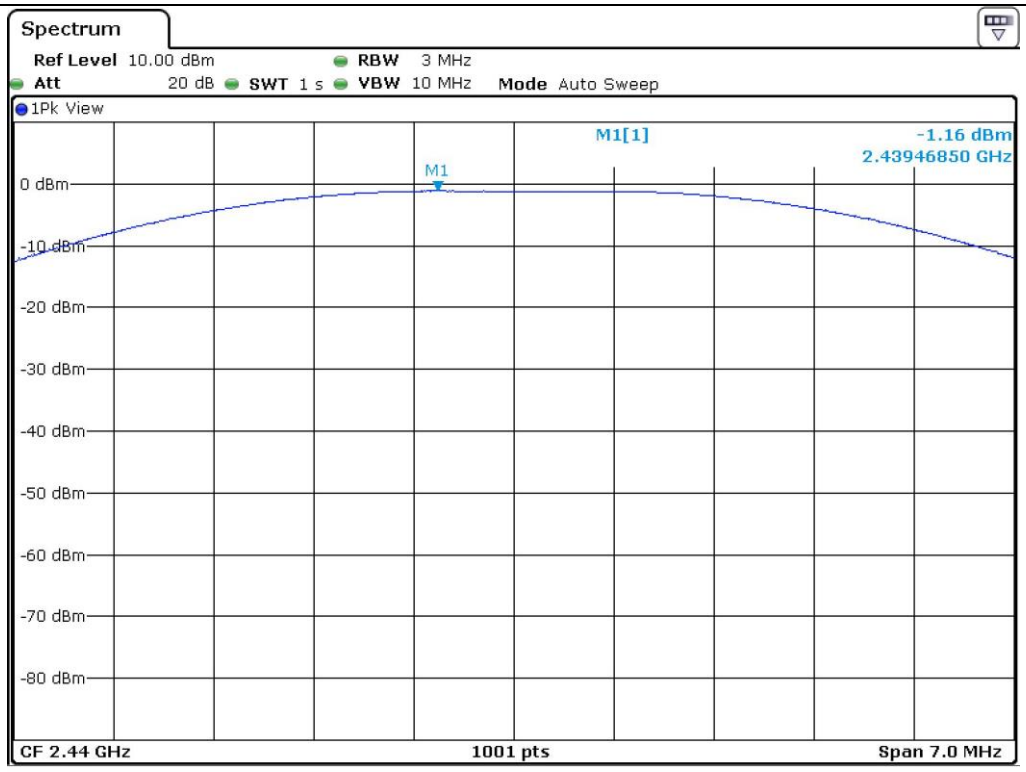


Low Channel



Middle Channel

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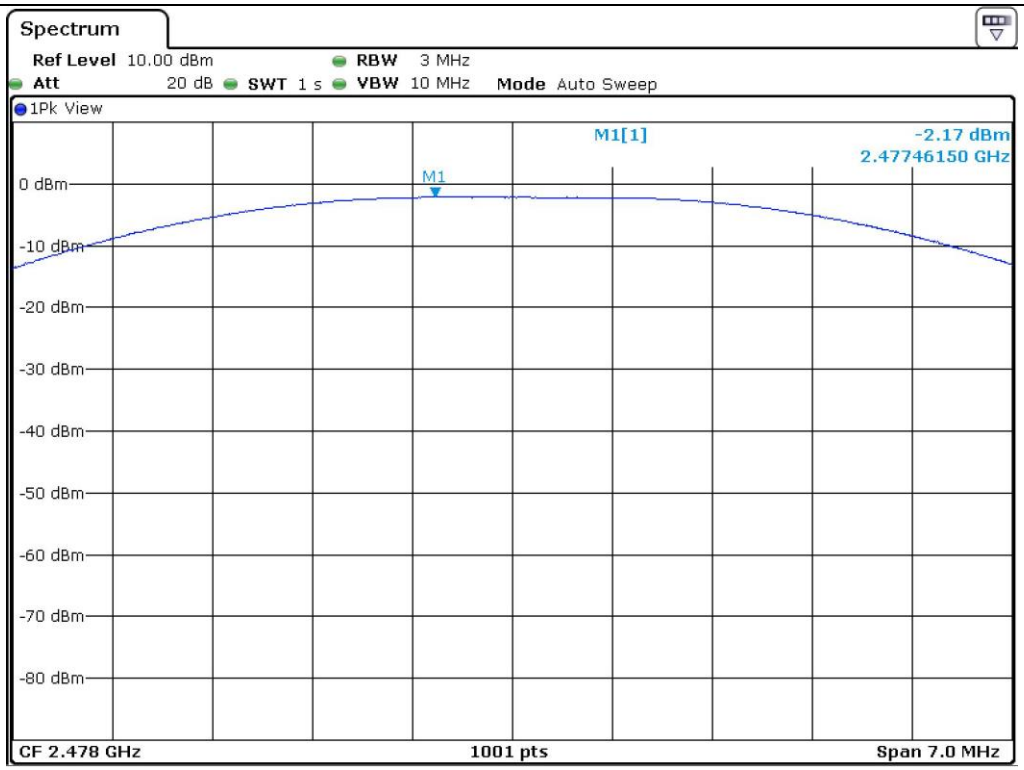

High Channel

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9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

9.1 Operating environment

Temperature : 22.2 ℃

Relative humidity : 45 % R.H.

9.2 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.

9.3 Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3 m, open-field test site. The EUT was placed on a non-conductive turntable above the ground plane.

The frequency spectrum from 30 MHz to 26.5 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 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

9.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
☐ -	ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Nov. 03, 2014(1Y)
■ -	ESU	Rohde & Schwarz	EMI Test Receiver	100261	Apr. 29, 2014(1Y)
☐ -	8564E	HP	Spectrum Analyzer	3650A00756	Apr. 28, 2014(1Y)
☐ -	FSP	Rohde & Schwarz	Spectrum Analyzer	100017	Oct. 08, 2014(1Y)
■ -	310N	Sonoma Instrument	AMPLIFIER	312544	Apr. 28, 2014(1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2014(1Y)
■ -	SCU-18	Rohde & Schwarz	PRE-AMPLIFIER	10041	Jan. 20, 2014(1Y)
■ -	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
■ -	HFH2-Z2	Rohde & Schwarz	Loop Antenna	879 285/26	Dec. 09, 2014(2Y)
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-255	May 02, 2014(2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Sep. 05, 2013(2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	N/A
■ -	83051A	Agilent	Microwave System Preamplifer	3950M00201	Apr. 30, 2014(1Y)

All test equipment used is calibrated on a regular basis.

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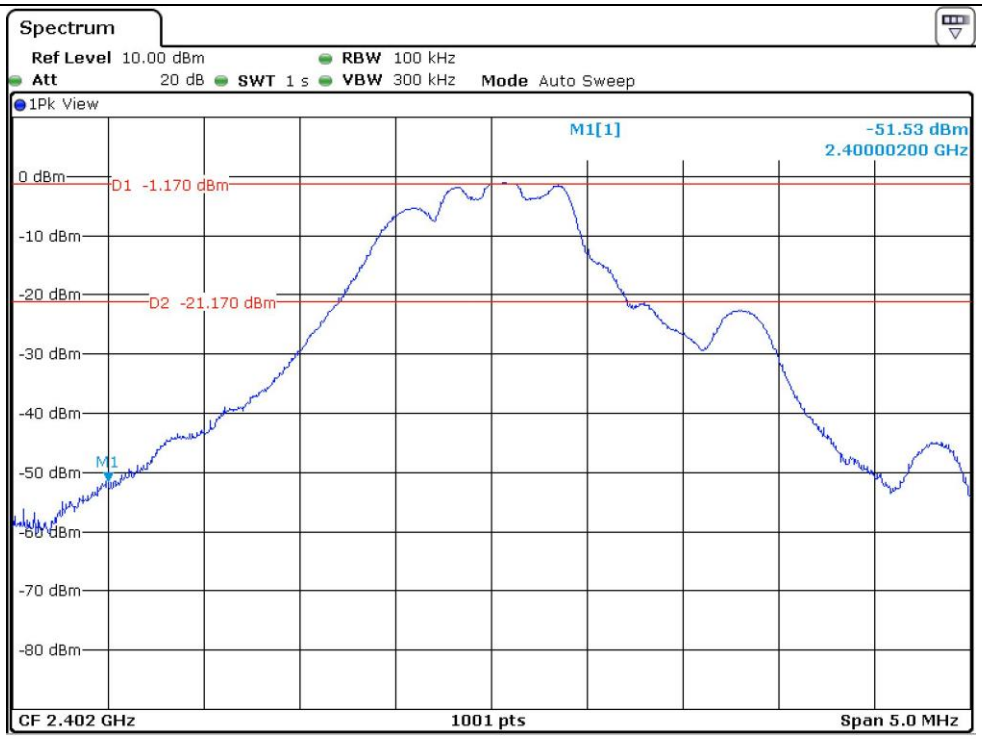
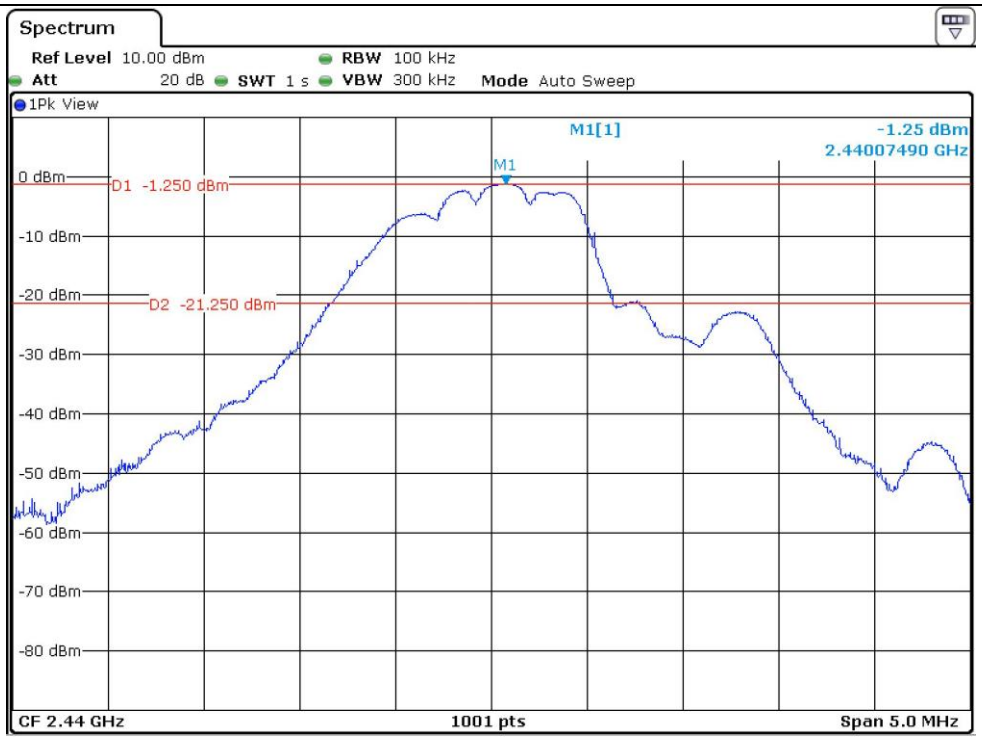
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

9.5 Test data for conducted emission



Low Channel



Middle Channel

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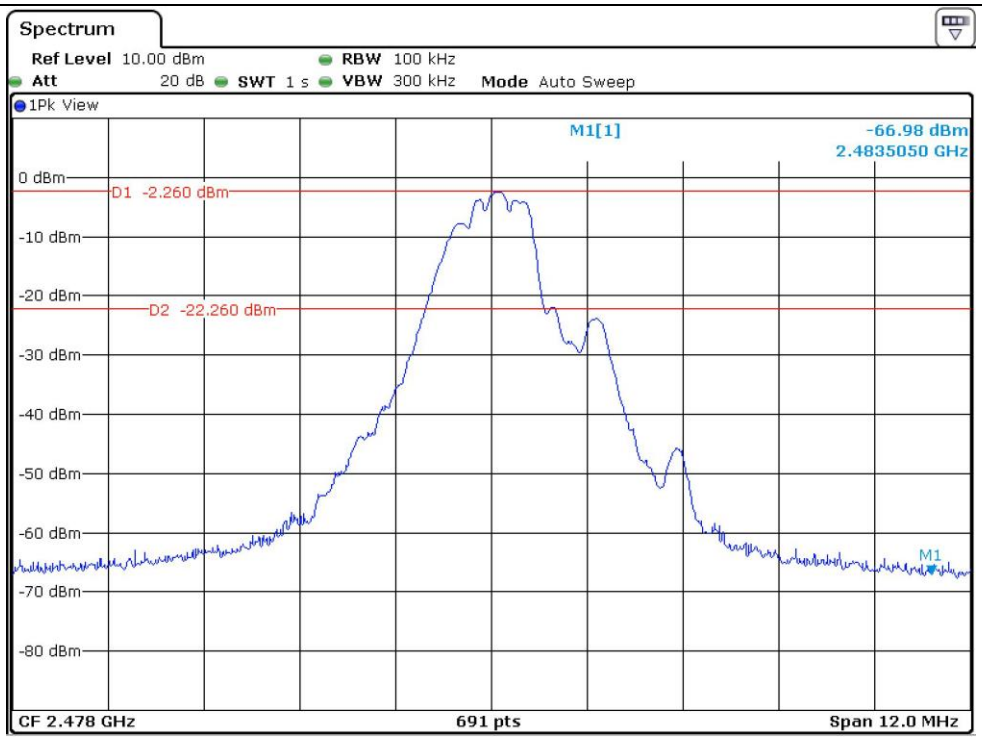

High Channel

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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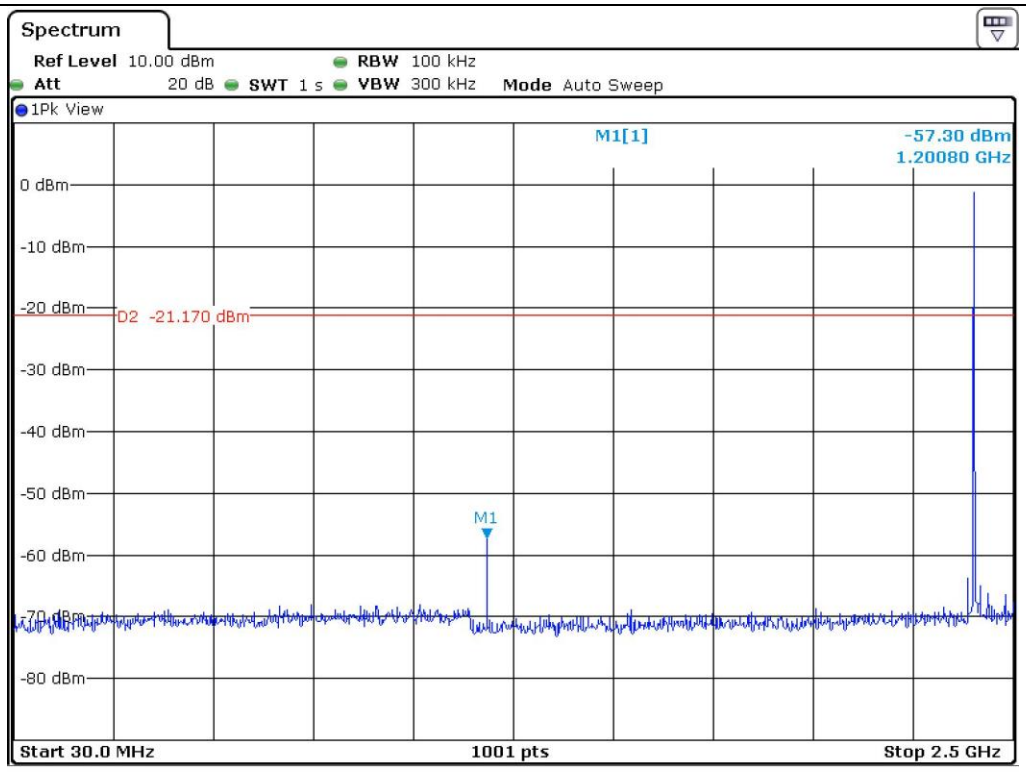
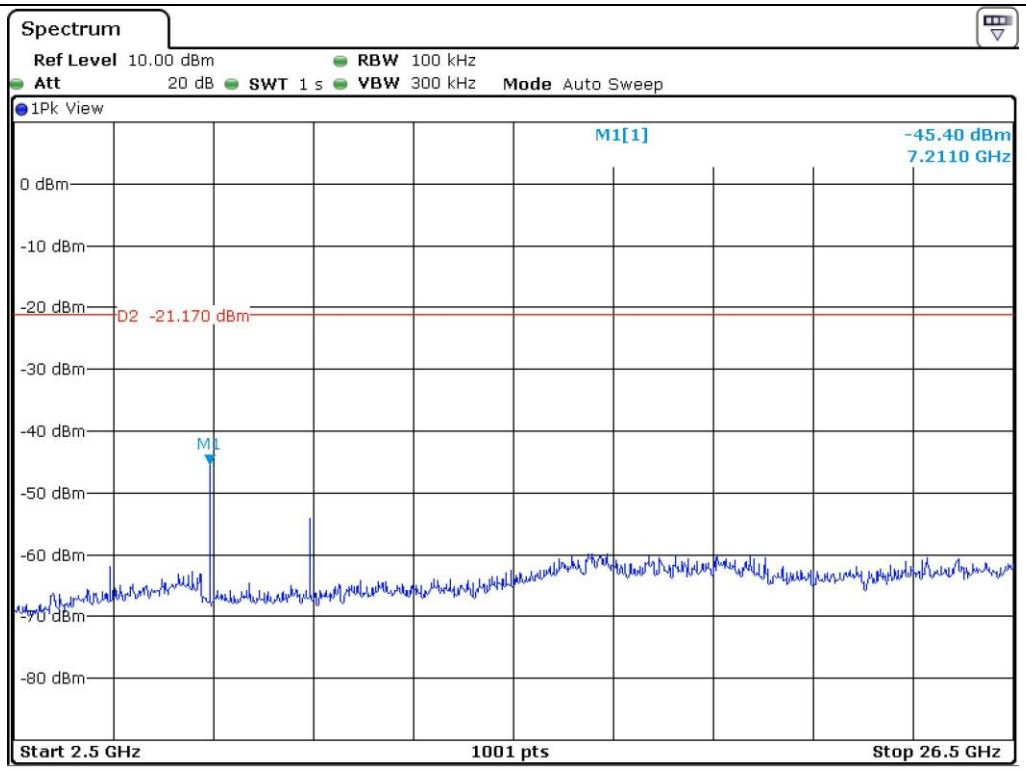


Low Channel



Low Channel

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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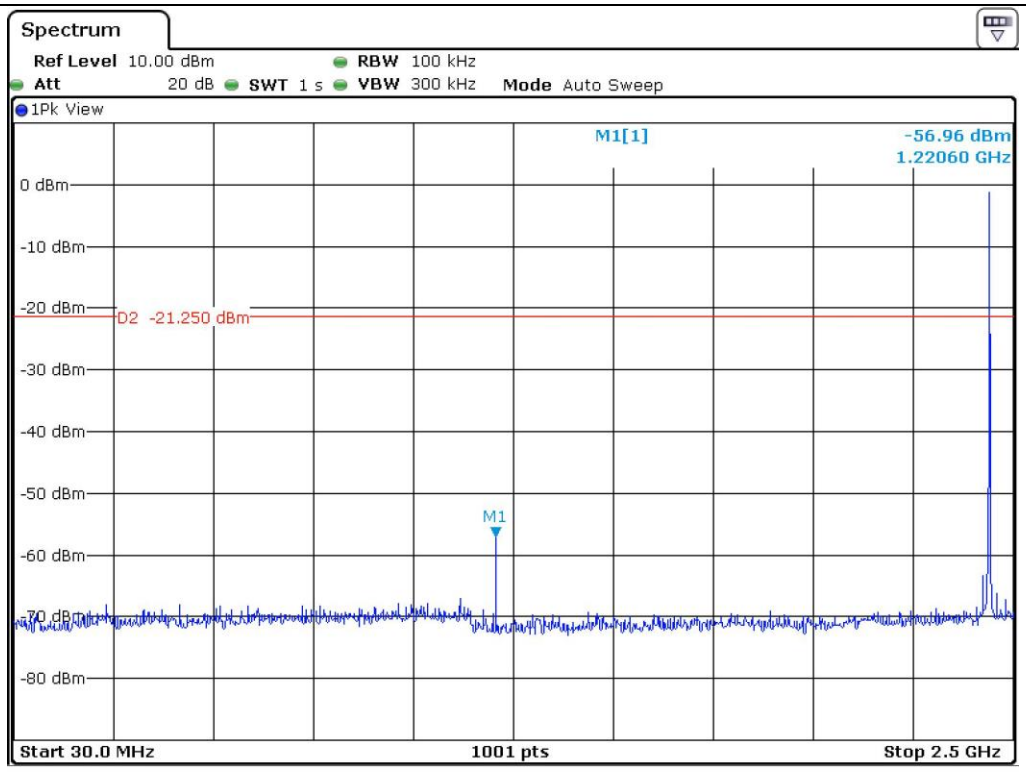
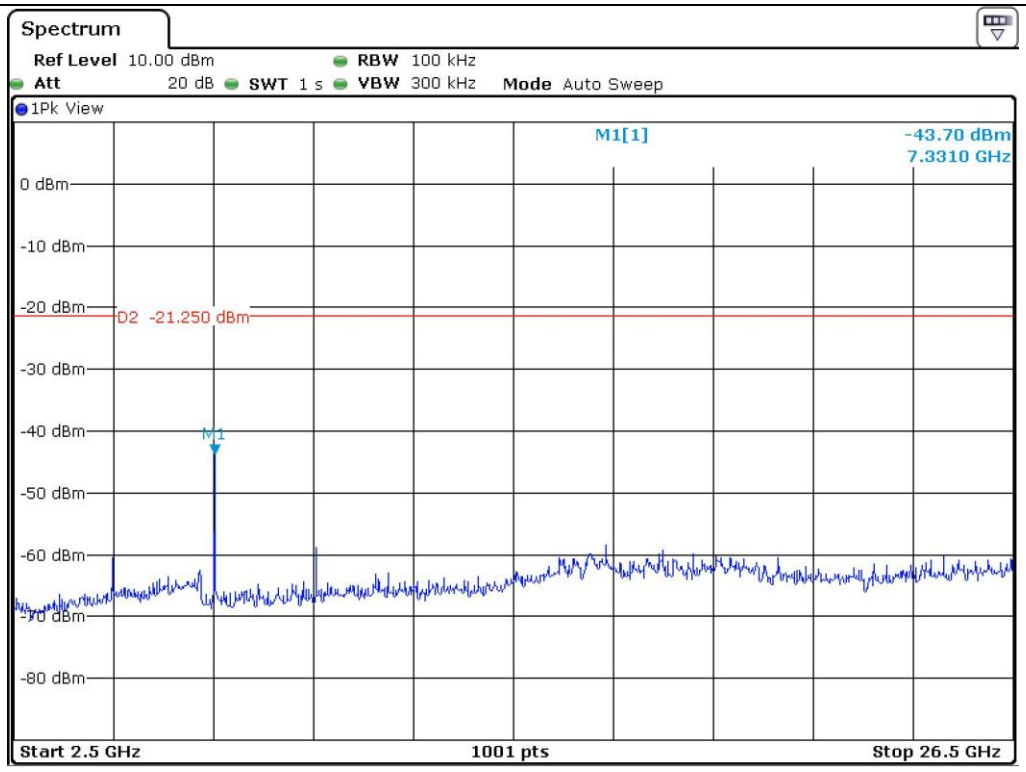


Middle Channel



Middle Channel

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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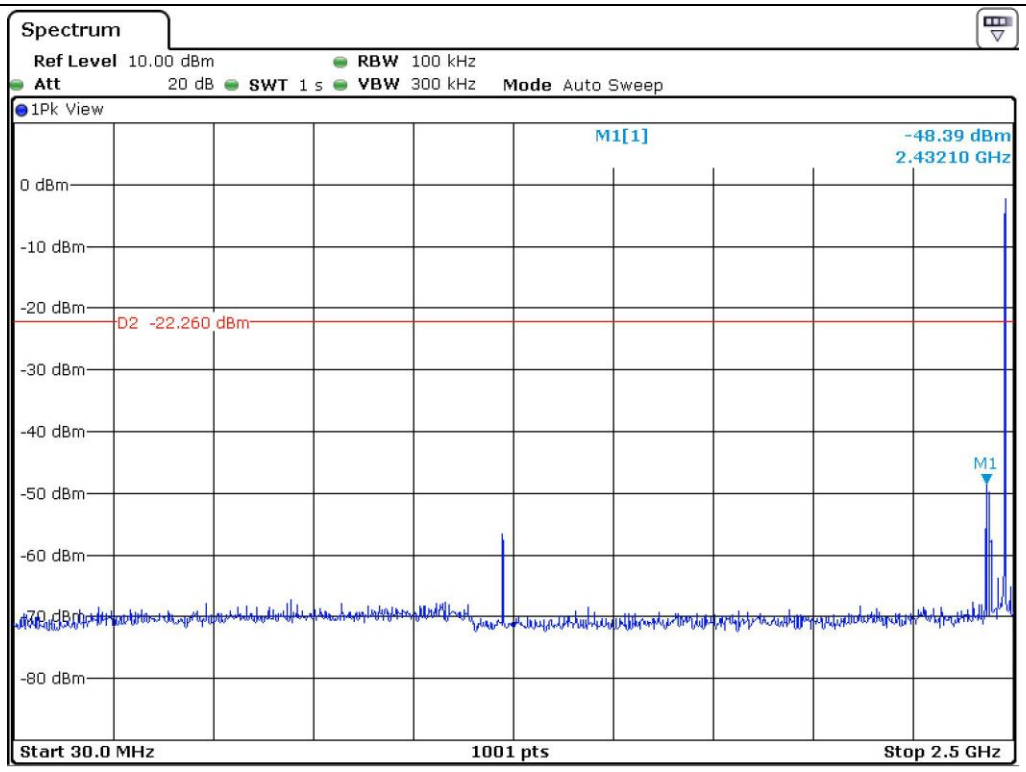
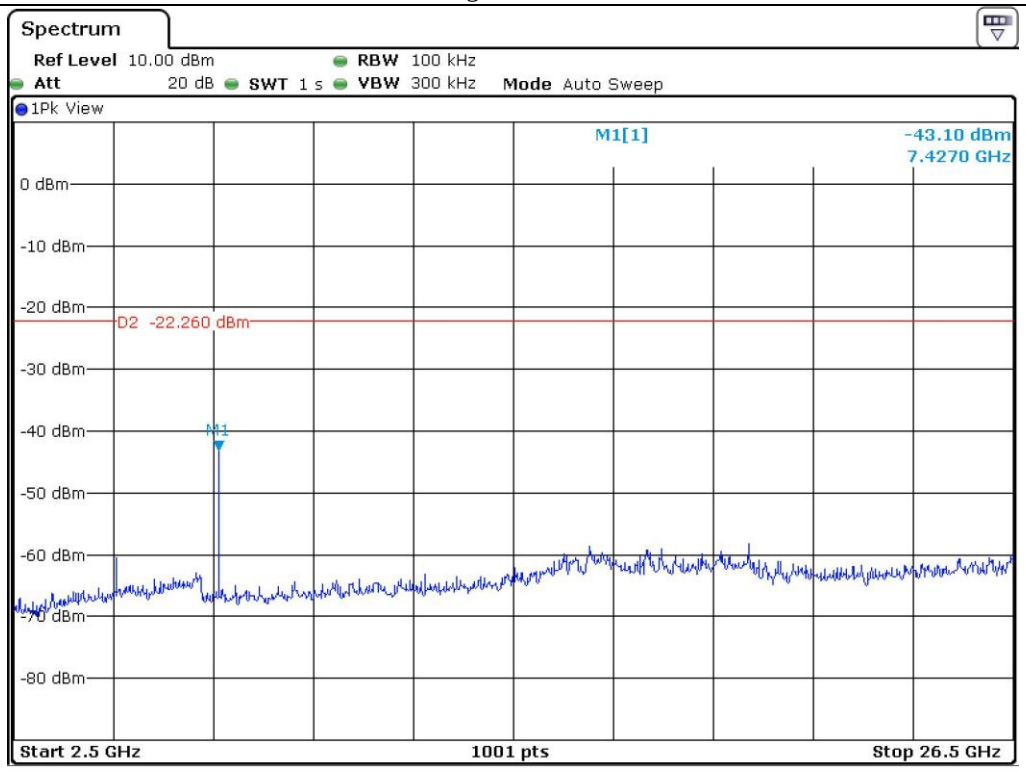


High Channel



High Channel

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9.6 Test data for radiated emission

9.6.1 Radiated Emission which fall in the Restricted Band

-. Test Date : December 16, 2014

-. 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 ~ 26.5 GHz

-. Measurement distance : 3 m

-. Result : PASSED

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									
2 337.04	48.51	Peak	H	27.10	7.50	43.00	40.11	74.00	33.89
	35.11	Average	H				26.71	54.00	27.29
2 337.04	48.38	Peak	V				39.98	74.00	34.02
	35.26	Average	V				26.86	54.00	27.14
Test Data for High Channel									
2 483.51	47.95	Peak	H	27.10	7.50	43.00	39.55	74.00	34.45
	35.15	Average	H				26.75	54.00	27.25
2 483.51	48.25	Peak	V				39.85	74.00	34.15
	34.86	Average	V				26.46	54.00	27.54

Tabulated test data for Restricted Band

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

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss – Pre-Amplifier Gain

Tested by: Tae-Ho, Kim / Project Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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9.6.2 Spurious & Harmonic Radiated Emission

-. Test Date : December 16, 2014

-. 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 ~ 26.5 GHz

-. Measurement distance : 3 m

-. Result : PASSED

Frequency (GHz)	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	96.16	Peak	H	27.00	7.50	42.80	87.86	-	87.86
	86.65	Peak	V				78.35	-	78.35
4 804.00	54.72	Peak	H	30.60	11.10	42.50	53.92	74.00	20.08
	49.26	Average	H				48.46	54.00	5.54
	46.41	Peak	V				45.61	74.00	28.39
	36.82	Average	V				36.02	54.00	17.98
Test Data for Middle Channel									
2 440.00	94.51	Peak	H	27.20	7.60	42.80	86.51	-	86.51
	76.02	Peak	V				68.02	-	68.02
4 880.00	54.11	Peak	H	30.70	11.20	42.50	53.51	74.00	20.49
	48.26	Average	H				47.66	54.00	6.34
	45.84	Peak	V				45.24	74.00	28.76
	36.22	Average	V				35.62	54.00	18.38

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Test Data for High Channel									
2 478.00	93.63	Peak	H	27.40	7.70	42.90	85.83	-	85.83
	85.47	Peak	V				77.67	-	77.67
4 960.00	53.56	Peak	H	30.80	11.30	42.50	53.16	74.00	20.84
	47.85	Average	H				47.45	54.00	6.55
	45.24	Peak	V				44.84	74.00	29.16
	35.86	Average	V				35.46	54.00	18.54

Tabulated test data for Restricted Band

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

Margin (dB) = Limits (dBμV/m) - Total Level (dBμV/m)

Total Level = Reading + Antenna Factor + Cable Loss – Pre-Amplifier Gain

Tested by: Tae-Ho, Kim / Project Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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10. SPURIOUS EMISSION - RECEIVER

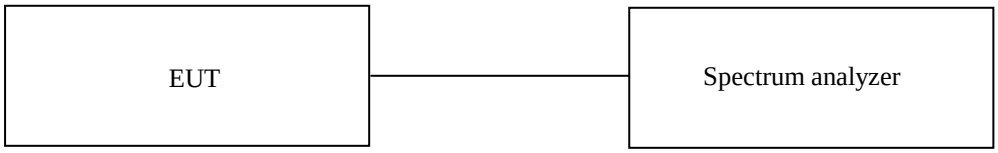
10.1 Operating environment

Temperature : 22.0 ℃

Relative humidity : 42.2 % R.H.

10.2 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.



10.3 Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3 m, open-field test site. The EUT was placed on a non-conductive turntable above the ground plane.

The frequency spectrum from 30 MHz to 26.5 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 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

10.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
☐ -	ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Nov. 03, 2014(1Y)
■ -	ESU	Rohde & Schwarz	EMI Test Receiver	100261	Apr. 29, 2014(1Y)
☐ -	8564E	HP	Spectrum Analyzer	3650A00756	Apr. 28, 2014(1Y)
■ -	310N	Sonoma Instrument	AMPLIFIER	312544	Apr. 28, 2014(1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2014(1Y)
■ -	SCU-18	Rohde & Schwarz	PRE-AMPLIFIER	10041	Jan. 20, 2014(1Y)
■ -	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
■ -	HFH2-Z2	Rohde & Schwarz	Loop Antenna	879 285/26	Dec. 11, 2012(2Y)
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-255	May 05, 2014(2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Sep. 05, 2013(2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Sep. 05, 2013(2Y)
■ -	83051A	Agilent	Microwave System Preamplifer	3950M00201	Apr. 30, 2014(1Y)

All test equipment used is calibrated on a regular basis.

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10.5 Test data – Conducted

-. Test Date : December 16, 2014

-. Resolution bandwidth : 120 kHz / 1 MHz

-. Frequency range : 30 MHz ~ 26.5 GHz

-. Test Result : Pass

Frequency (MHz)	Spectrum Reading (dBm)	Cable Loss (dB)	Total (dBm)
Test result for Low Channel			
256.27	-71.14	0.08	-71.06
2 643.00	-60.53	0.38	-60.15
Test result for Middle Channel			
256.27	-71.16	0.08	-71.08
2 643.00	-60.36	0.38	-59.98
Test result for High Channel			
256.27	-71.35	0.08	-71.27
2 642.00	-60.75	0.38	-60.37

Tested by: Tae-Ho, Kim / Project Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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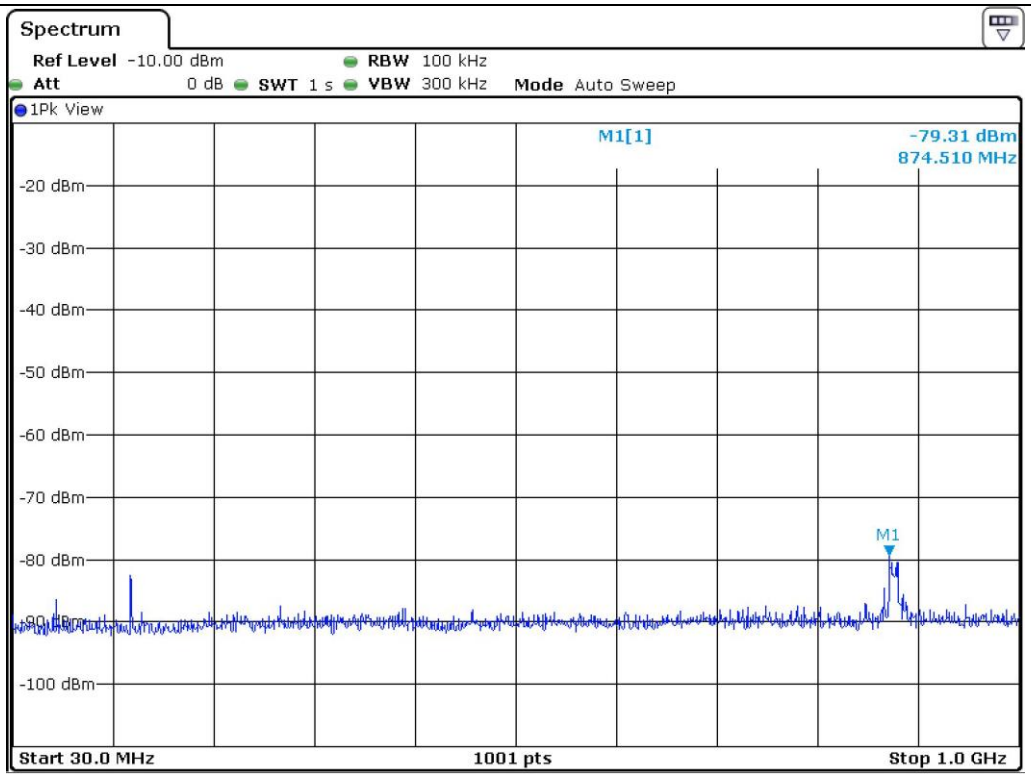
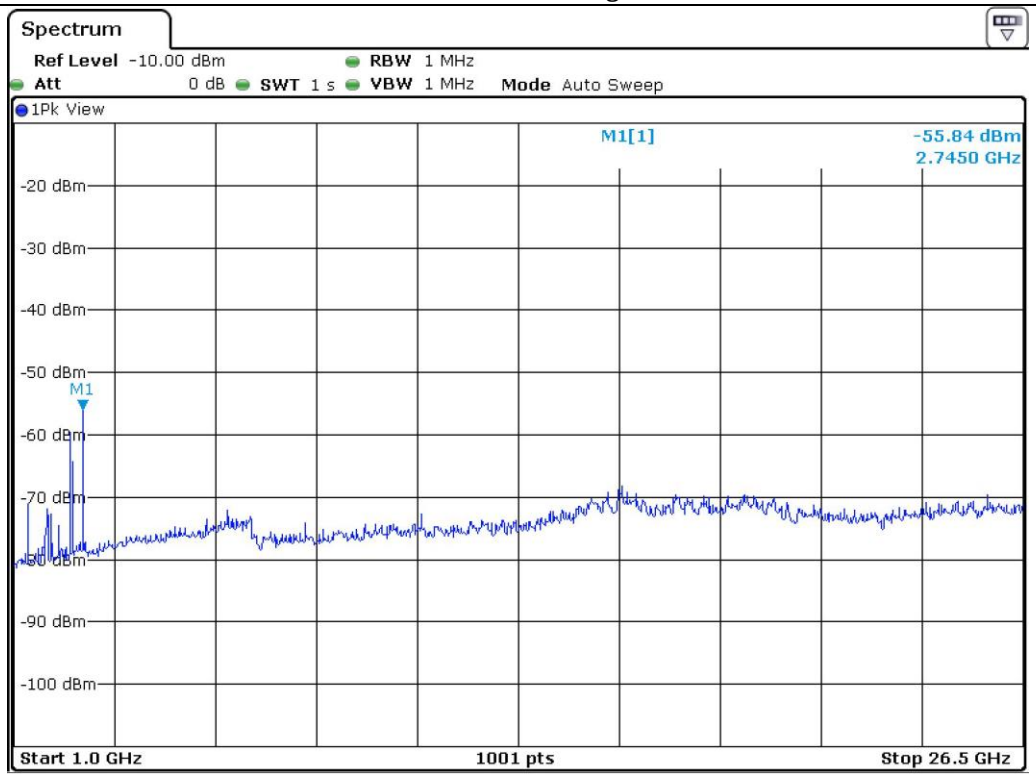


Low Channel - Receiving Mode



Low Channel - Receiving Mode

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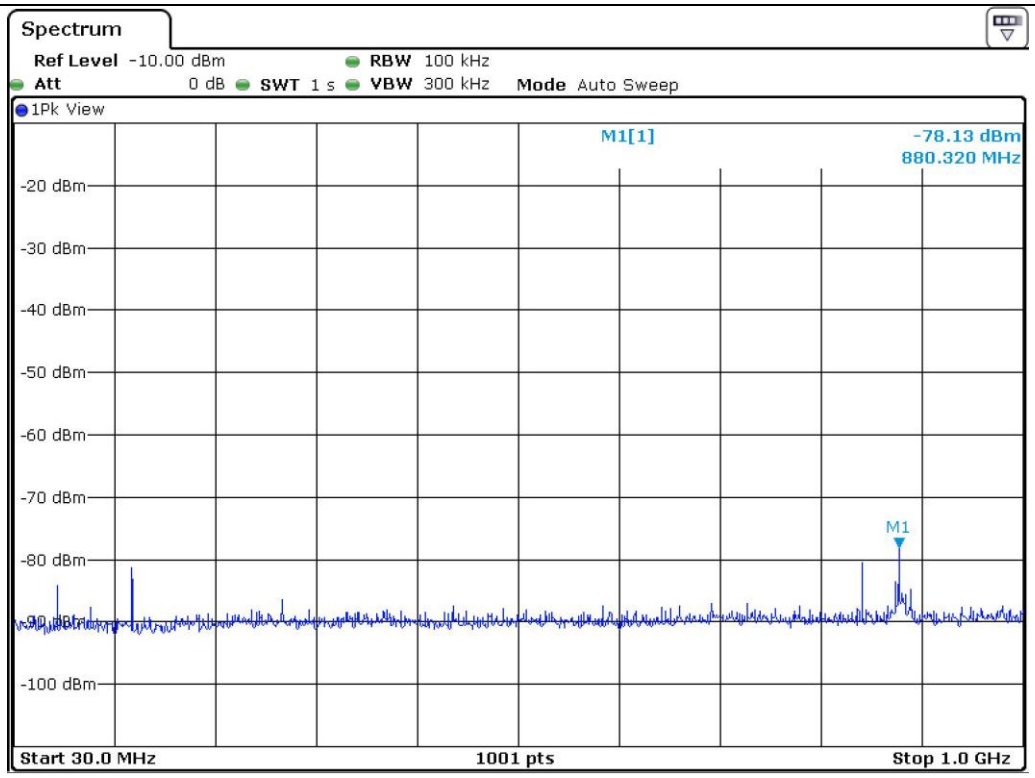
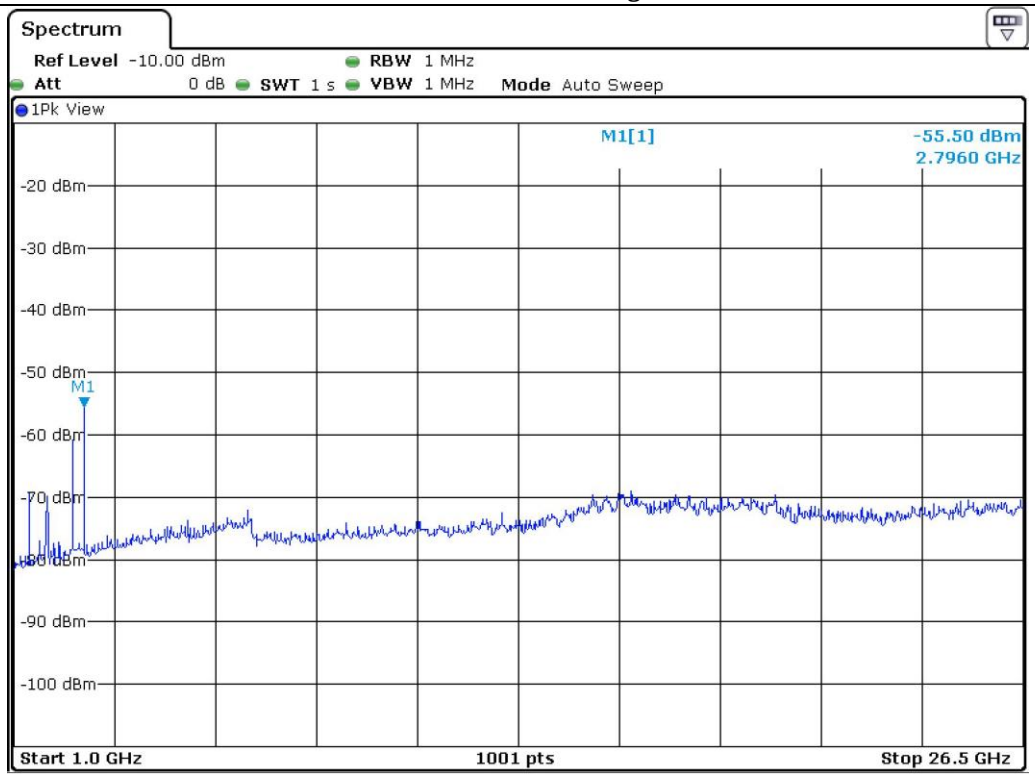


Middle Channel - Receiving Mode



Middle Channel - Receiving Mode

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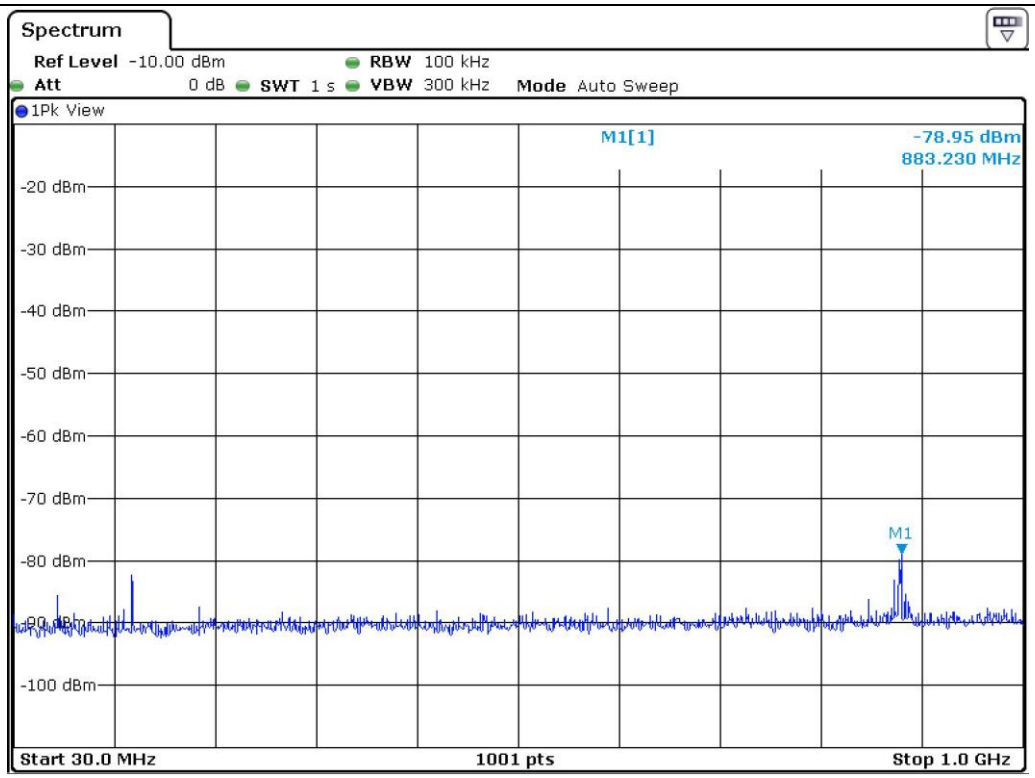
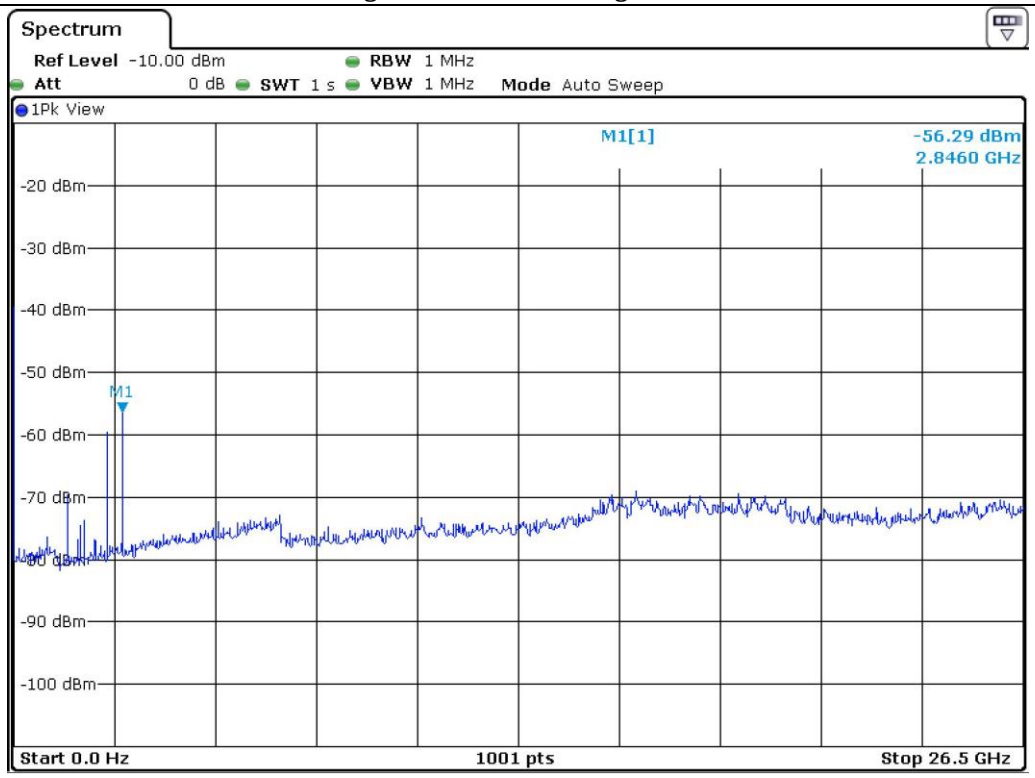


High Channel - Receiving Mode



High Channel - Receiving Mode

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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10.6 Test data - Radiated

10.6.1 Test data for Below 30 MHz

-. Test Date : December 16, 2014

-. Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

-. Frequency range : 9 kHz ~ 30 MHz

-. Measurement distance : 3 m

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

Tested by: Tae-Ho, Kim / Project Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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10.6.2 Test data for 30 MHz ~ 1 000 MHz

Humidity Level : 42.2 % R.H. Temperature: 22.0 ℃

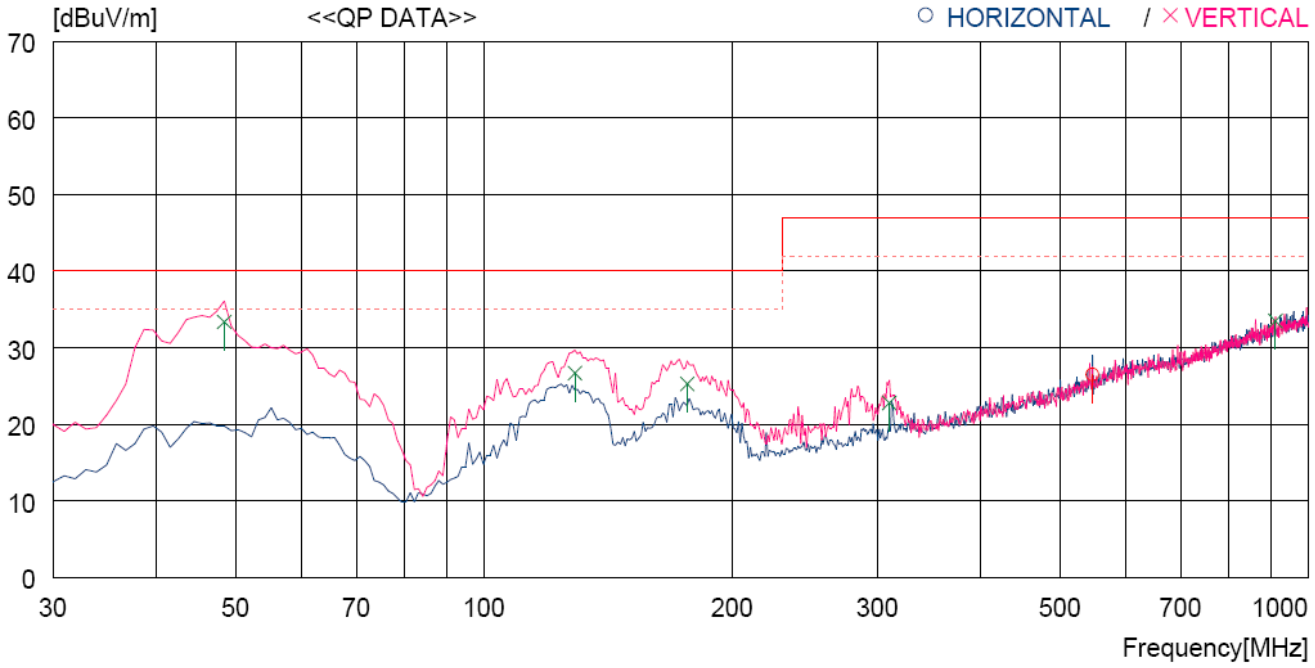
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT : Kinetic Chain Analyzer Sensor Date: December 16, 2014

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

Operating condition : Low Channel



No.	FREQ	READING QP	ANT FACTOR	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal ------										
1	547.010	28.9	18.0	12.8	33.2	26.5	47.0	20.5	400	359
----- Vertical ------										
2	48.430	44.8	14.3	7.3	33.0	33.4	40.0	6.6	100	243
3	128.940	41.9	9.1	8.7	33.0	26.7	40.0	13.3	100	103
4	176.470	39.6	9.3	9.3	32.9	25.3	40.0	14.7	100	300
5	310.330	31.5	13.5	10.7	32.9	22.8	47.0	24.2	143	0
6	912.689	28.7	21.9	15.2	32.3	33.5	47.0	13.5	143	0

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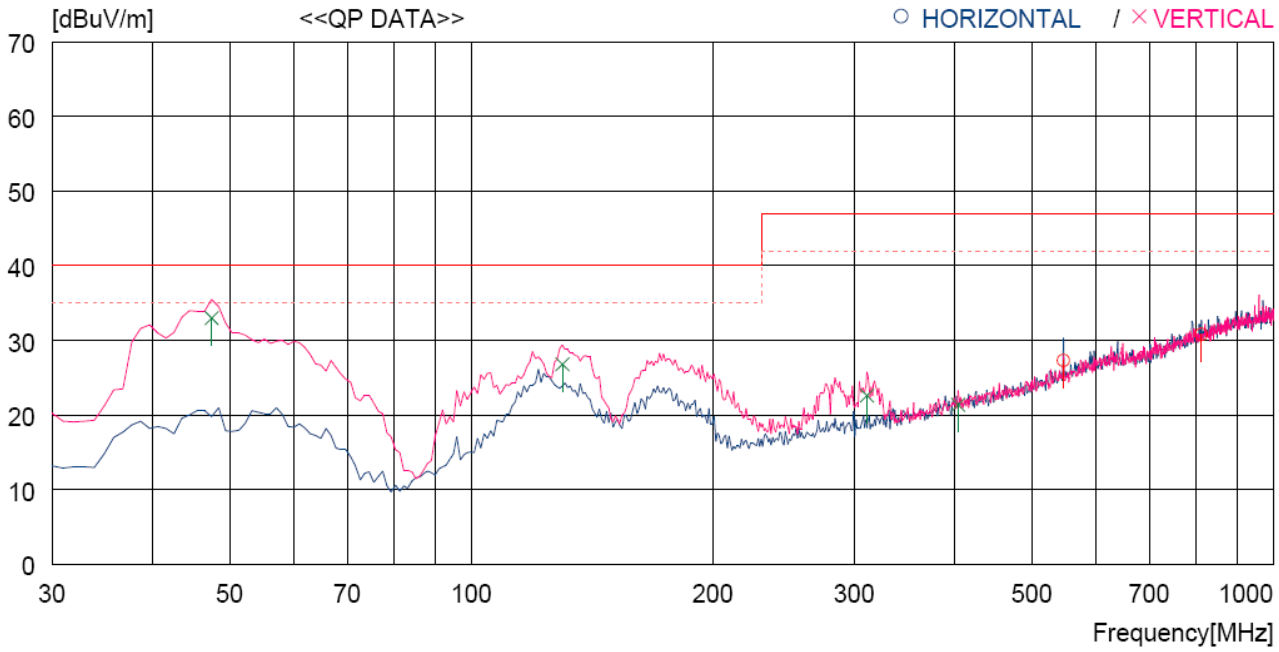
Operating condition : Middle Channel



No.	FREQ	READING QP	ANT FACTOR	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal ------										
1	547.010	29.7	18.0	12.8	33.2	27.3	47.0	19.7	400	306
2	812.782	28.3	20.6	14.8	32.9	30.8	47.0	16.2	400	13
----- Vertical ------										
3	47.460	44.5	14.3	7.2	33.0	33.0	40.0	7.0	100	201
4	129.910	42.1	9.0	8.7	33.0	26.8	40.0	13.2	100	328
5	311.300	31.3	13.5	10.7	32.9	22.6	47.0	24.4	100	347
6	404.420	27.3	15.6	11.5	33.0	21.4	47.0	25.6	100	341

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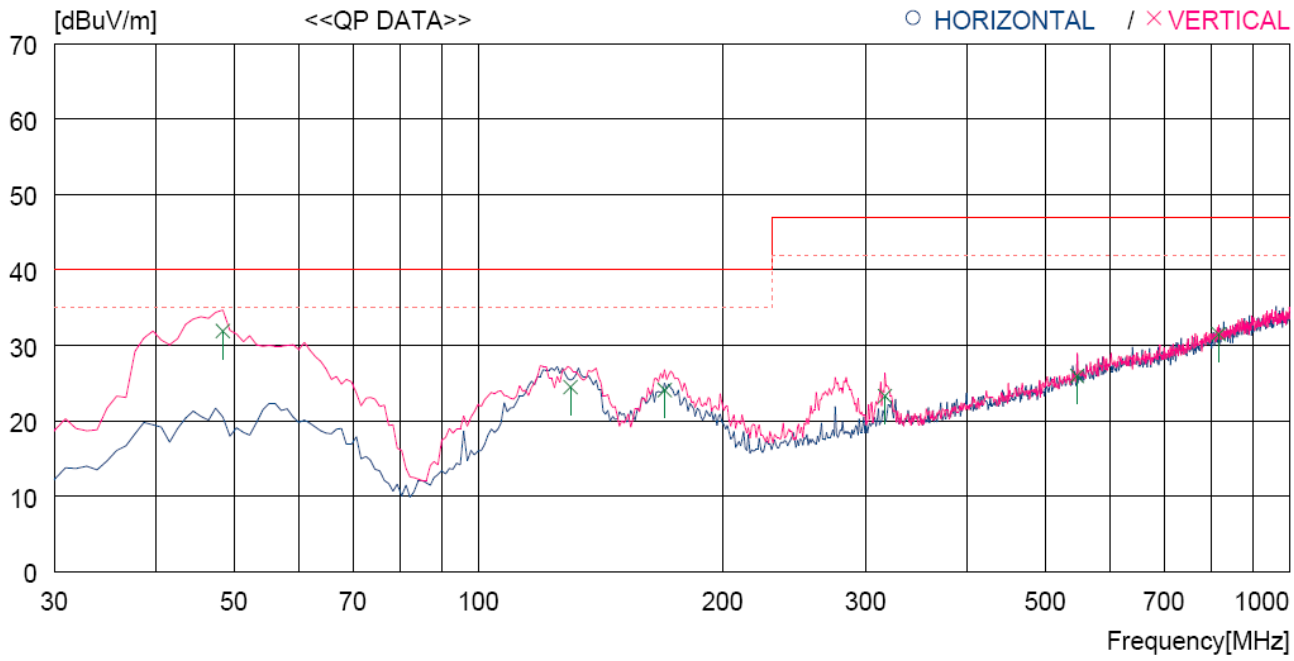
Operating condition : High Channel



No.	FREQ	READING QP	ANT FACTOR	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Vertical ------										
1	48.430	43.3	14.3	7.3	33.0	31.9	40.0	8.1	100	132
2	129.910	39.8	9.0	8.7	33.0	24.5	40.0	15.5	100	12
3	169.680	38.9	9.0	9.2	33.0	24.1	40.0	15.9	100	251
4	317.120	31.7	13.7	10.8	32.9	23.3	47.0	23.7	100	251
5	547.010	28.4	18.0	12.8	33.2	26.0	47.0	21.0	300	359
6	817.631	28.9	20.7	14.8	32.9	31.5	47.0	15.5	200	0

Tested by: Tae-Ho, Kim / Project Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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10.6.3 Test data for above 1 GHz

-. Test Date : December 16, 2014

-. 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 ~ 26.5 GHz

-. Measurement distance : 3 m

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

Tested by: Tae-Ho, Kim / Project Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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11 PEAK POWER SPECTRUL DENSITY

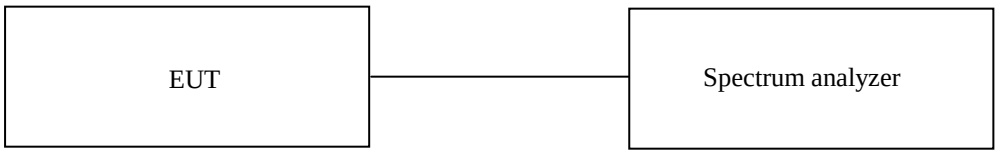
11.1 Operating environment

Temperature : 22.2 ℃

Relative humidity : 45 % R.H.

11.2 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 set to 3 times the resolution bandwidth.



11.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2014(1Y)

All test equipment used is calibrated on a regular basis.

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

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11.4 Test data

-. Test Date : December 16, 2014

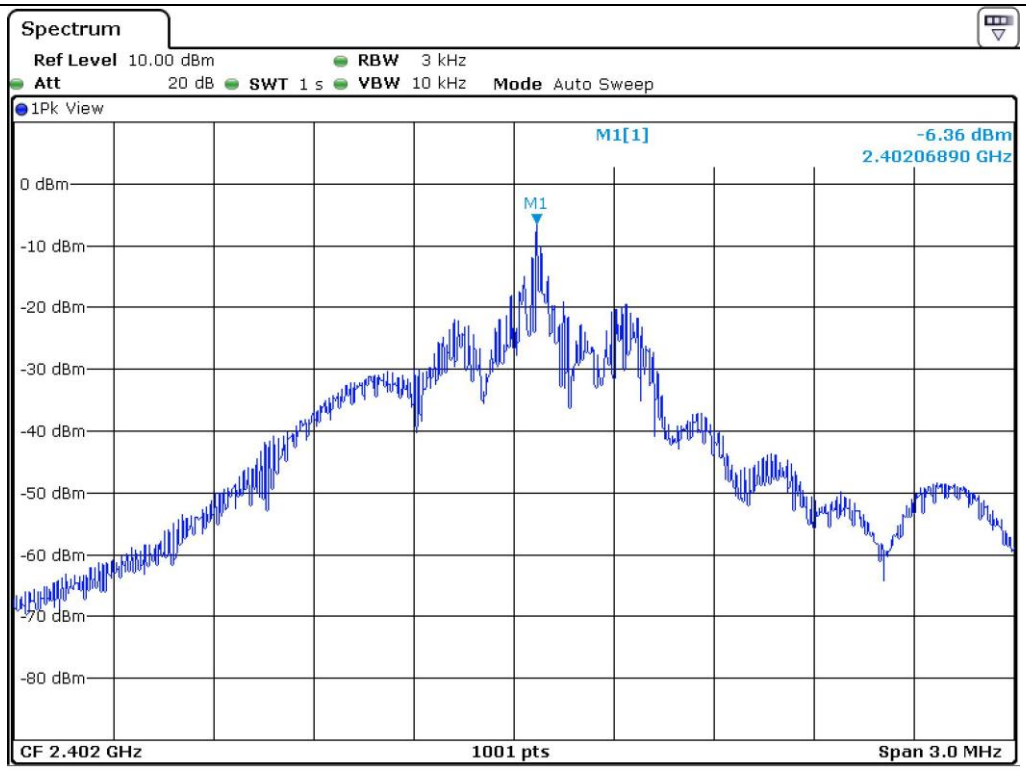
-. Test Result : Pass

-. Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402	-6.36	8.00	14.36
Middle	2 440	-4.56	8.00	12.56
High	2 478	-5.76	8.00	13.76

Remark. Margin = Limit – Measured value

Tested by: Tae-Ho, Kim / Project Engineer



Low Channel

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

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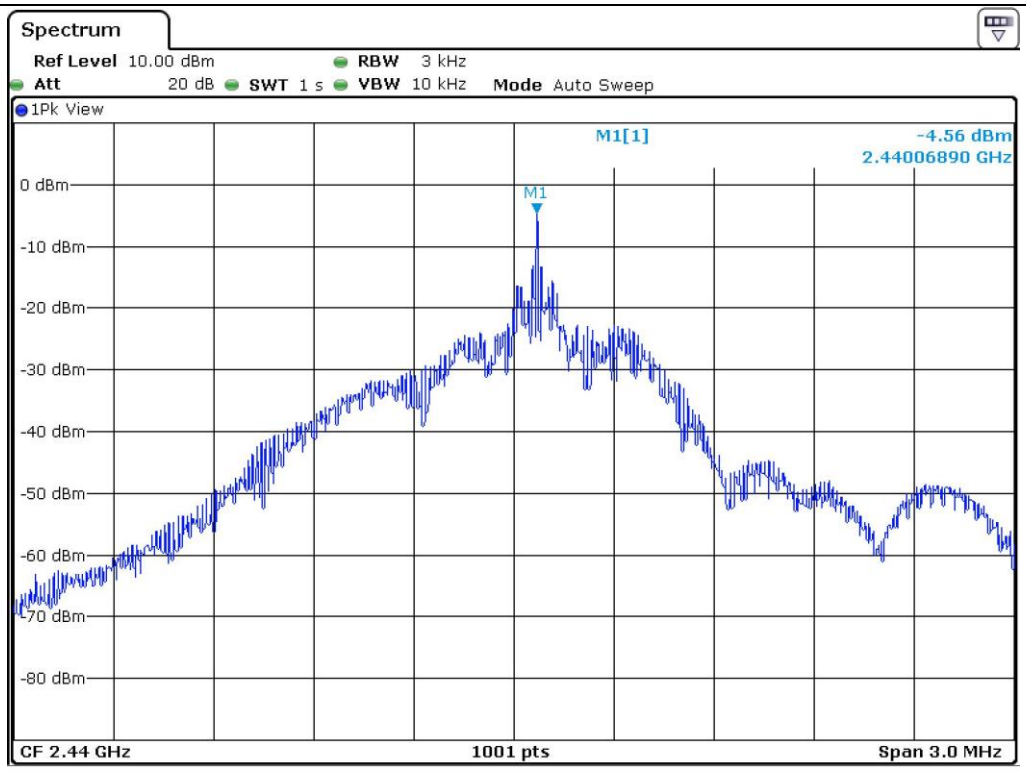
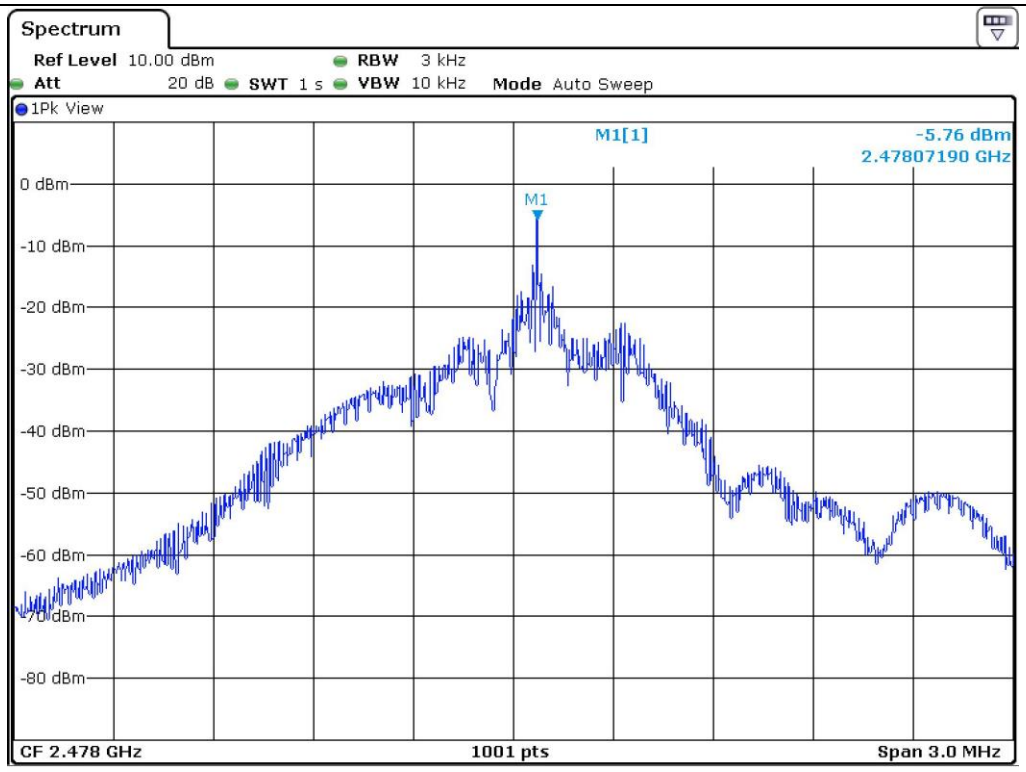


Middle Channel



High Channel

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

12. RADIATED EMISSION TEST

12.1 Operating environment

Temperature : 22.2 ℃

Relative humidity : 45 % R.H.

12.2 Test set-up

The radiated emissions measurements were on the 3 m, 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 26.5 GHz 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 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

12.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ -	8564E	HP	Spectrum Analyzer	3650A00756	Apr. 28, 2014(1Y)
■ -	ESU	Rohde & Schwarz	EMI Test Receiver	100261	Apr. 29, 2014(1Y)
■-	310N	Sonoma Instrument	AMPLIFIER	312544	Apr. 28, 2014(1Y)
■ -	83051A	Agilent	Microwave System Preamplifer	3950M00201	Apr. 30, 2014(1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	May 20, 2013(1Y)
■ -	SCU-18	Rohde & Schwarz	PRE-AMPLIFIER	10041	Apr. 28, 2014(1Y)
■ -	MA220	HD	Turn Table	N/A	N/A
■ -	HD240	HD	Antenna Mast	N/A	N/A
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-421	May 02, 2014(2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D294	Sep. 05, 2013(2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	N/A

All test equipment used is calibrated on a regular basis.

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

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

12.4 Test data for Charging mode

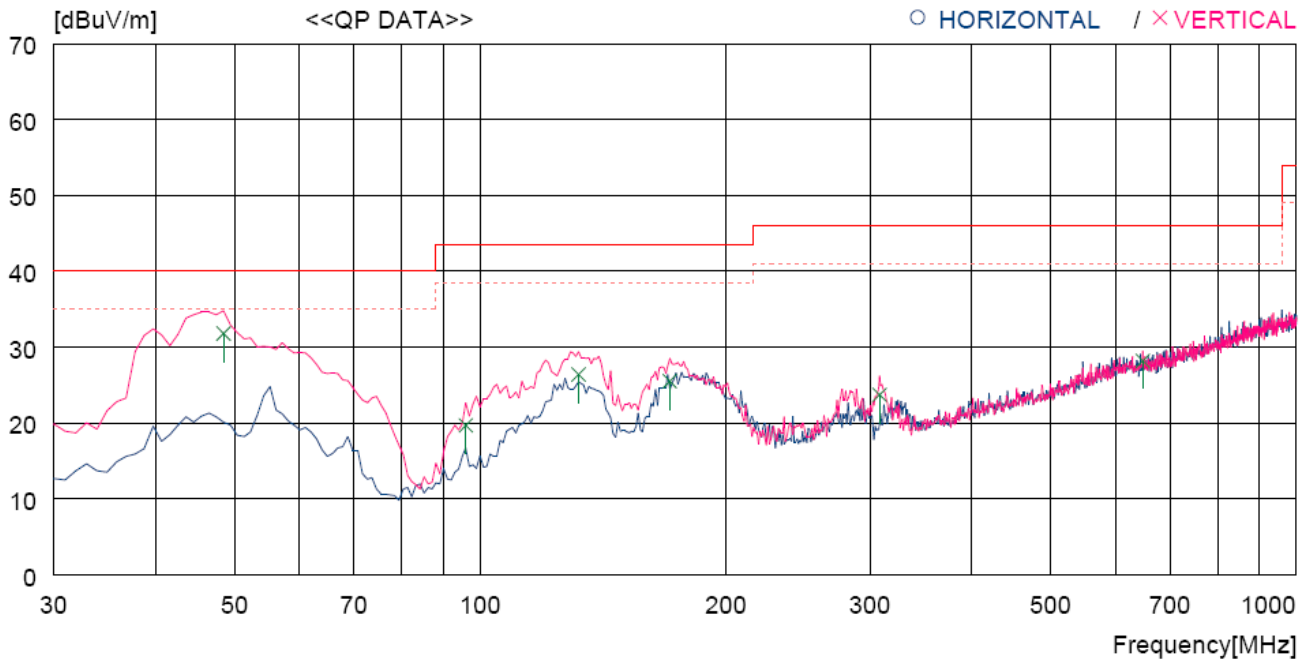
Humidity Level : 45 % R.H. Temperature: 22.2 ℃

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT : Kinetic Chain Analyzer Sensor Date: December 16, 2014

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



No.	FREQ	READING QP	ANT FACTOR	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Vertical ------										
1	48.430	43.2	14.3	7.3	33.0	31.8	40.0	8.2	153	0
2	95.960	33.7	11.0	8.1	33.1	19.7	43.5	23.8	153	0
3	131.850	41.9	8.8	8.7	33.0	26.4	43.5	17.1	100	334
4	170.650	40.3	9.0	9.2	33.0	25.5	43.5	18.0	100	328
5	308.390	32.5	13.5	10.6	32.9	23.7	46.0	22.3	153	0
6	647.887	28.8	19.2	13.5	33.3	28.2	46.0	17.8	100	89

Tested by: Tae-Ho, Kim / Project Engineer

HEAD OFFICE : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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12.4.1 Test data for Below 30 MHz

-. Test Date : December 16, 2014

-. Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

-. Frequency range : 9 kHz ~ 30 MHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode

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

12.4.2 Test data for above 1 GHz

-. Test Date : December 16, 2014

-. 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 ~ 26.5 GHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode

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

Tested by: Tae-Ho, Kim / Project Engineer

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13. CONDUCTED EMISSION TEST

13.1 Operating environment

Temperature : 22.2 ℃

Relative humidity : 45 % R.H.

13.2 Test set-up

The EUT was placed on a wooden table, 0.8 m height above the floor. Power was fed to the EUT through a 50 Ω / 50 μH + 5 Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

13.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	ESPI	Rohde & Schwarz	EMI Test Receiver	101278	Nov. 03, 2014 (1Y)
☐ -	ESHS10	Rohde & Schwarz	EMI Test Receiver	834467/007	Jul. 15, 2014 (1Y)
☐	NSLK8128	Schwarzbeck	AMN	8128-216	Apr. 11, 2014 (1Y)
■ -	NSLK8126	Schwarzbeck	AMN	8126-404	Jul. 11, 2014 (1Y)
☐ -	3825/2	EMCO	AMN	9109-1869	Apr. 29, 2014 (1Y)
■ --	3825/2	EMCO	AMN	9109-1867	Apr. 29, 2014 (1Y)

All test equipment used is calibrated on a regular basis.

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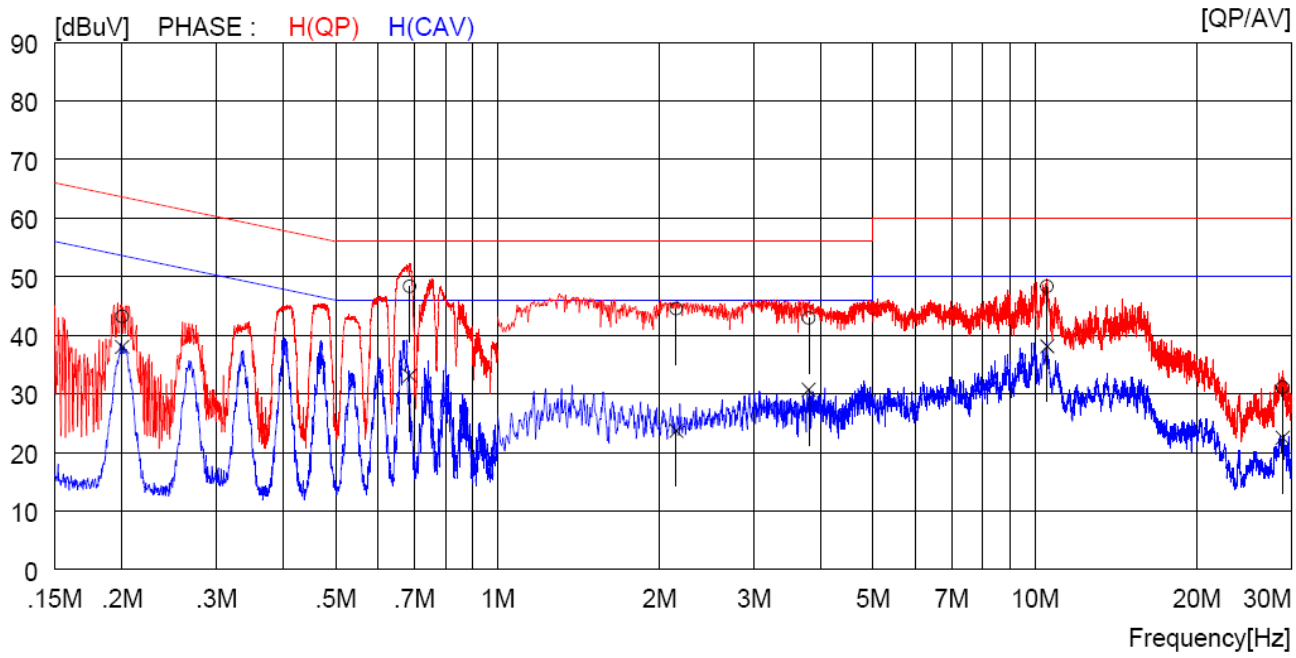
13.4 Test data for Charging mode

-. Test Date : December 16, 2014

-. Resolution bandwidth : 9 kHz

-. Frequency range : 0.15 MHz ~ 30 MHz

-. Tested Line : HOT LINE



NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.20000	33.2	----	10.0	43.2	----	63.6	----	20.4	----	H(QP)
2	0.68600	38.3	----	10.0	48.3	----	56.0	----	7.7	----	H(QP)
3	2.15200	34.5	----	10.0	44.5	----	56.0	----	11.5	----	H(QP)
4	3.79200	32.9	----	10.0	42.9	----	56.0	----	13.1	----	H(QP)
5	10.54000	38.1	----	10.2	48.3	----	60.0	----	11.7	----	H(QP)
6	28.90000	20.8	----	10.3	31.1	----	60.0	----	28.9	----	H(QP)
7	0.20000	----	28.0	10.0	----	38.0	----	53.6	----	15.6	H(CAV)
8	0.68600	----	23.1	10.0	----	33.1	----	46.0	----	12.9	H(CAV)
9	2.15200	----	13.7	10.0	----	23.7	----	46.0	----	22.3	H(CAV)
10	3.79200	----	20.7	10.0	----	30.7	----	46.0	----	15.3	H(CAV)
11	10.54000	----	27.9	10.2	----	38.1	----	50.0	----	11.9	H(CAV)
12	28.90000	----	12.2	10.3	----	22.5	----	50.0	----	27.5	H(CAV)

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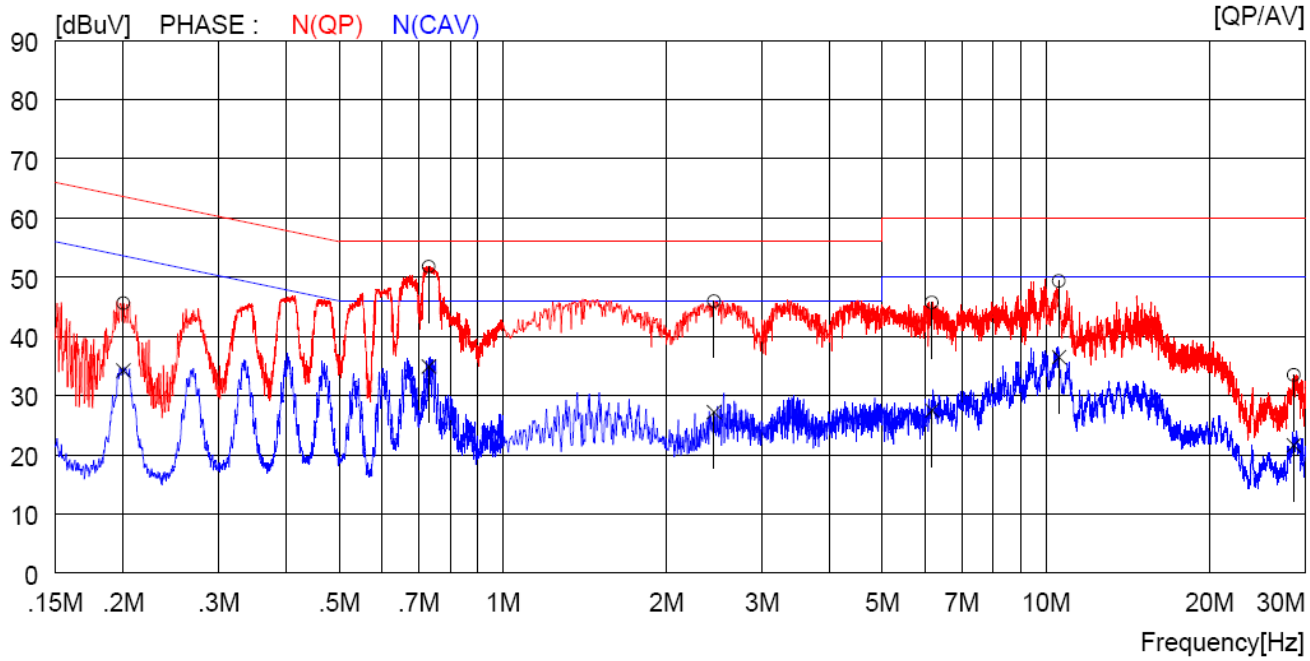
-. Tested Line : NEUTRAL LINE



NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.20000	35.6	----	10.0	45.6	----	63.6	----	18.0	----	N(QP)
2	0.73100	41.8	----	10.0	51.8	----	56.0	----	4.2	----	N(QP)
3	2.44800	35.9	----	10.0	45.9	----	56.0	----	10.1	----	N(QP)
4	6.17000	35.6	----	10.1	45.7	----	60.0	----	14.3	----	N(QP)
5	10.57000	39.1	----	10.2	49.3	----	60.0	----	10.7	----	N(QP)
6	28.60000	23.2	----	10.3	33.5	----	60.0	----	26.5	----	N(QP)
7	0.20000	----	24.2	10.0	----	34.2	----	53.6	----	19.4	N(CAV)
8	0.73100	----	24.9	10.0	----	34.9	----	46.0	----	11.1	N(CAV)
9	2.44800	----	17.2	10.0	----	27.2	----	46.0	----	18.8	N(CAV)
10	6.17000	----	17.4	10.1	----	27.5	----	50.0	----	22.5	N(CAV)
11	10.57000	----	26.3	10.2	----	36.5	----	50.0	----	13.5	N(CAV)
12	28.60000	----	11.3	10.3	----	21.6	----	50.0	----	28.4	N(CAV)

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

Tested by: Tae-Ho, Kim / Project Engineer

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