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

Test Report No.	**: W159R-D009**
AGR No.	**: A158A-145**
Applicant	**: LG Innotek Co., Ltd.**
Address	**: 978-1, Jangduk-dong, Gwangsan-gu, Gwangju, 506-731 Korea**
Manufacturer	**: LG Innotek Co., Ltd.**
Address	**: 978-1, Jangduk-dong, Gwangsan-gu, Gwangju, 506-731 Korea**
Type of Equipment	**: Bluetooth/WLAN Combo Module for Automotive**
FCC ID.	**: YZP-RBHAC213B**
Model Name	**: RBHA-C213B**
Serial number	**: N/A**
Total page of Report	**: 65 pages (including this page)**
Date of Incoming	**: August 27, 2015**
Date of issue	**: September 09, 2015**

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.

Reviewed by: Ki-Hong, Nam / Asst, Chief 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
W159R-D009	September 09, 2015	Initial Issue	All

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1. VERIFICATION OF COMPLIANCE

Applicant	: LG Innotek Co., Ltd.
Address	: 978-1, Jangduk-dong, Gwangsan-gu, Gwangju, 506-731 Korea
Contact Person	: Inchang, Jeong / Director
Telephone No.	: +82-62-950-0332
FCC ID	: YZP-RBHAC213B
Model Name	: RBHA-C213B
Serial Number	: N/A
Date	: September 09, 2015

EQUIPMENT CLASS	DTS – DIGITAL TRNSMISSION SYSTEM
E.U.T. DESCRIPTION	Modular Transmitter, Bluetooth/WLAN Combo Module for Automotive
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
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 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)	Minimum 6 dB Bandwidth	Met the Limit / PASS
15.247 (b) (3)	Maximum Peak Conducted Output Power	Met the Limit / PASS
15.247 (d)	100 kHz Bandwidth Outside the Frequency Band	Met the Limit / PASS
15.247 (d)	Radiated Emission which fall in the Restricted Band	Met the Limit / PASS
15.247 (e)	Peak Power Spectral Density	Met the Limit / PASS
15.209	Radiated Emission Limits	Met the Limit / PASS
15.207	Conducted Limits	Met the Limit / PASS
15.203	Antenna Requirement	Met requirement / PASS

2.2 Additions, deviations, exclusions from standards

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

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.247

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

3. GENERAL INFORMATION

3.1 Product Description

The LG Innotek Co., Ltd., Model RBHA-C213B (referred to as the EUT in this report) is a Bluetooth/WLAN Combo Module for Automotive. Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Bluetooth/WLAN Combo Module for Automotive		
OPERATING FREQUENCY	WLAN	2 412 MHz ~ 2 462 MHz (802.11b/g/n(HT20))	
	Bluetooth	2 402 MHz ~ 2 480 MHz	
	Bluetooth LE	2 402 MHz ~ 2 480 MHz	
MAX. RF OUTPUT POWER	WLAN	Wi-Fi 802.11b (11.25 dBm)	
		Wi-Fi 802.11g (10.31 dBm)	
		Wi-Fi 802.11n_20 MHz (10.20 dBm)	
	Bluetooth	1 Mbps	6.70 dBm
		2 Mbps	5.15 dBm
		3 Mbps	5.43 dBm
	Bluetooth LE	2.63 dBm	
MODULATION TYPE	WLAN	DSSS Modulation(DBPSK/DQPSK/CCK)	
	Bluetooth	GFSK for 1 Mbps, DQPSK for 2 Mbps, 8-DPSK for 3 Mbps	
	Bluetooth LE	GFSK	
ANTENNA TYPE	Dipole Antenna		
ANTENNA GAIN	2.41 dBi		
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	26 MHz		

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	LG Innotek Co., Ltd.	RBHA-C211A Carrier B'D Rev 0.2	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
RBHA-C213B	LG Innotek Co., Ltd.	Bluetooth/WLAN Combo Module for Automotive (EUT)	Notebook PC
PP11L	DELL	Notebook PC	EUT

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5.3 Mode of operation during the test

Modulation & Channel selected	DATA RATE	OUTPUT POWER[dBm]
802.11 b (Middle Channel)	1 Mbps	10.41
	2 Mbps	10.38
	5.5 Mbps	9.89
	11 Mbps	9.24
802.11g (Middle Channel))	6 Mbps	9.68
	9 Mbps	9.14
	12 Mbps	8.77
	18 Mbps	8.52
	24 Mbps	8.18
	36 Mbps	7.76
	48 Mbps	7.19
	54 Mbps	6.84
HT 20 (Middle Channel))	6.5 Mbps	9.49
	13 Mbps	9.30
	19.5 Mbps	9.05
	26 Mbps	8.69
	39 Mbps	8.45
	52 Mbps	8.31
	58.5 Mbps	8.09
	65 Mbps	7.77

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

The worse case data rate for each modulation is determined 1 Mbps for IEEE 802.11b, 6 Mbps for IEEE 802.11g, 6.5 Mbps for HT20.

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5.4 Configuration of Test System

Line Conducted Test: The jig board of the EUT 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 C63.10: 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 shall be used inverse spiral interface antenna Connector of the EUT at the manufacturer side.

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6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Test, the following operating mode was investigated.

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

6.2 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

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

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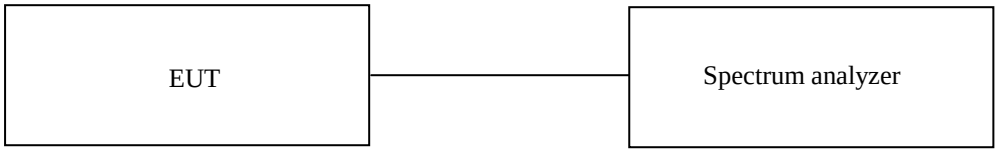
7. MIMIMUM 6 dB BANDWIDTH

7.1 Operating environment

Temperature	:	21.4 ℃
Relative humidity	:	45.1 % 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.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jul. 22, 2015 (1Y)

All test equipment used is calibrated on a regular basis.

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7.4 Test data for 802.11b

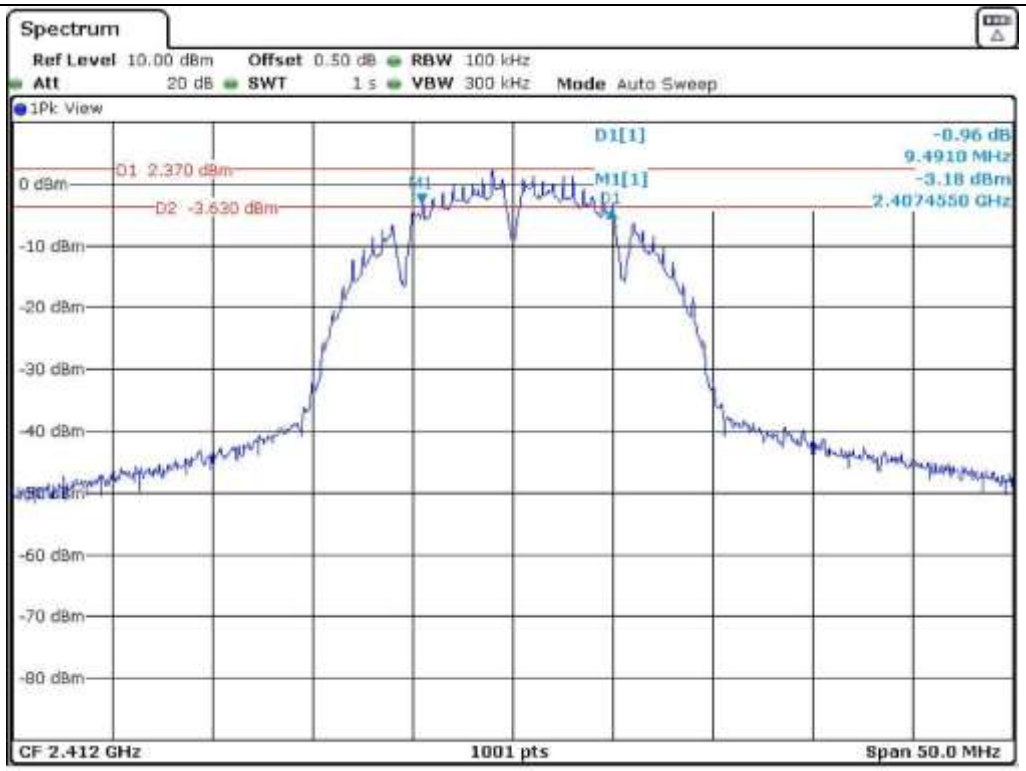
-. Test Date : September 07, 2015

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 412	9.49	0.50	8.99
Middle	2 442	9.49	0.50	8.99
High	2 462	9.49	0.50	8.99

Remark. Margin = Measured Value - Limit

Tested by: Hyung-Kwon, Oh / Engineer



Low Channel

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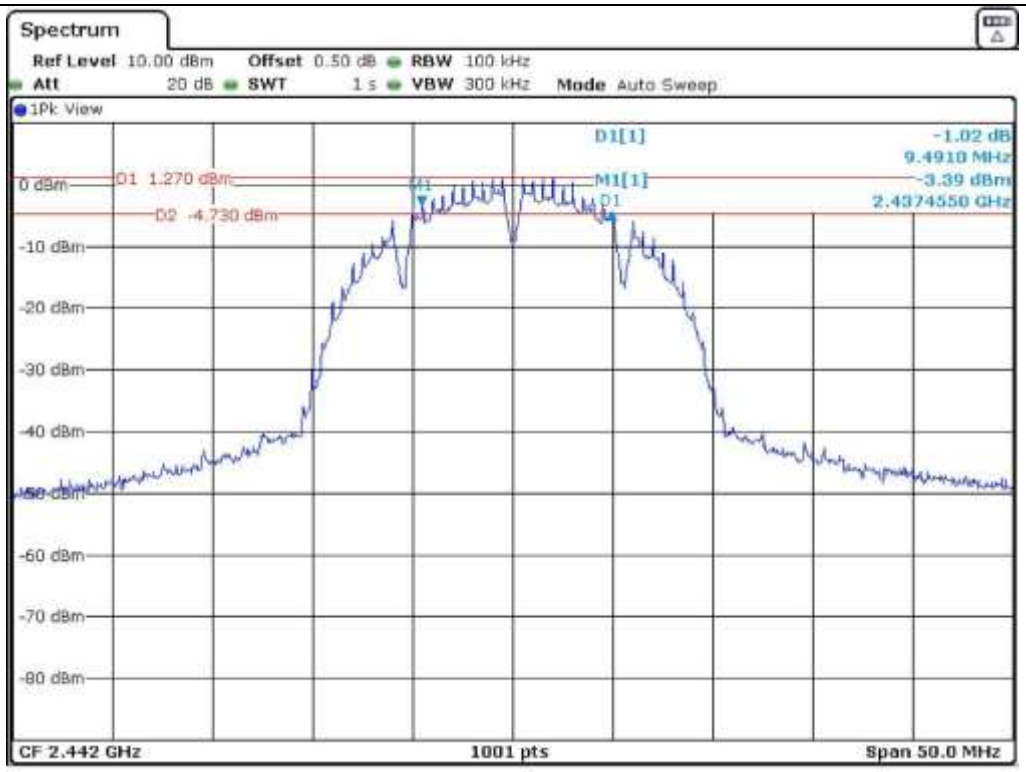
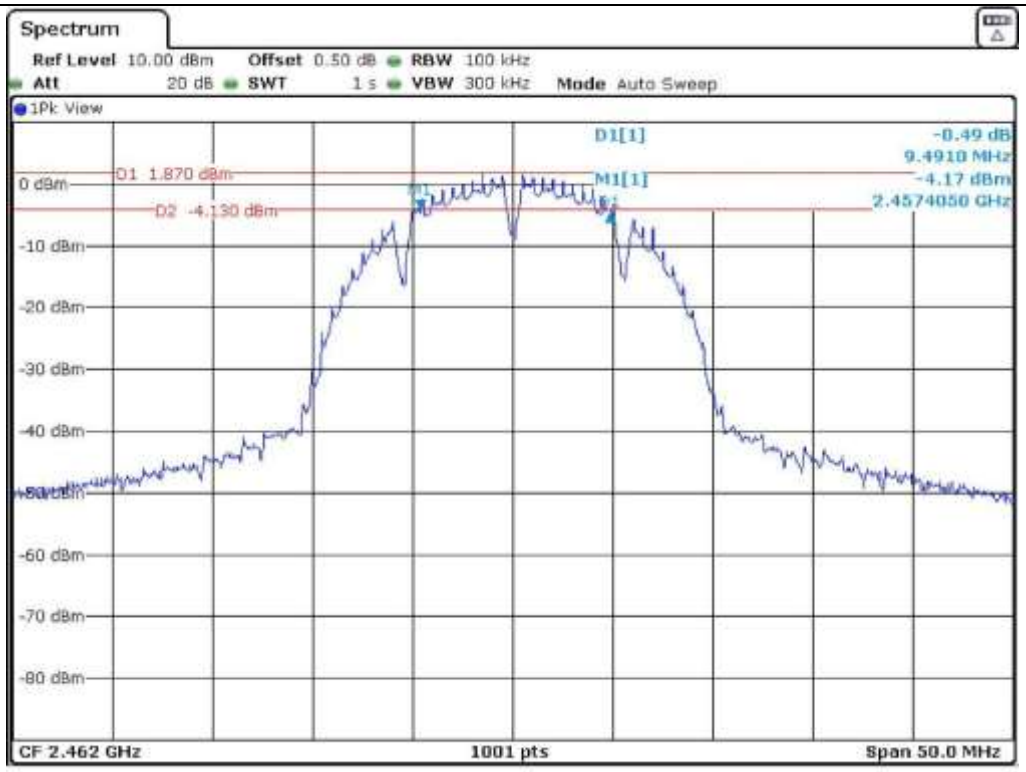


Middle Channel



High Channel

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7.5 Test data for 802.11g

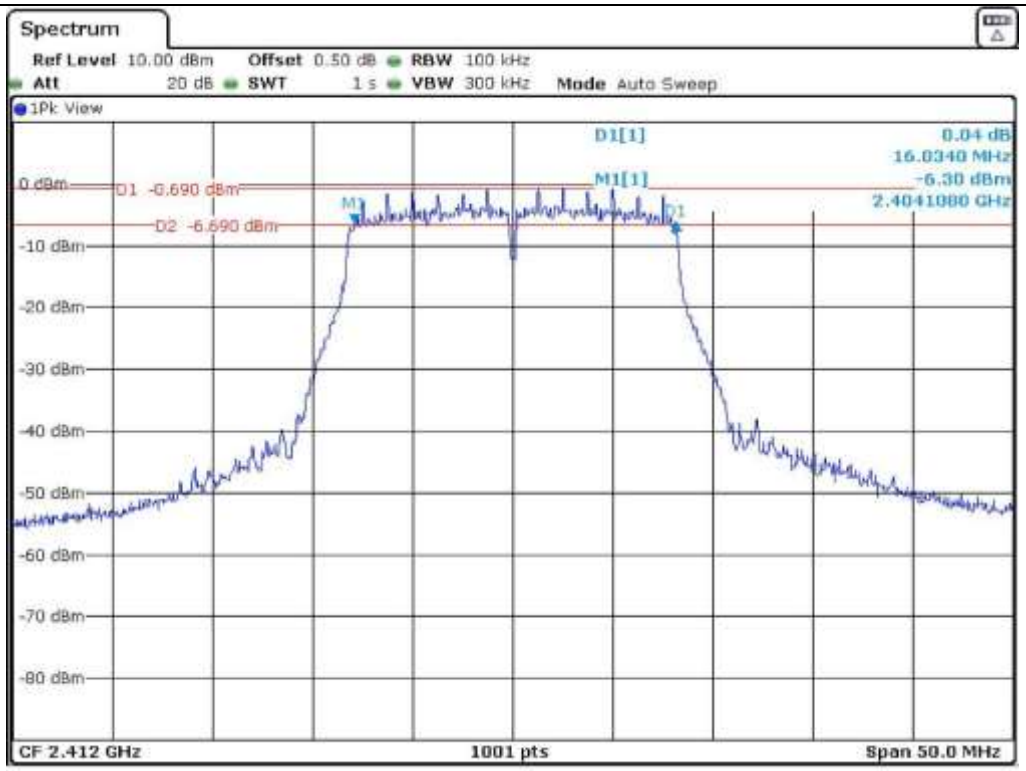
-. Test Date : September 07, 2015

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 412	16.03	0.50	15.53
Middle	2 442	16.08	0.50	15.58
High	2 462	16.03	0.50	15.53

Remark. Margin = Measured Value - Limit

Tested by: Hyung-Kwon, Oh / Engineer



Low Channel

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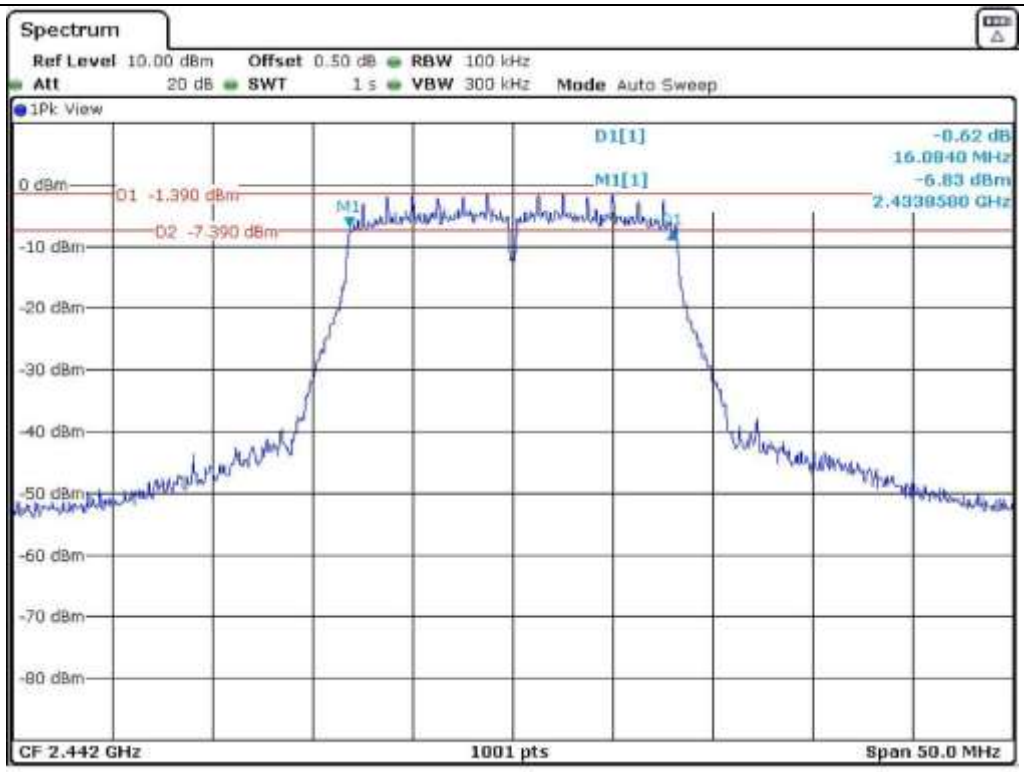
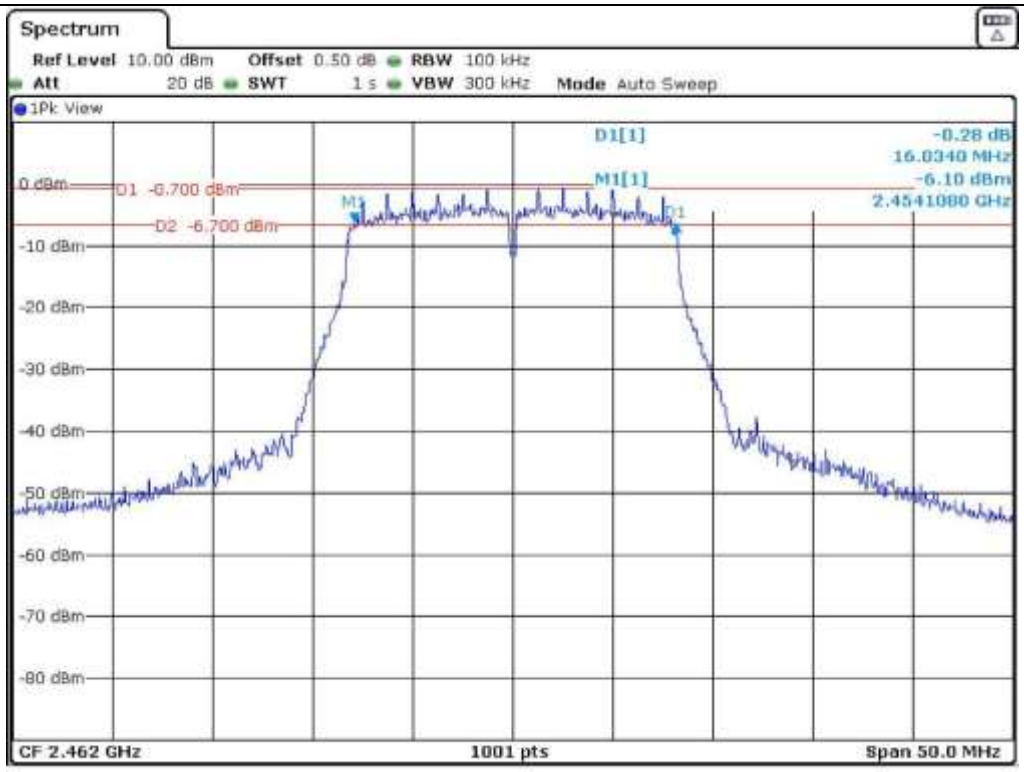


Middle Channel



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7.6 Test data for 802.11n_HT20

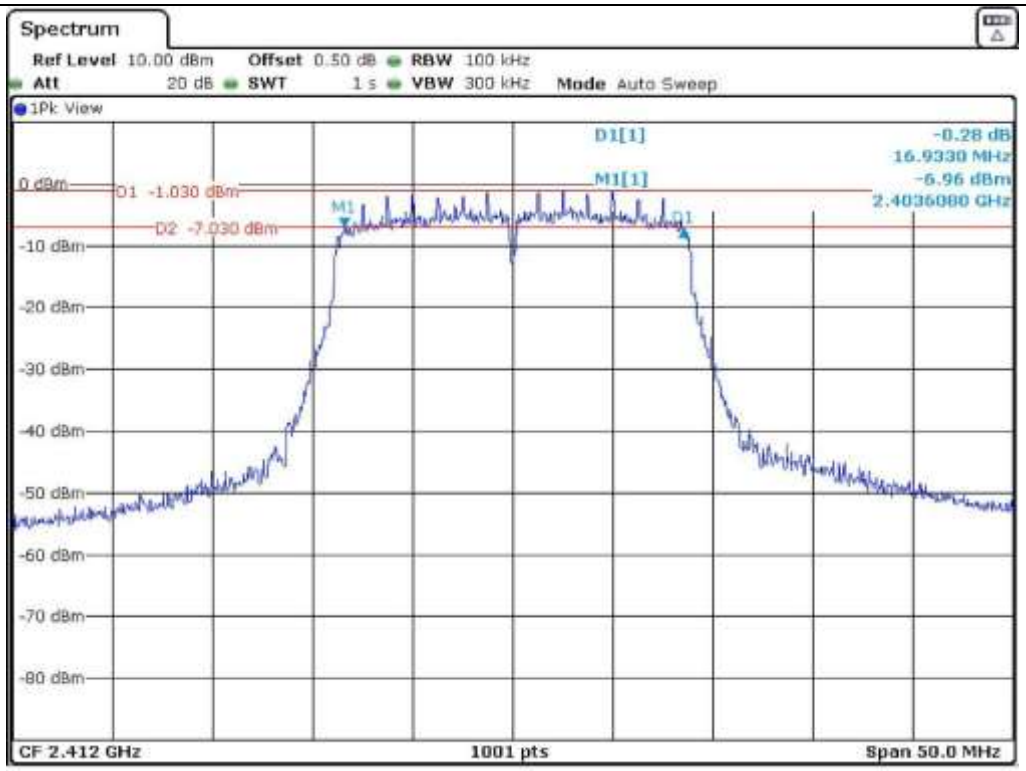
-. Test Date : September 07, 2015

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 412	16.93	0.50	16.43
Middle	2 442	16.93	0.50	16.43
High	2 462	16.88	0.50	16.38

Remark. Margin = Measured Value - Limit

Tested by: Hyung-Kwon, Oh / Engineer



Low Channel

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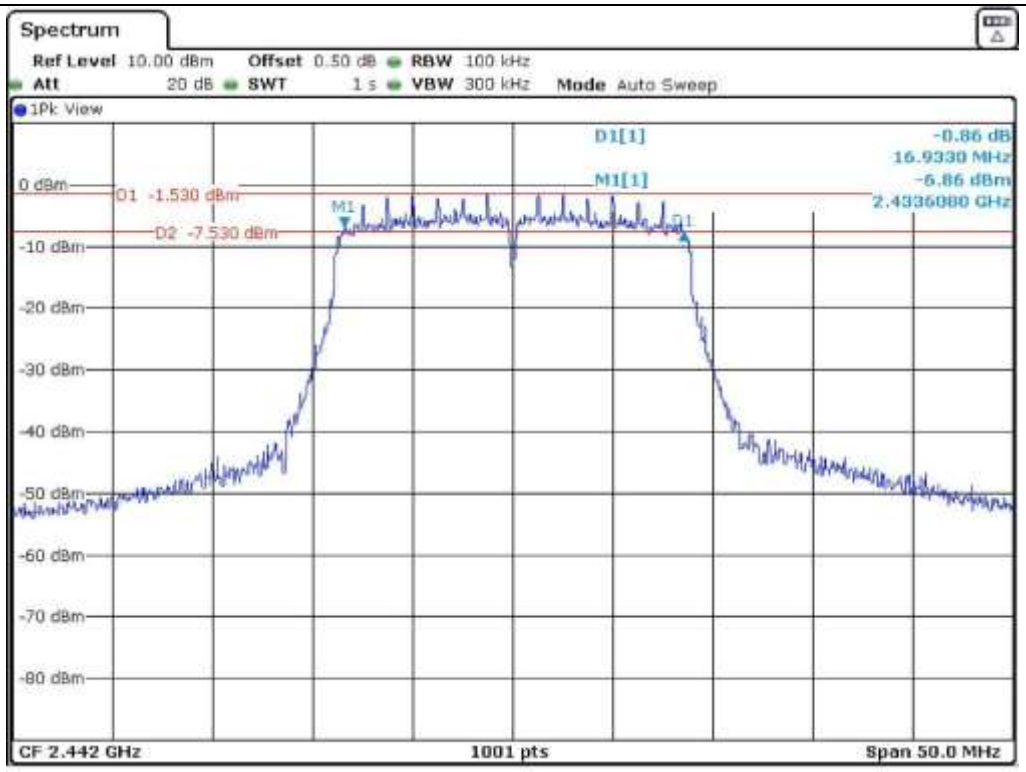
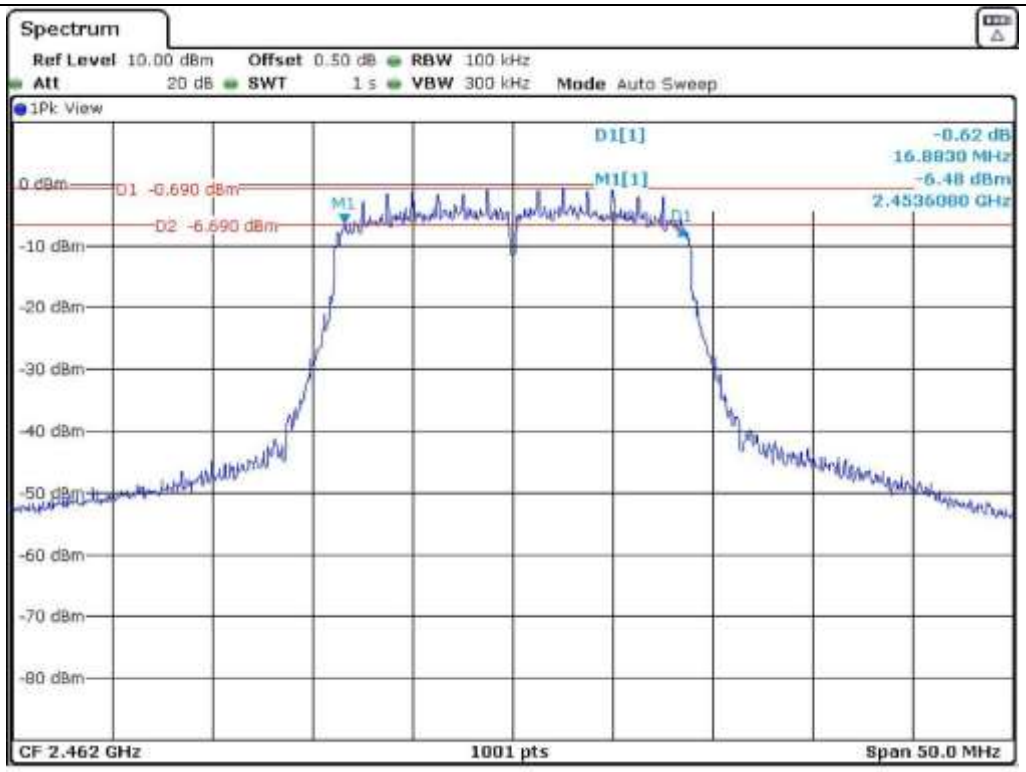


Middle Channel



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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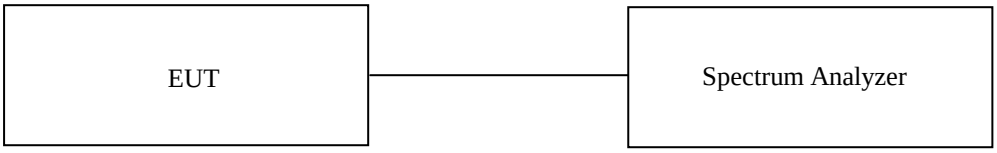
8. MAXIMUM PEAK OUTPUT POWER

8.1 Operating environment

Temperature	:	21.4 ℃
Relative humidity	:	45.1 % R.H.

8.2 Test set-up

The maximum peak output power was measured with the spectrum analyzer connected to the antenna output of the EUT. The spectrum analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99 % bandwidth. The EUT was operating in transmit mode at the appropriate center frequency.



8.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jul. 22, 2015 (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)

8.4 Test data for 802.11b

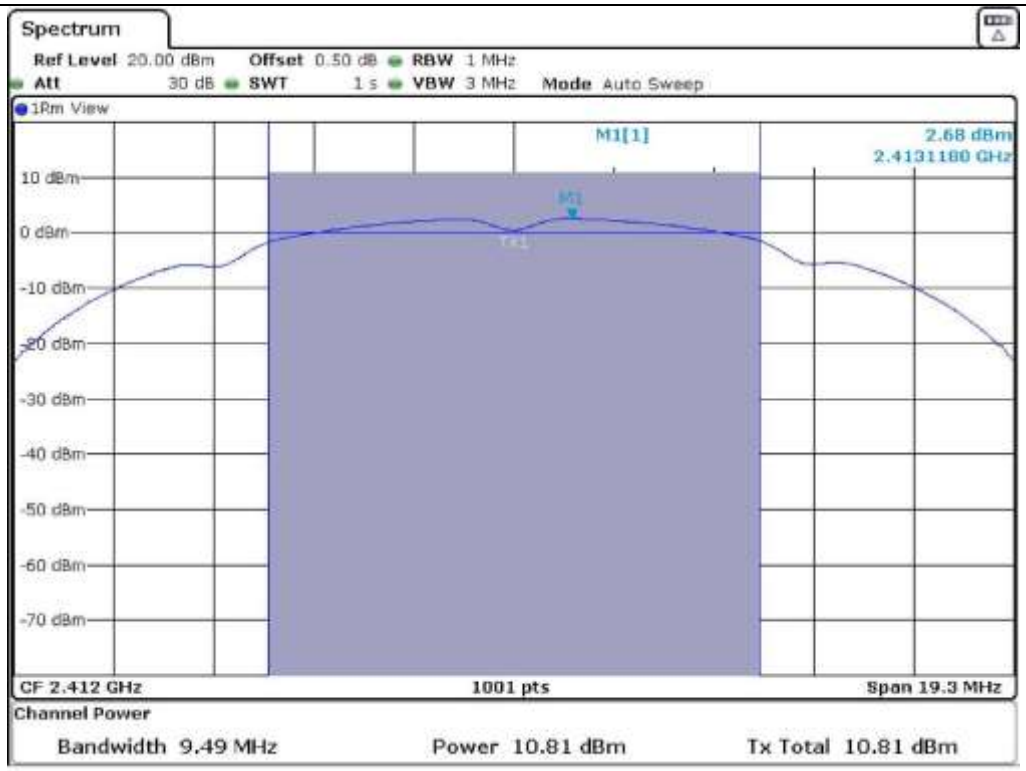
-. Test Date : September 07, 2015

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412	9.49	10.81	30.00	19.19
MIDDLE	2 442	9.49	10.41	30.00	19.59
HIGH	2 462	9.49	11.25	30.00	18.75

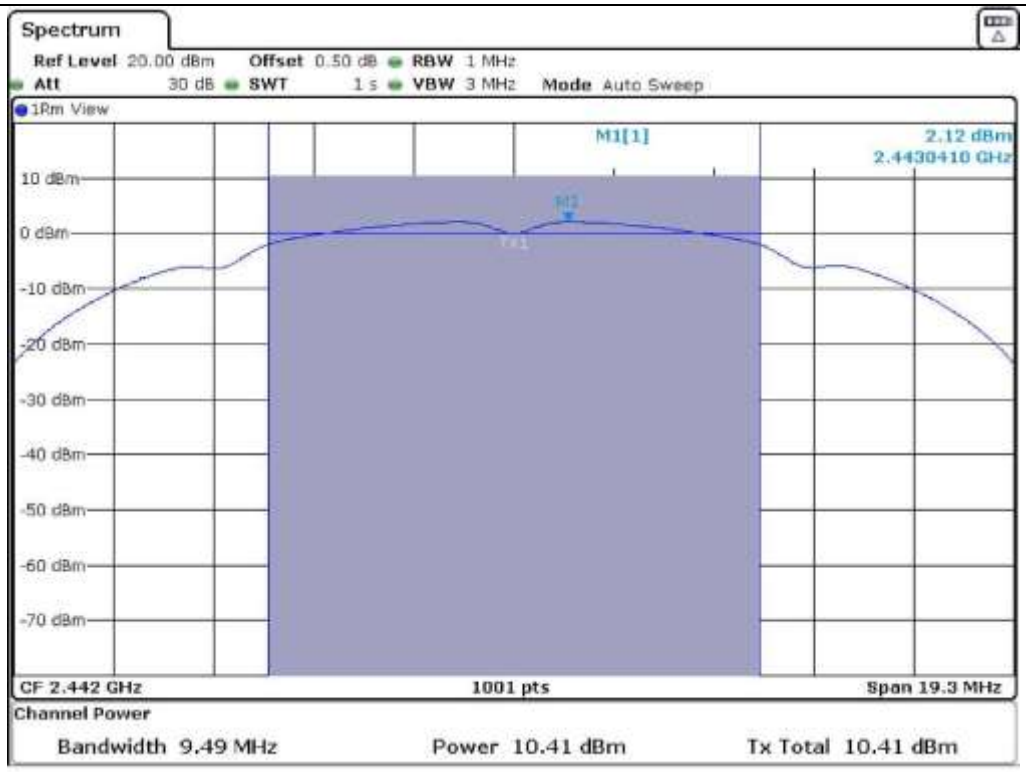
Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

Tested by: Hyung-Kwon, Oh / Engineer

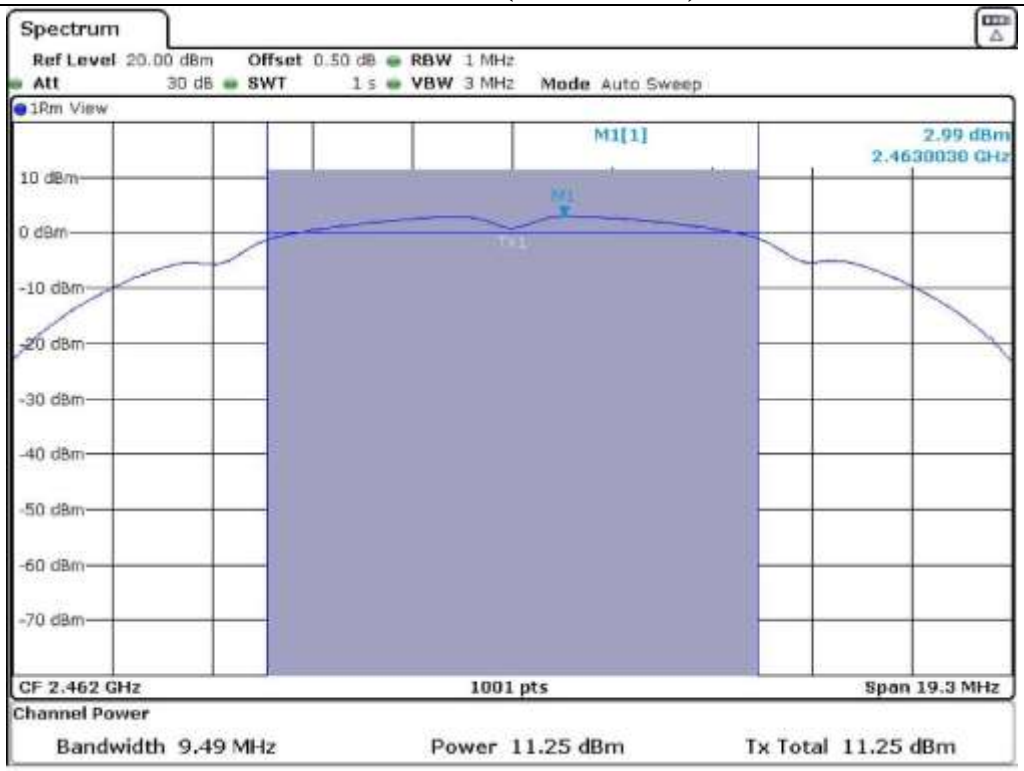


Low Channel (6 dB Bandwidth)

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)



Middle Channel (6 dB Bandwidth)



High Channel (6 dB Bandwidth)

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)

8.5 Test data for 802.11g

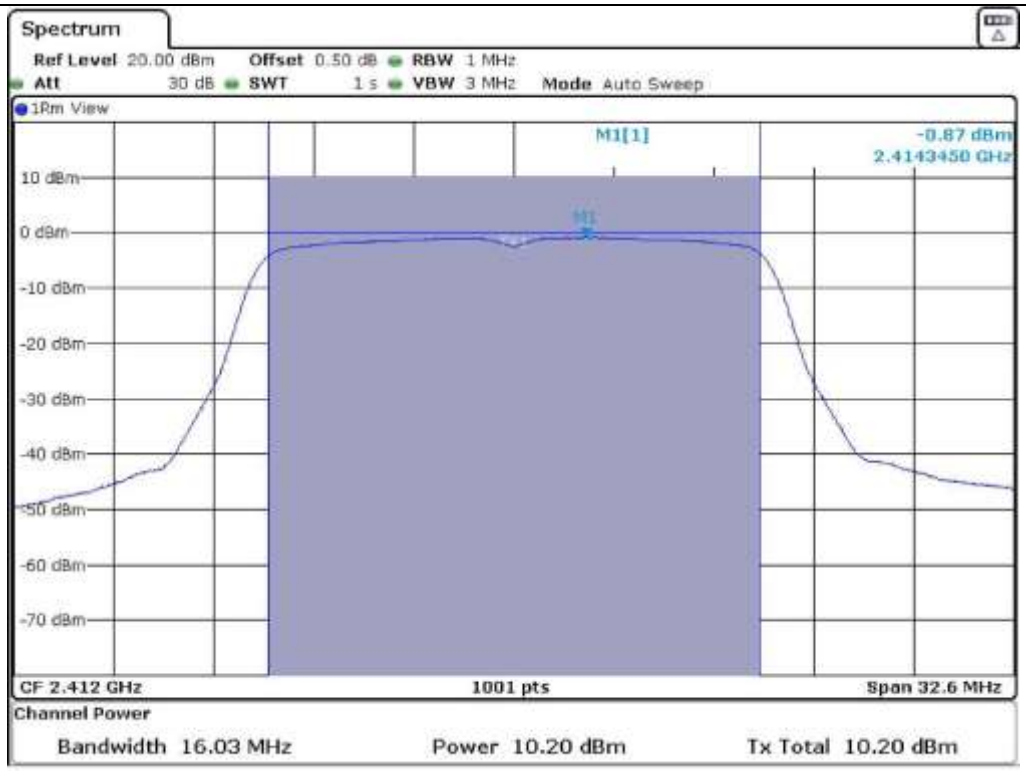
-. Test Date : September 07, 2015

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412	16.03	10.20	30.00	19.80
MIDDLE	2 442	16.08	9.68	30.00	20.32
HIGH	2 462	16.03	10.31	30.00	19.69

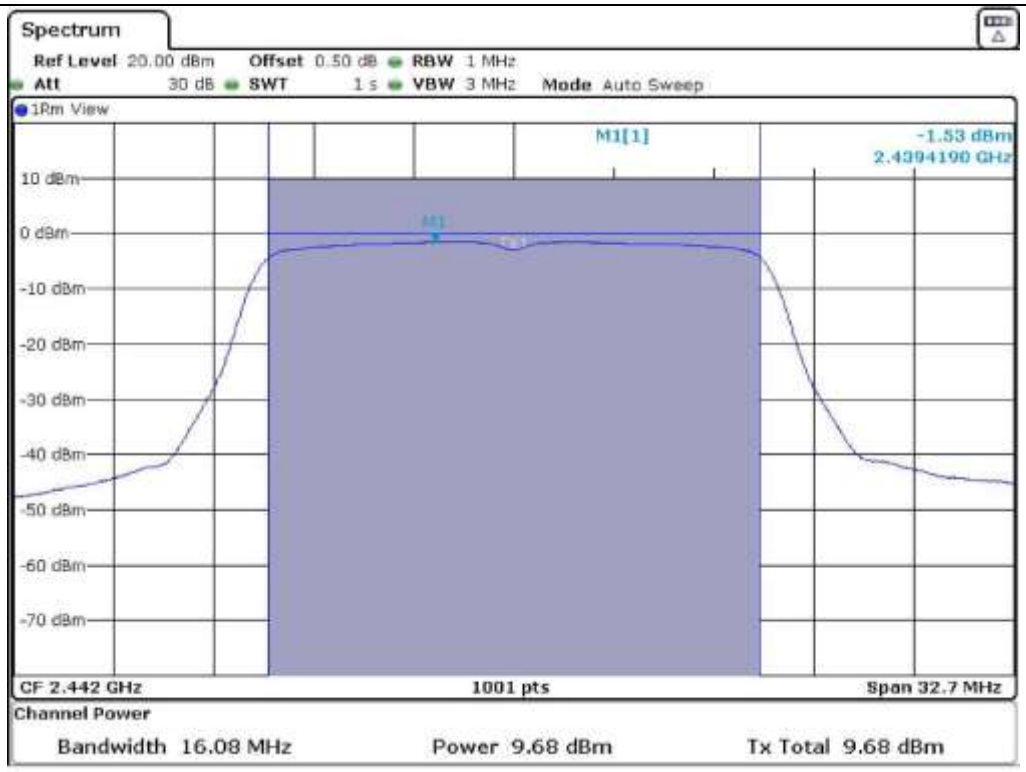
Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

Tested by: Hyung-Kwon, Oh / Engineer

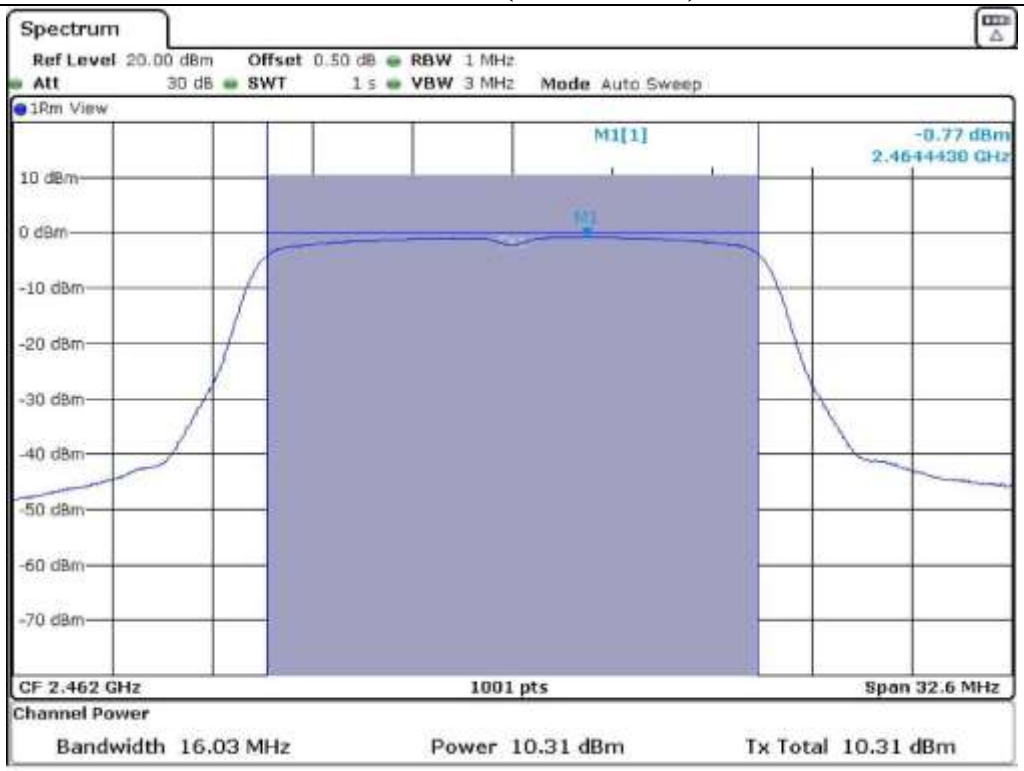


Low Channel (6 dB Bandwidth)

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)



Middle Channel (6 dB Bandwidth)



High Channel (6 dB Bandwidth)

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)

8.6 Test data for 802.11n_HT20

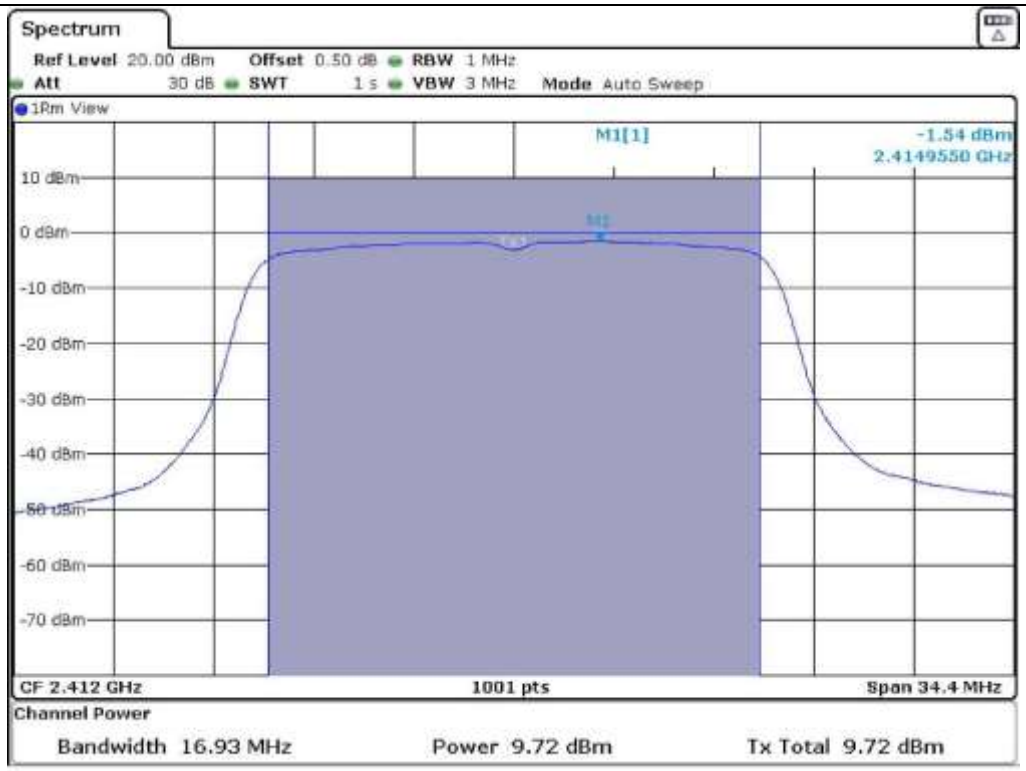
-. Test Date : September 07, 2015

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412	16.93	9.72	30.00	20.28
MIDDLE	2 442	16.93	9.49	30.00	20.51
HIGH	2 462	16.88	10.20	30.00	19.80

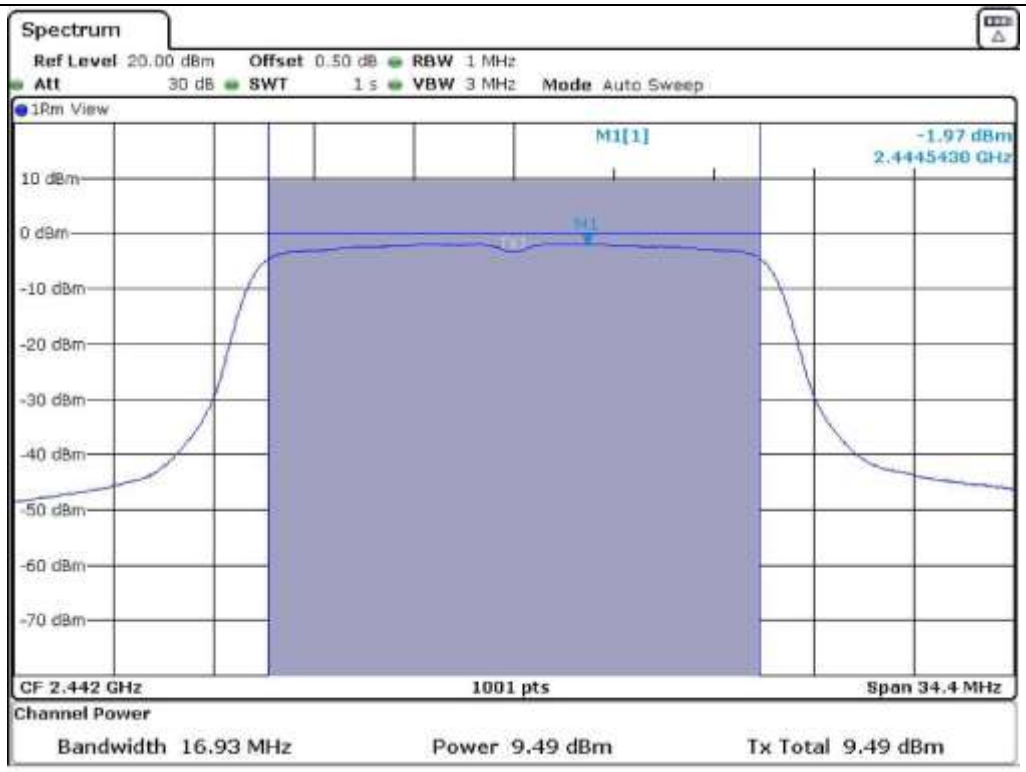
Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

Tested by: Hyung-Kwon, Oh / Engineer

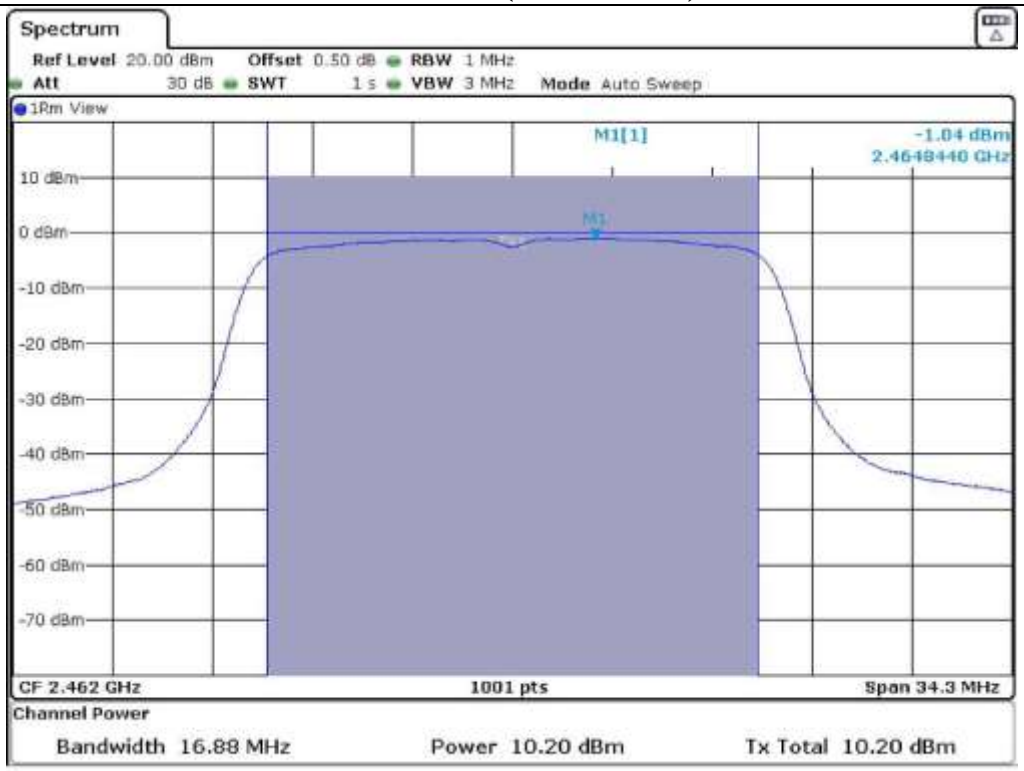


Low Channel (6 dB Bandwidth)

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)



Middle Channel (6 dB Bandwidth)



High Channel (6 dB Bandwidth)

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9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

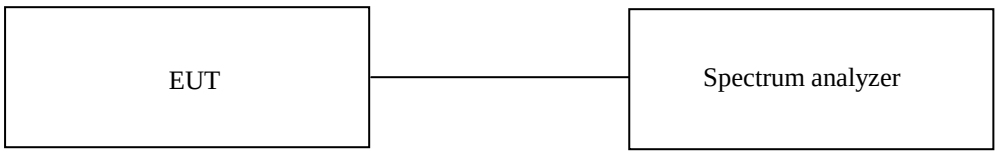
9.1 Operating environment

Temperature : 21.4 ℃

Relative humidity : 45.1 % 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 semi anechoic chamber. The EUT was placed on turntable approximately 1.5 m 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)
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jul. 22, 2015 (1Y)
■ -	ESU	Rohde & Schwarz	EMI Test Receiver	100261	Apr. 29, 2015 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Apr. 29, 2015 (1Y)
■ -	SCU-18	Rohde & Schwarz	Pre-Amplifier	10041	Nov. 25, 2014 (1Y)
■ -	DT3000	Innco System	Turn Table	930611	N/A
■ -	MA4000-EP	Innco System	Antenna Master	3320611	N/A
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-421	Jul. 10, 2014 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 31, 2015 (2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Apr. 30, 2015 (2Y)

All test equipment used is calibrated on a regular basis.

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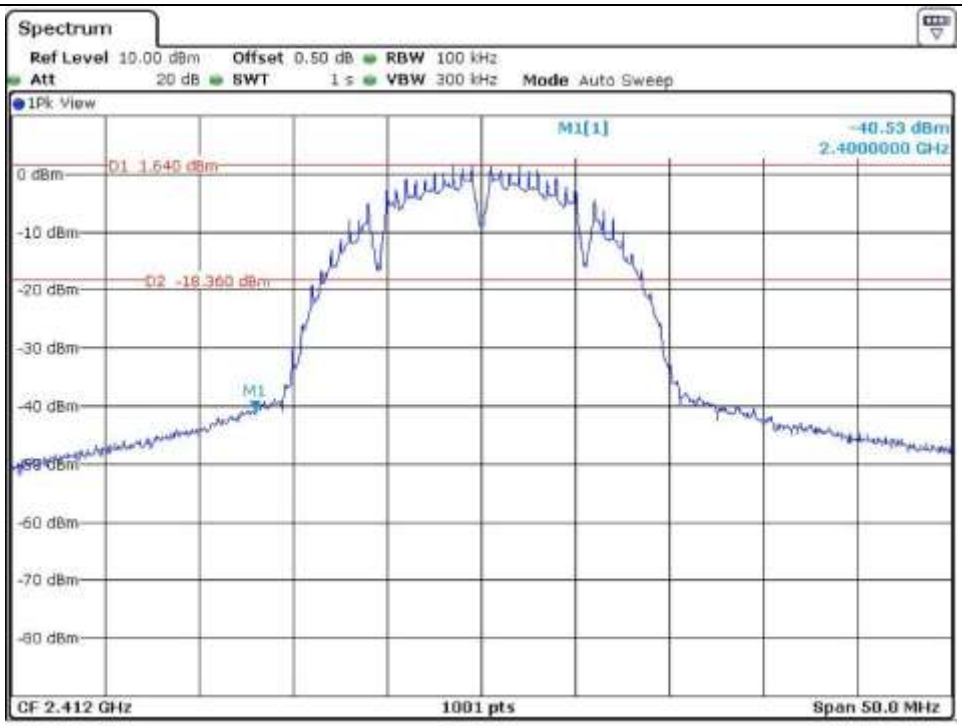
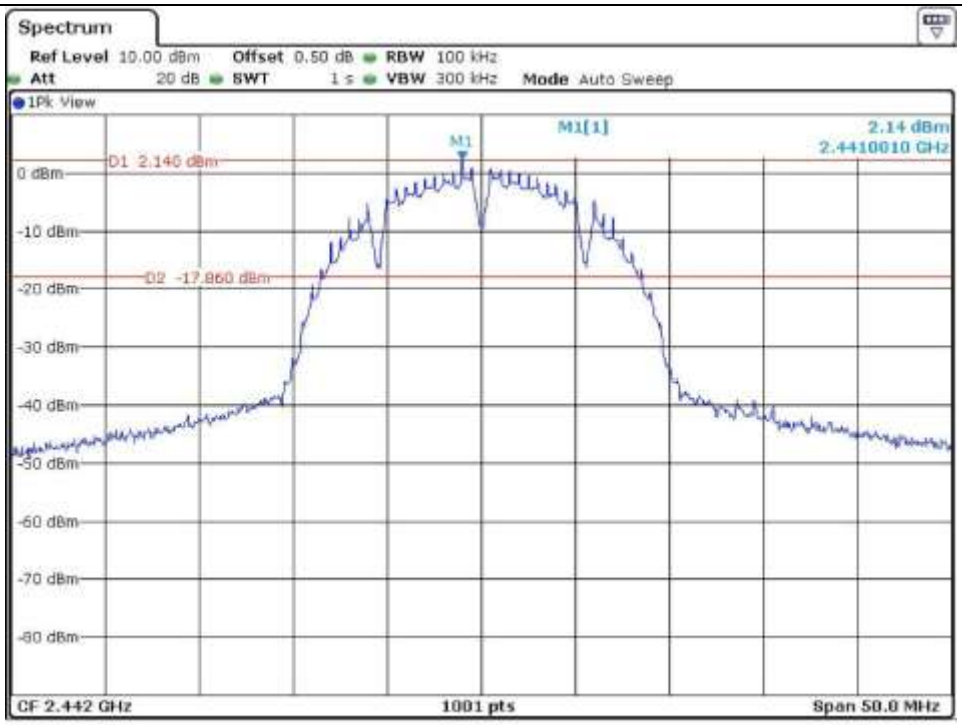
EMC Testing Div. : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

9.5 Test data for conducted emission

9.5.1 Test data for 802.11b



Low 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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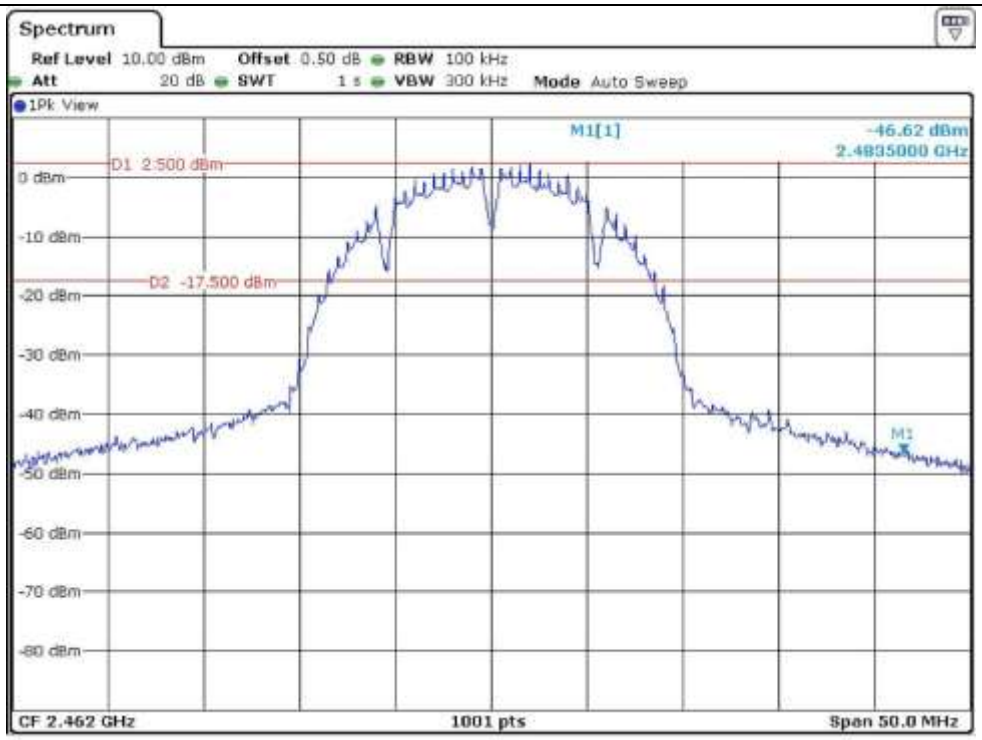
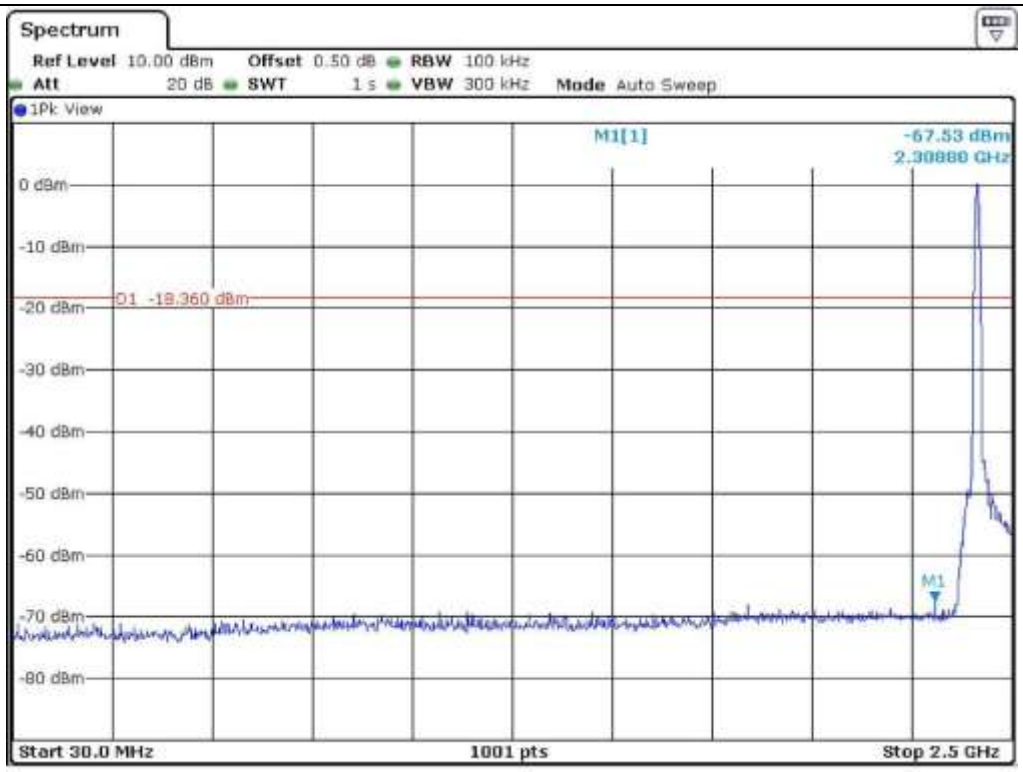
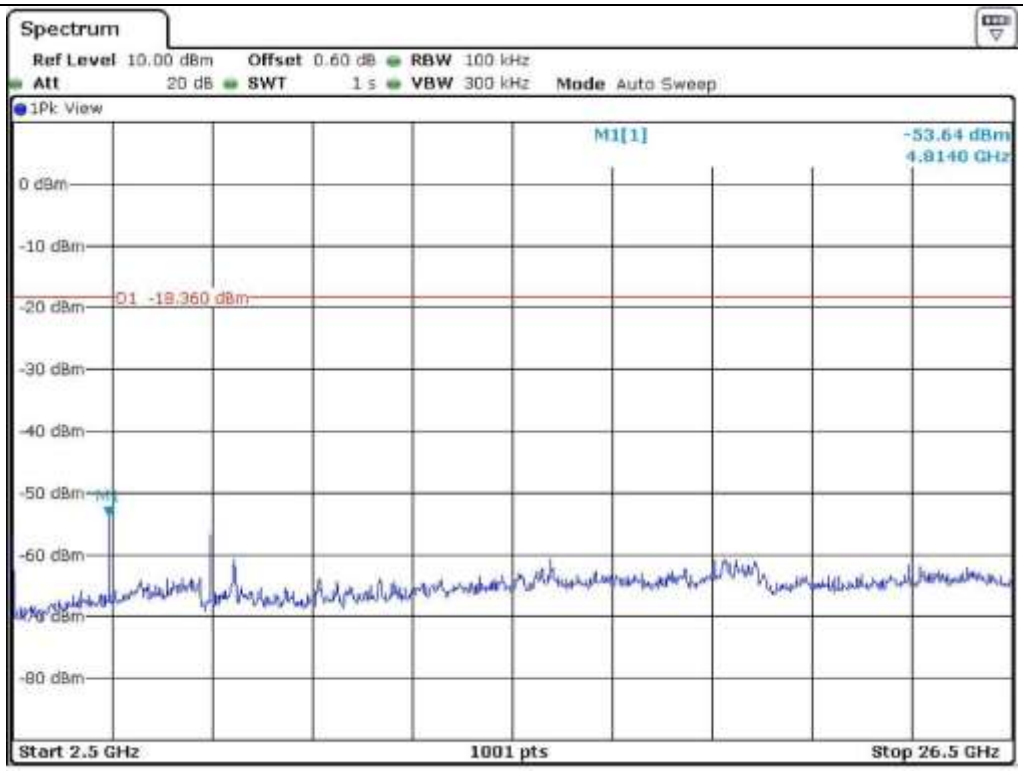


High Channel

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)

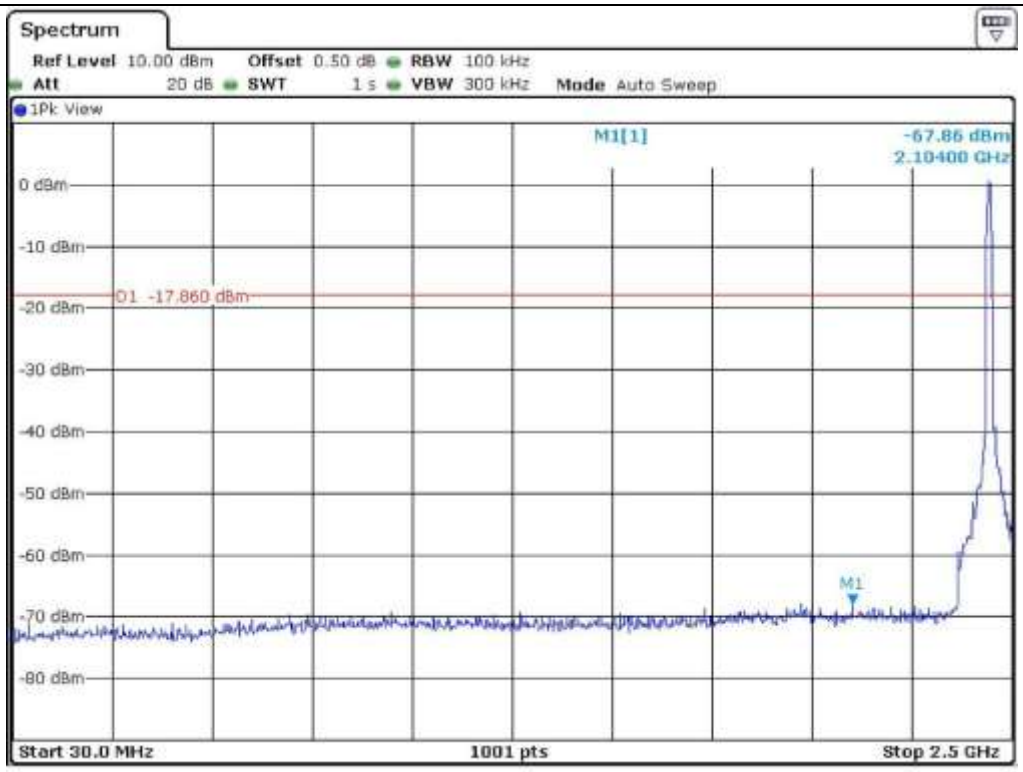


Low Channel

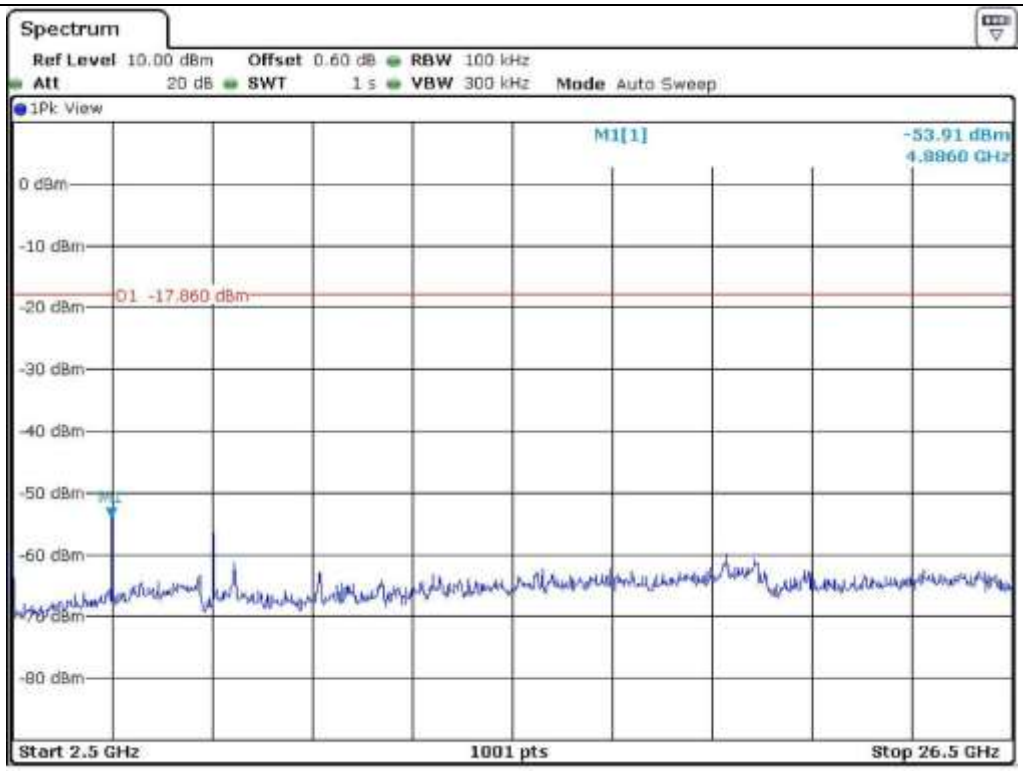


Low Channel

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)
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)

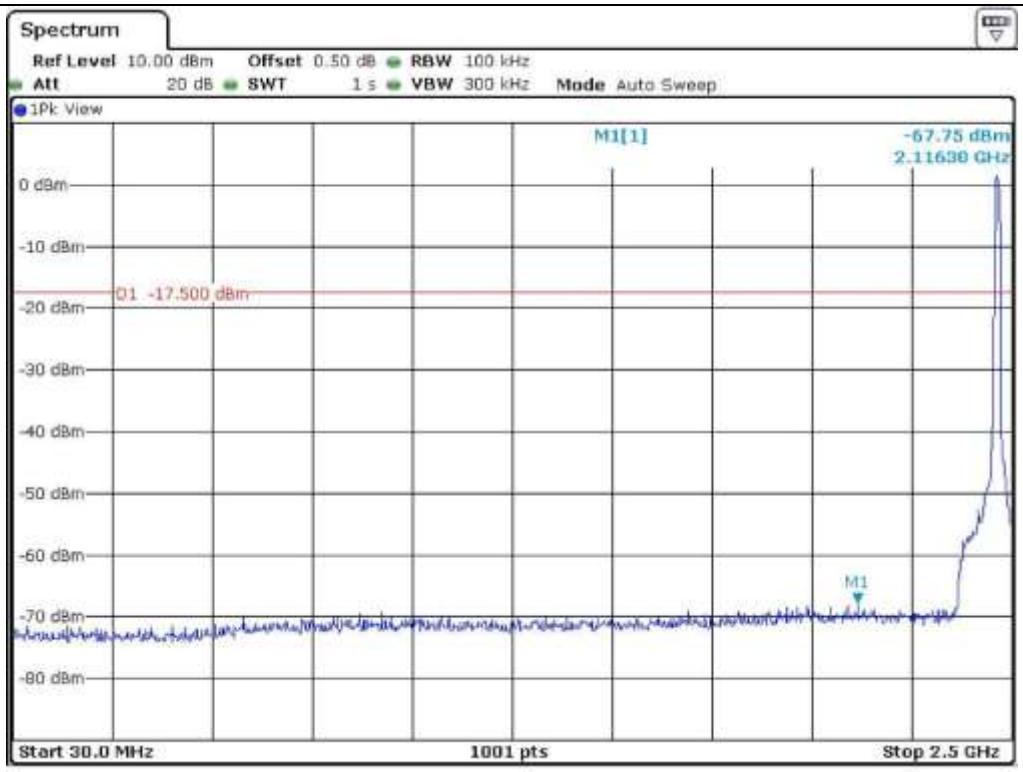


Middle Channel

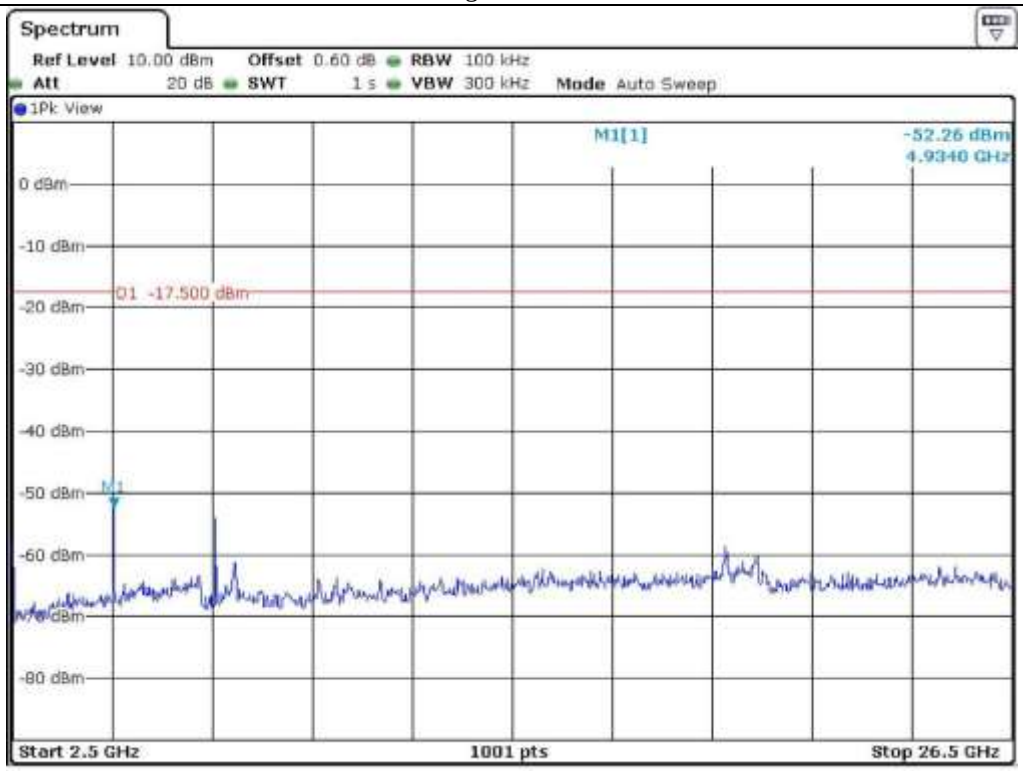


Middle Channel

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)
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)



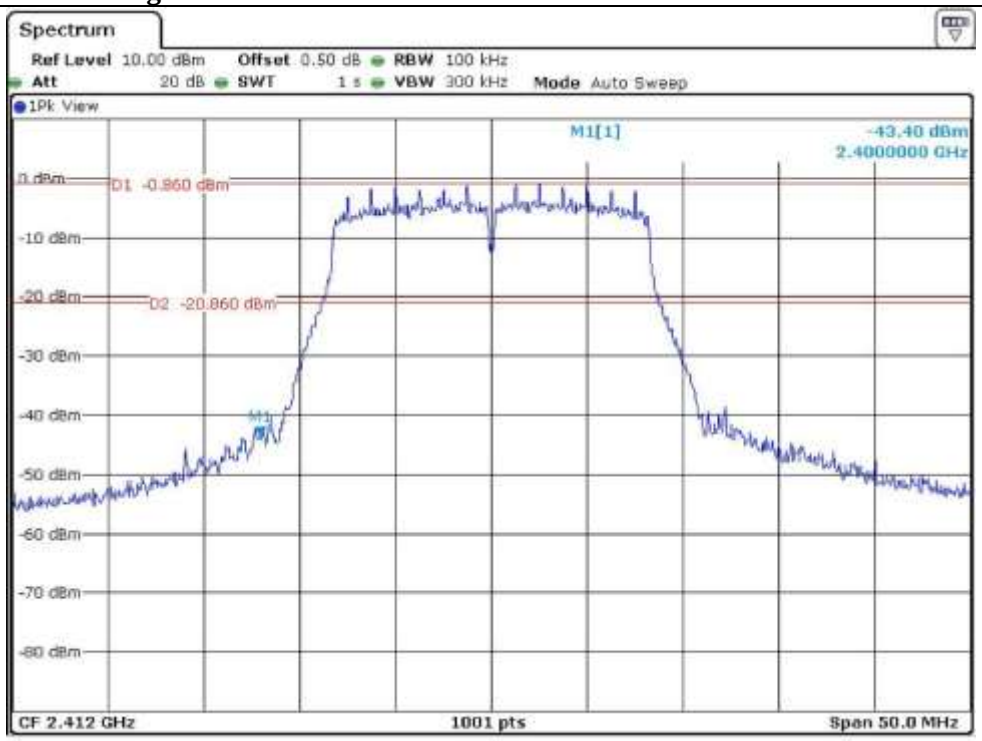
High Channel



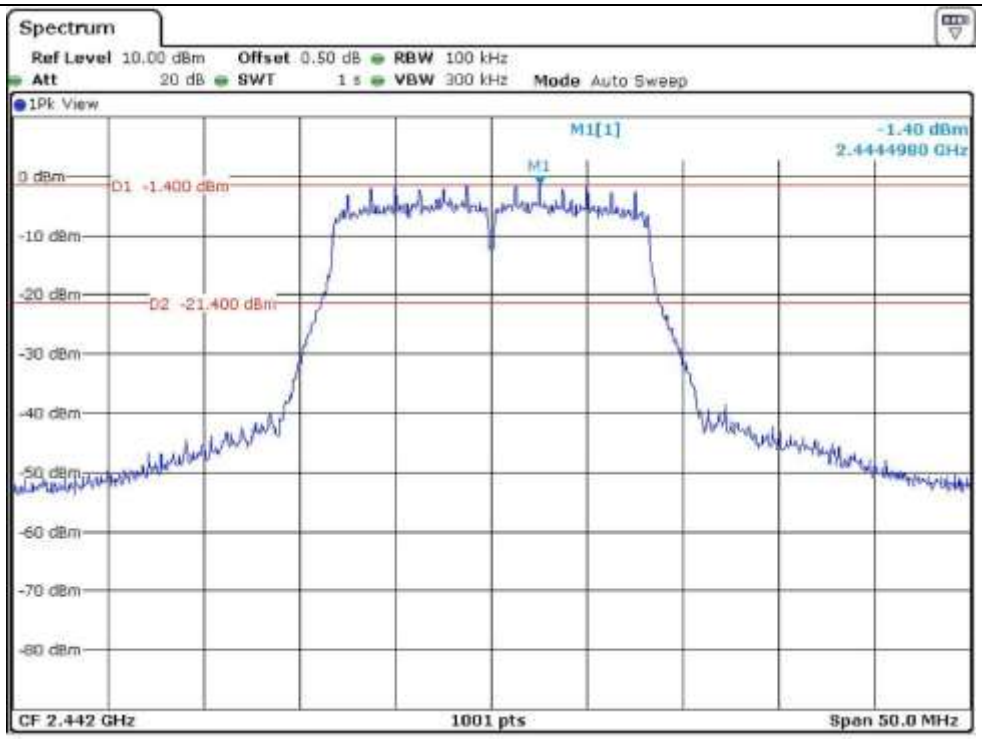
High Channel

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)
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)

9.5.2 Test data for 802.11g

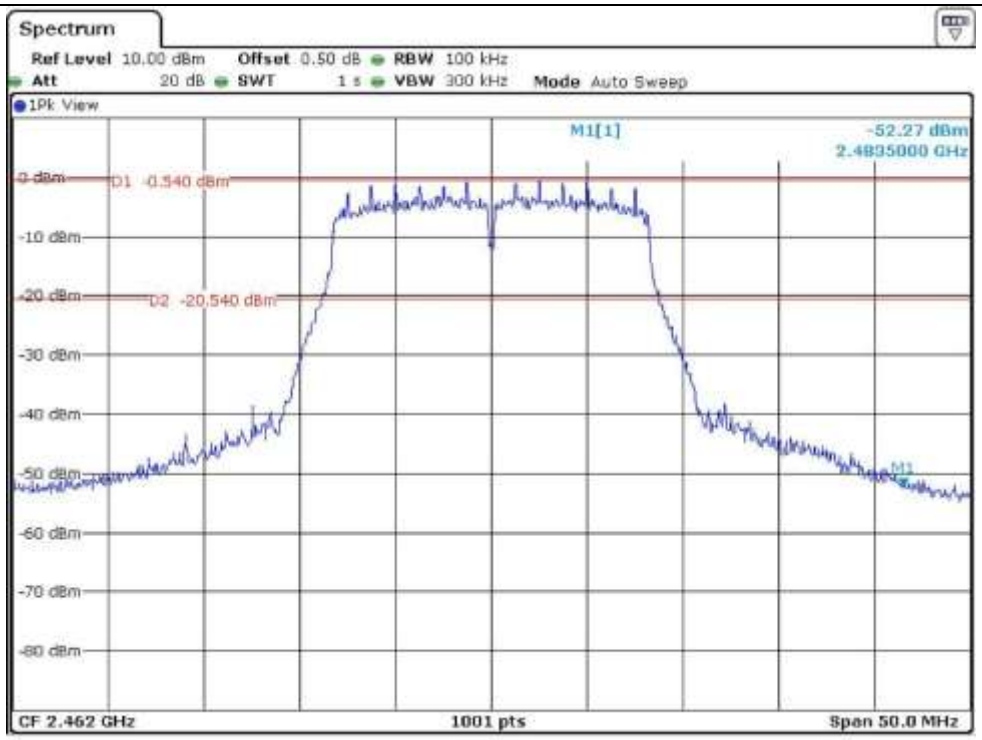


Low Channel



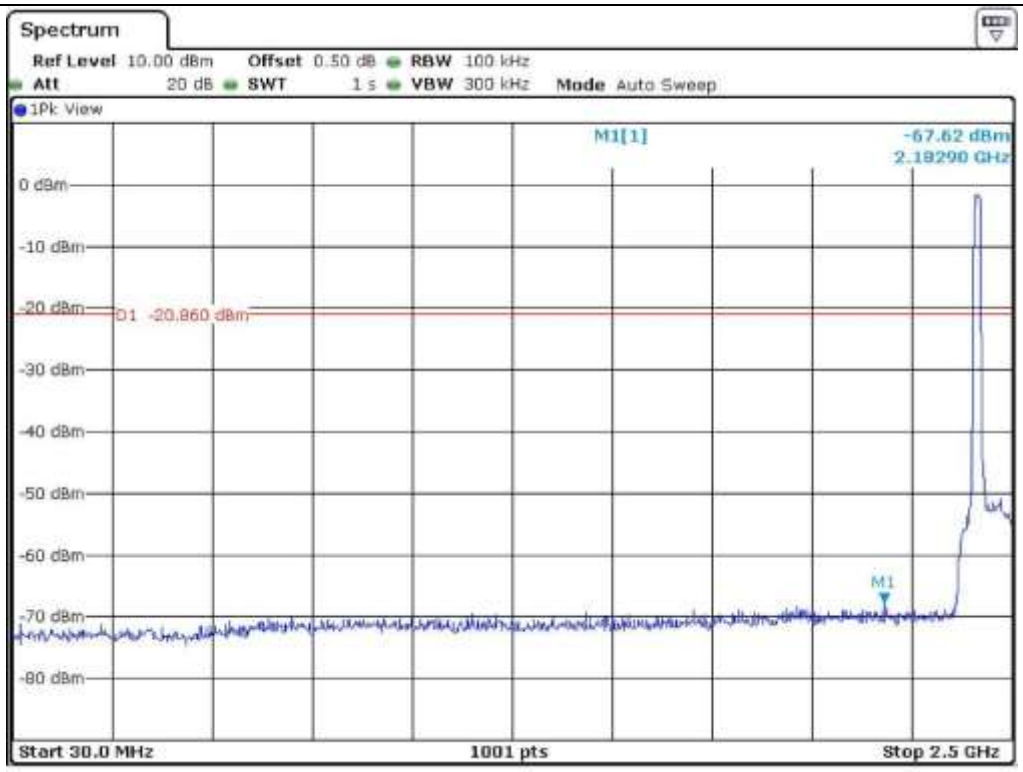
Middle Channel

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)
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)

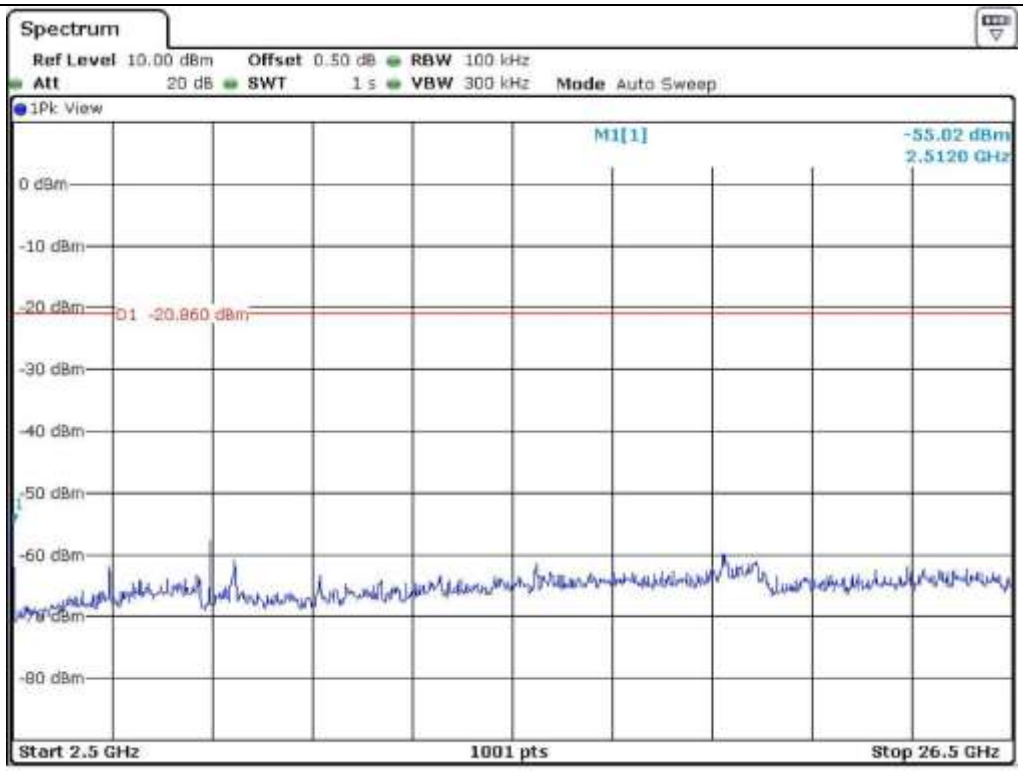


High Channel

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)
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)

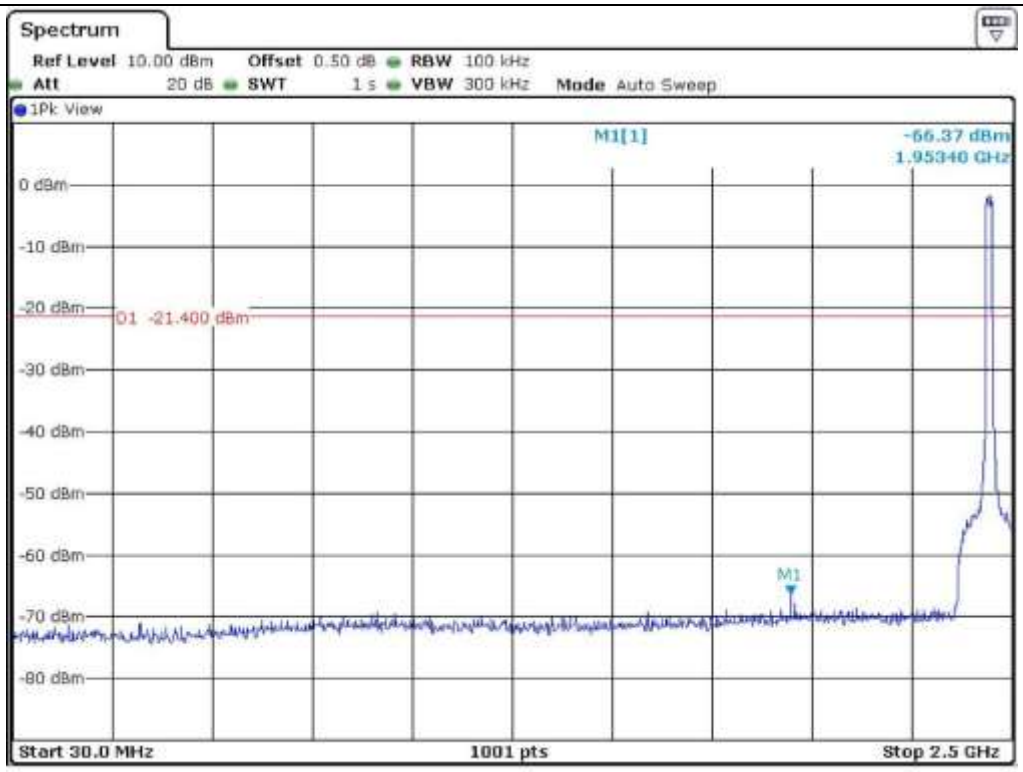


Low Channel

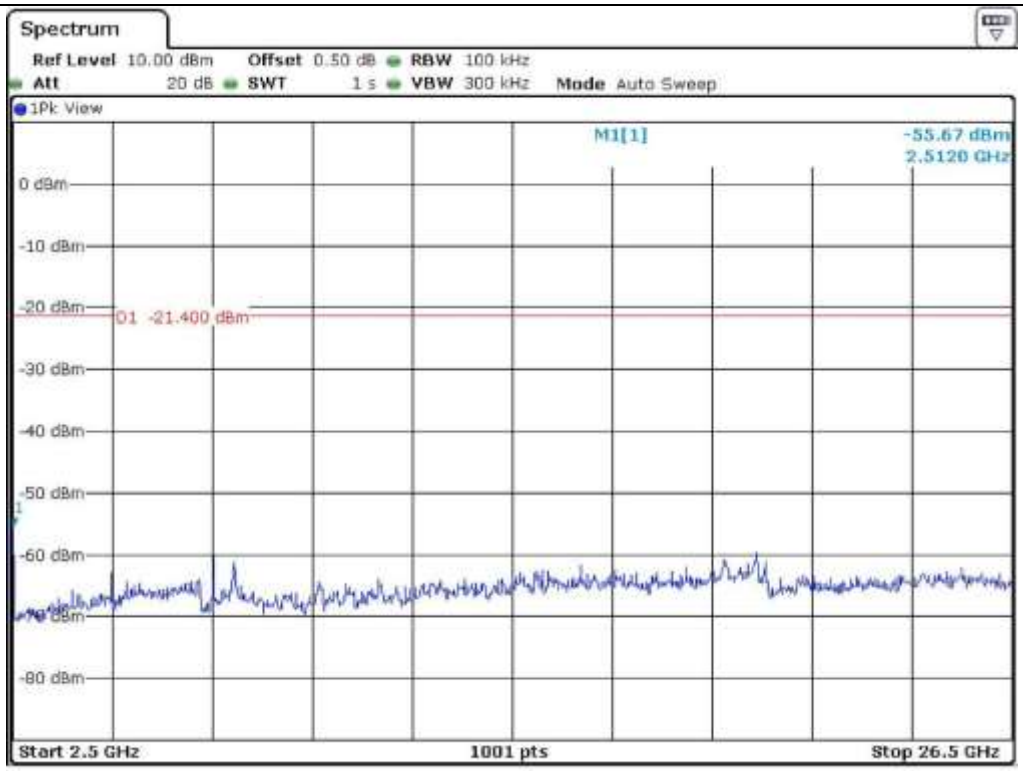


Low Channel

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)
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)

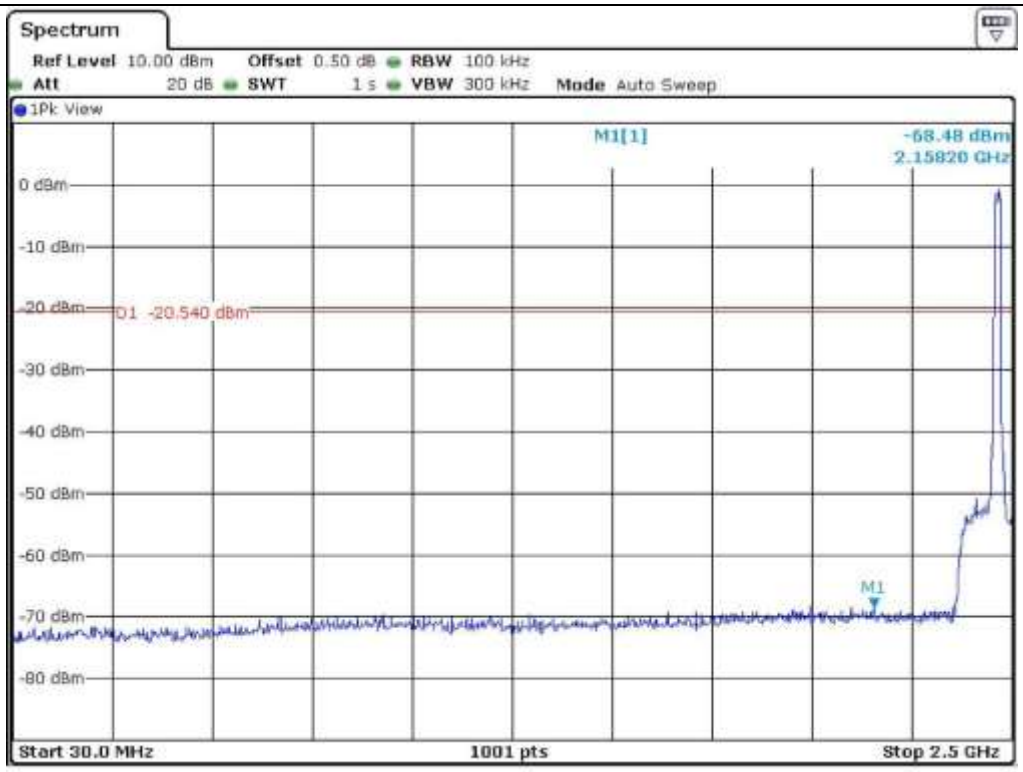


Middle Channel

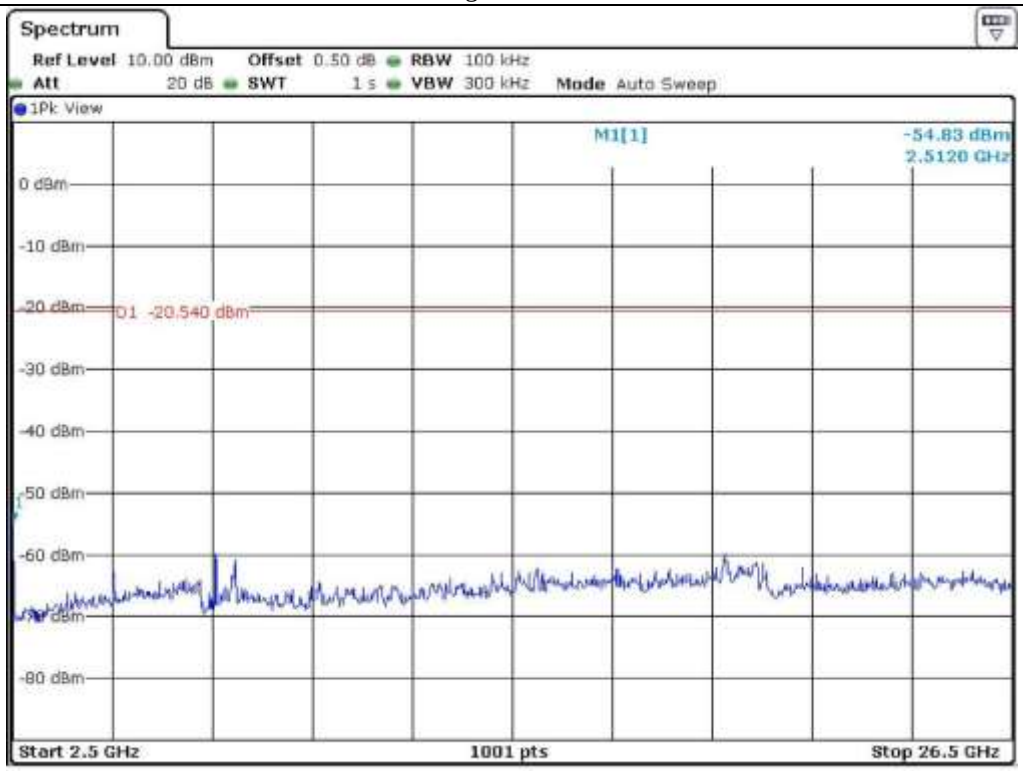


Middle Channel

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)
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)



High Channel



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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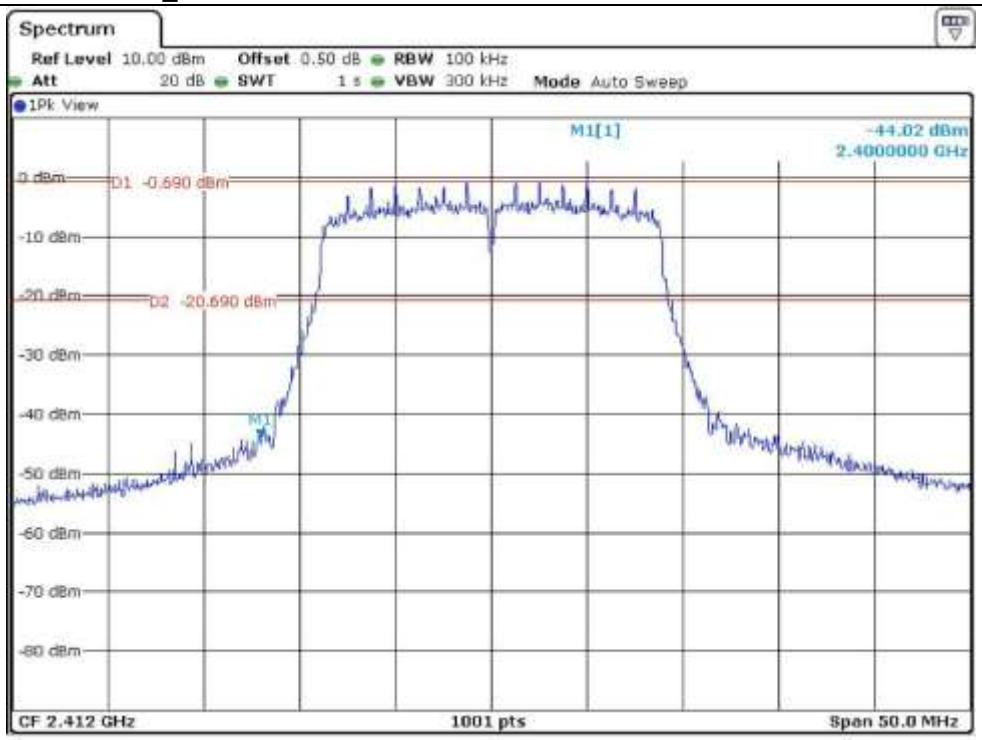
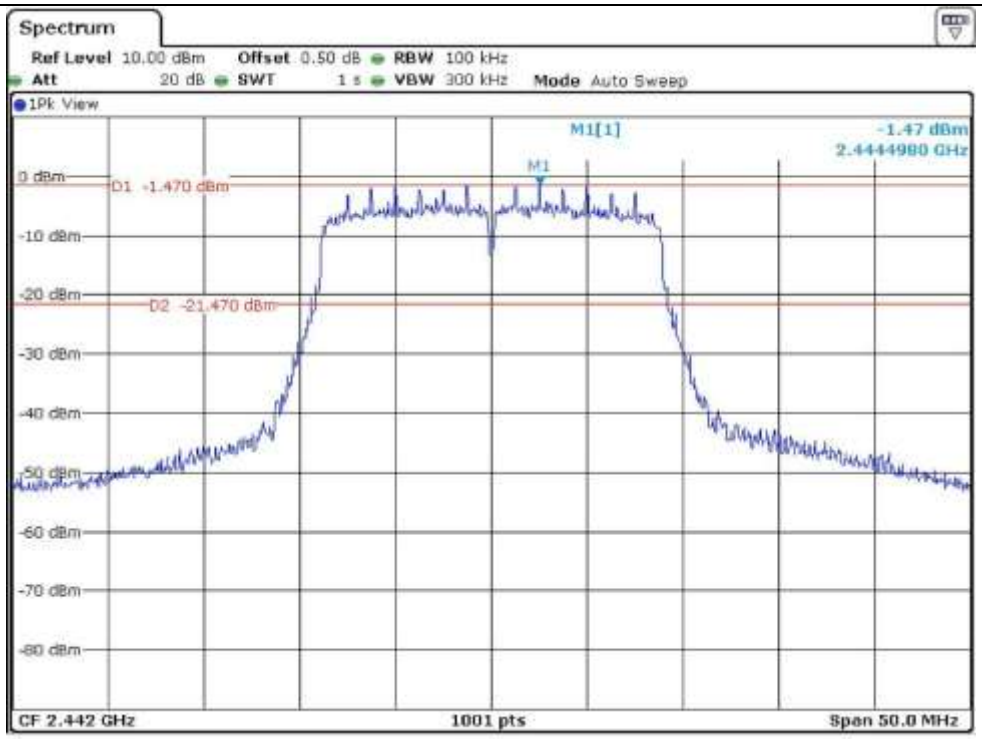
9.5.3 Test data for 802.11n_HT20



Low 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

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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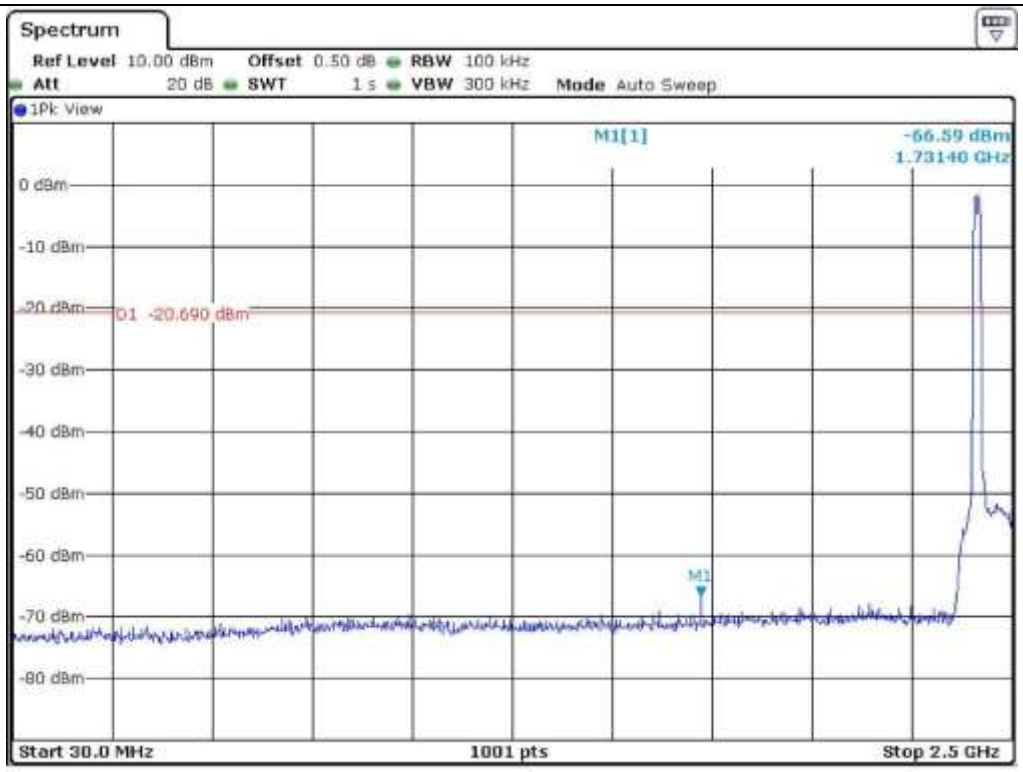
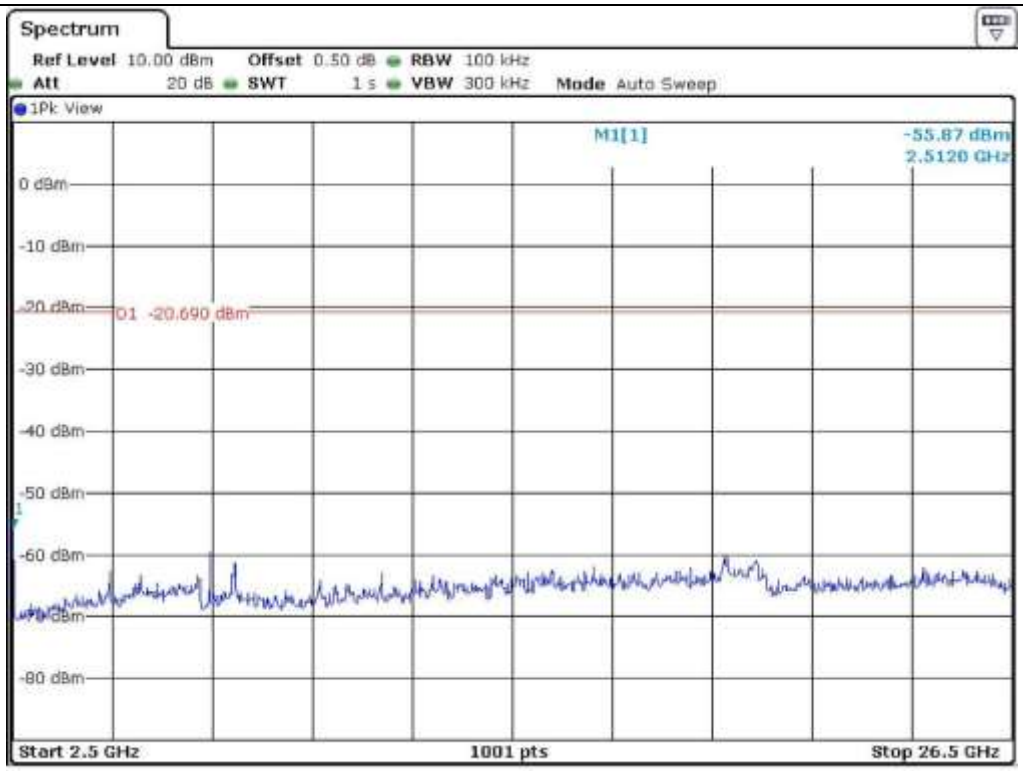


Low Channel



Low Channel

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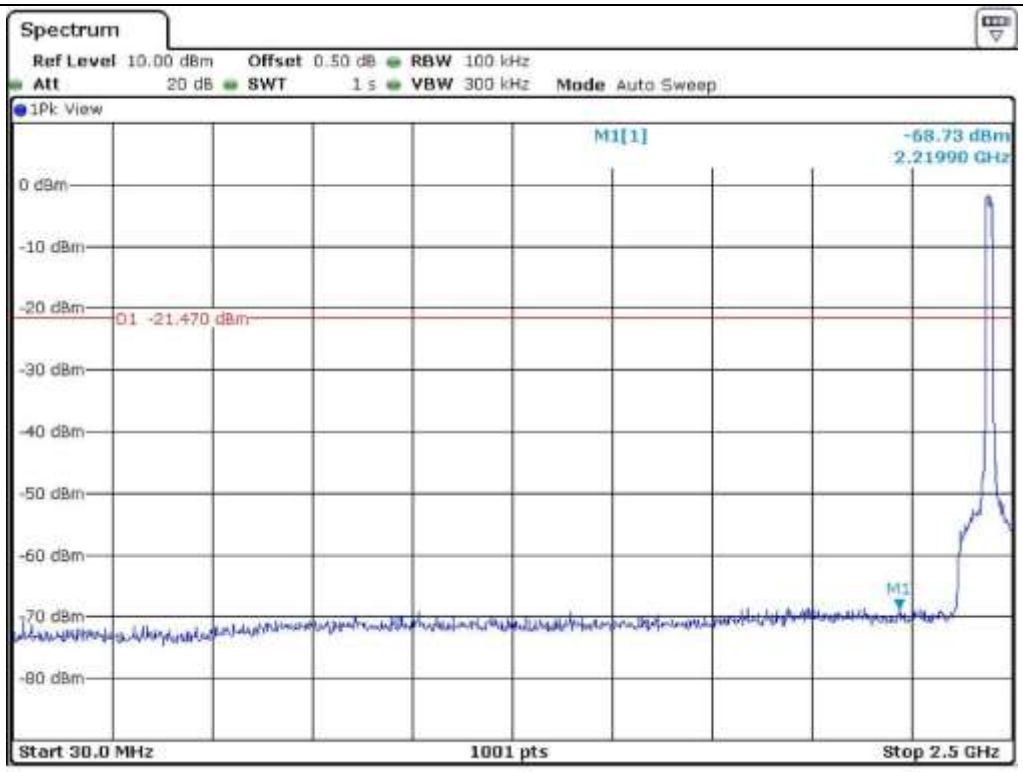

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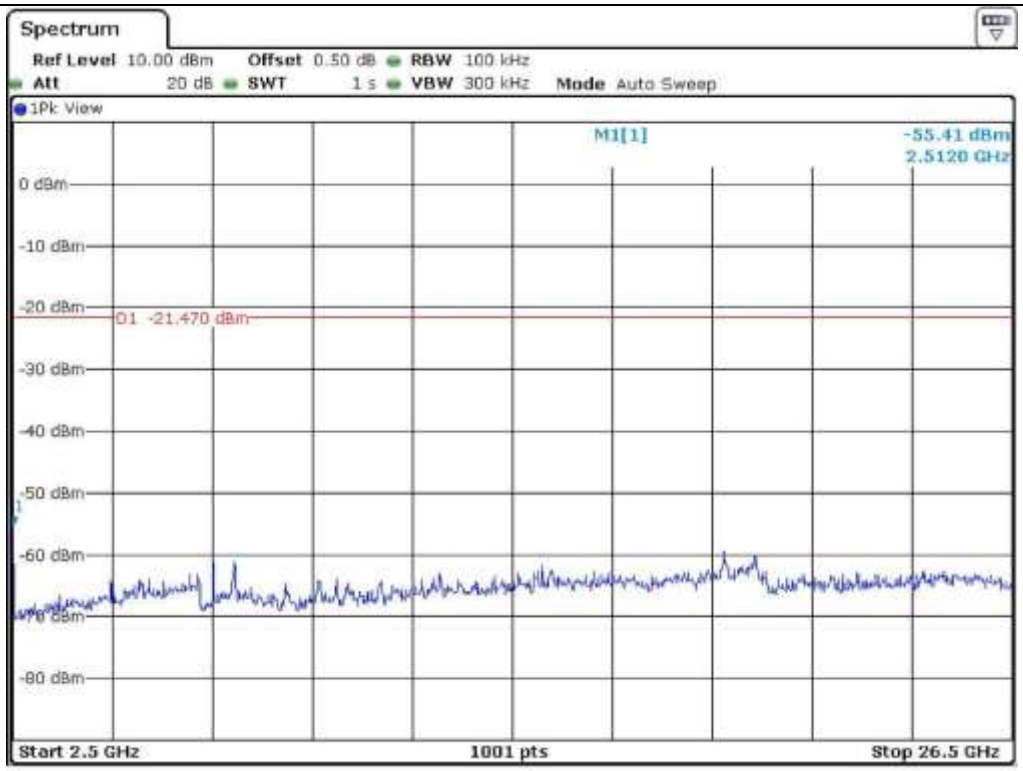

Middle Channel

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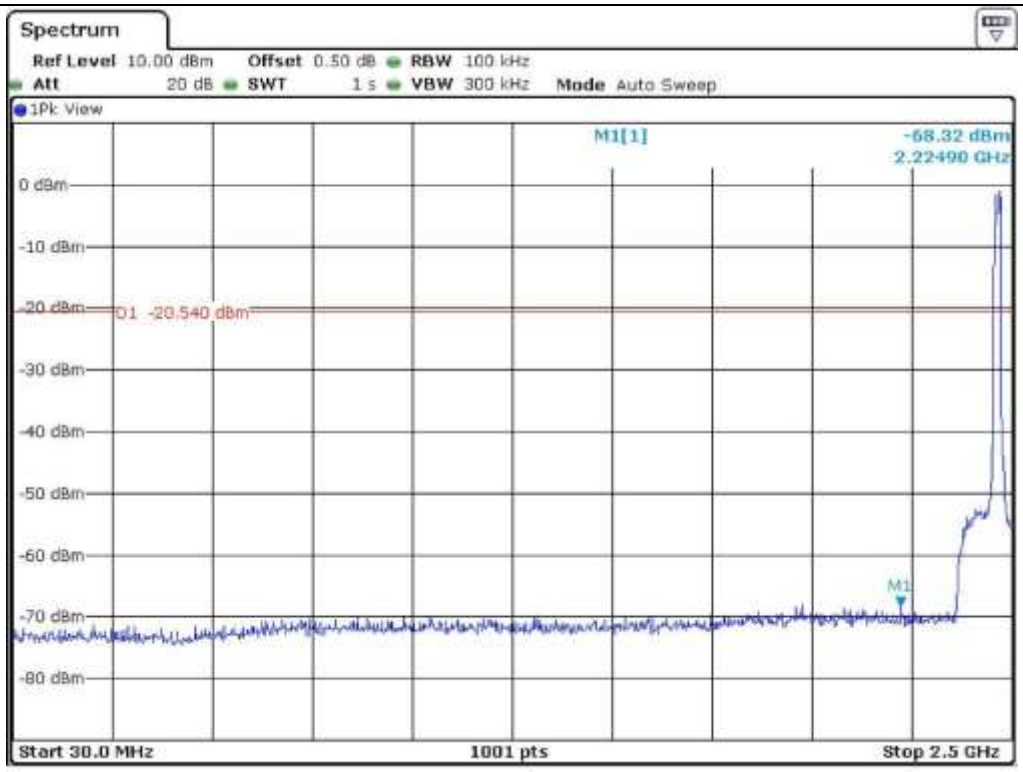
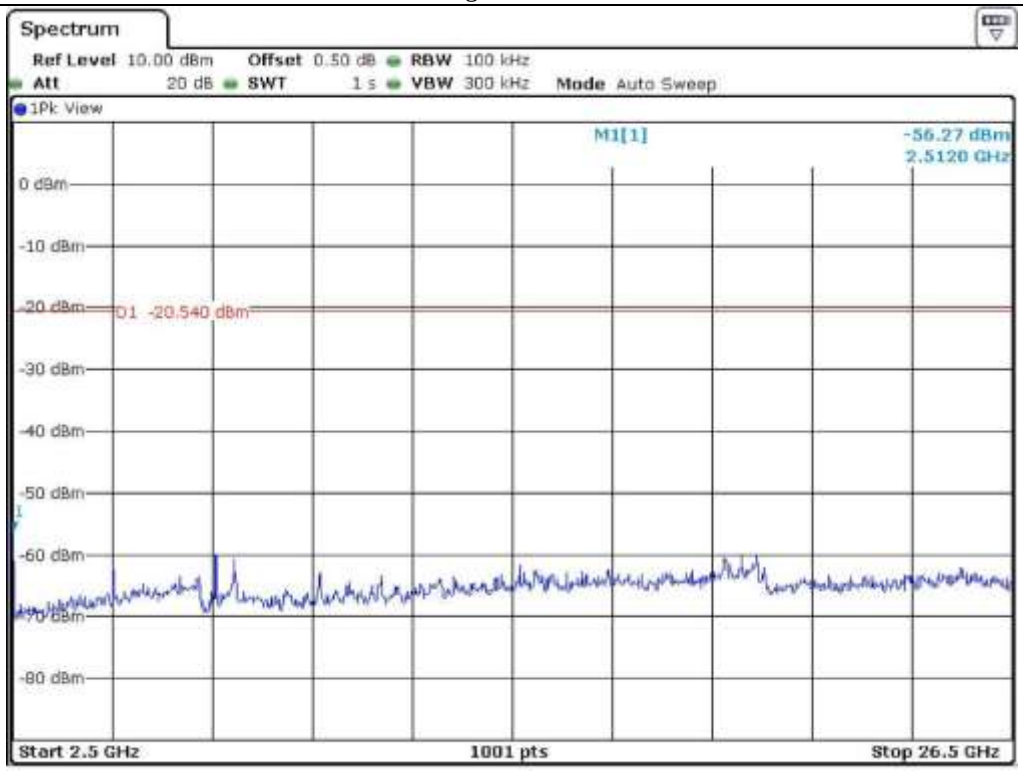


High Channel



High Channel

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9.6 Test data for radiated emission

9.6.1 Radiated Emission which fall in the Restricted Band

9.6.1.1 Test data for 802.11b

-. Test Date : September 09, 2015

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Frequency range : 30 MHz ~ 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									
2 390.00	58.81	Peak	H	27.10	7.50	43.00	50.41	74.00	23.59
	49.76	Average	H				41.36	54.00	12.64
	57.42	Peak	V				49.02	74.00	24.98
	46.88	Average	V				38.48	54.00	15.52
Test Data for Low Channel									
2 400.00	62.79	Peak	H	27.10	7.50	43.00	54.39	74.00	19.61
	52.01	Average	H				43.61	54.00	10.39
	62.84	Peak	V				54.44	74.00	19.56
	52.29	Average	V				43.89	54.00	10.11
Test Data for High Channel									
2 483.50	56.11	Peak	H	27.10	7.50	43.00	47.71	74.00	26.29
	48.25	Average	H				39.85	54.00	14.15
	56.17	Peak	V				47.77	74.00	26.23
	48.20	Average	V				39.80	54.00	14.20

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: Hyung-Kwon, Oh / 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)
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)

9.6.1.2 Test data for 802.11g

-. Test Date : September 09, 2015

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Frequency range : 30 MHz ~ 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									
2 390.00	59.18	Peak	H	27.10	7.50	43.00	50.78	74.00	23.22
	50.22	Average	H				41.82	54.00	12.18
	59.06	Peak	V				50.66	74.00	23.34
	50.37	Average	V				41.97	54.00	12.03
Test Data for Low Channel									
2 400.00	62.75	Peak	H	27.10	7.50	43.00	54.35	74.00	19.65
	52.13	Average	H				43.73	54.00	10.27
	62.77	Peak	V				54.37	74.00	19.63
	52.04	Average	V				43.64	54.00	10.36
Test Data for High Channel									
2 483.50	59.20	Peak	H	27.10	7.50	43.00	50.80	74.00	23.20
	50.37	Average	H				41.97	54.00	12.03
	59.16	Peak	V				50.76	74.00	23.24
	50.22	Average	V				41.82	54.00	12.18

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: Hyung-Kwon, Oh / 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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9.6.1.3 Test data for 802.11n_HT20

-. Test Date : September 09, 2015

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Frequency range : 30 MHz ~ 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									
2 390.00	58.69	Peak	H	27.10	7.50	43.00	50.29	74.00	23.71
	49.54	Average	H				41.14	54.00	12.86
	58.77	Peak	V				50.37	74.00	23.63
	49.42	Average	V				41.02	54.00	12.98
Test Data for Low Channel									
2 400.00	62.50	Peak	H	27.10	7.50	43.00	54.10	74.00	19.90
	52.37	Average	H				43.97	54.00	10.03
	62.66	Peak	V				54.26	74.00	19.74
	52.29	Average	V				43.89	54.00	10.11
Test Data for High Channel									
2 483.50	57.02	Peak	H	27.10	7.50	43.00	48.62	74.00	25.38
	48.86	Average	H				40.46	54.00	13.54
	57.05	Peak	V				48.65	74.00	25.35
	48.93	Average	V				40.53	54.00	13.47

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: Hyung-Kwon, Oh / 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

9.6.2.1 Test data for 802.11b

-. Test Date : September 09, 2015

-. 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									
4 824.00	45.17	Peak	H	30.60	11.10	42.50	44.37	74.00	29.63
	36.62	Average	H				35.82	54.00	18.18
	45.24	Peak	V				44.44	74.00	29.56
	36.58	Average	V				35.78	54.00	18.22
Test Data for Middle Channel									
4 884.00	45.33	Peak	H	30.70	11.20	42.50	44.73	74.00	29.27
	36.17	Average	H				35.57	54.00	18.43
	45.30	Peak	V				44.70	74.00	29.30
	36.35	Average	V				35.75	54.00	18.25
Test Data for High Channel									
4 924.00	45.29	Peak	H	30.80	11.30	42.50	44.89	74.00	29.11
	36.64	Average	H				36.24	54.00	17.76
	45.41	Peak	V				45.01	74.00	28.99
	36.58	Average	V				36.18	54.00	17.82

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: Hyung-Kwon, Oh / Engineer

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9.6.2.2 Test data for 802.11g

-. Test Date : September 09, 2015

-. 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									
4 824.00	44.81	Peak	H	30.60	11.10	42.50	44.01	74.00	29.99
	36.29	Average	H				35.49	54.00	18.51
	44.90	Peak	V				44.10	74.00	29.90
	36.17	Average	V				35.37	54.00	18.63
Test Data for Middle Channel									
4 884.00	45.03	Peak	H	30.70	11.20	42.50	44.43	74.00	29.57
	36.30	Average	H				35.70	54.00	18.30
	44.87	Peak	V				44.27	74.00	29.73
	36.21	Average	V				35.61	54.00	18.39
Test Data for High Channel									
4 924.00	44.85	Peak	H	30.80	11.30	42.50	44.45	74.00	29.55
	36.59	Average	H				36.19	54.00	17.81
	44.87	Peak	V				44.47	74.00	29.53
	36.38	Average	V				35.98	54.00	18.02

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: Hyung-Kwon, Oh / Engineer

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9.6.2.3 Test data for 802.11n_HT20

-. Test Date : September 09, 2015

-. 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									
4 824.00	45.24	Peak	H	30.60	11.10	42.50	44.44	74.00	29.56
	36.70	Average	H				35.90	54.00	18.10
	45.29	Peak	V				44.49	74.00	29.51
	36.59	Average	V				35.79	54.00	18.21
Test Data for Middle Channel									
4 884.00	45.89	Peak	H	30.70	11.20	42.50	45.29	74.00	28.71
	36.21	Average	H				35.61	54.00	18.39
	45.81	Peak	V				45.21	74.00	28.79
	36.07	Average	V				35.47	54.00	18.53
Test Data for High Channel									
4 924.00	46.01	Peak	H	30.80	11.30	42.50	45.61	74.00	28.39
	37.29	Average	H				36.89	54.00	17.11
	45.87	Peak	V				45.47	74.00	28.53
	37.36	Average	V				36.96	54.00	17.04

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: Hyung-Kwon, Oh / Engineer

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10. PEAK POWER SPECTRUL DENSITY

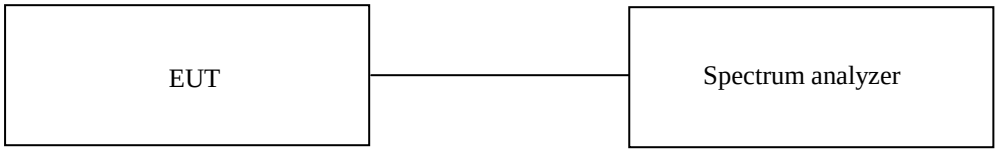
10.1 Operating environment

Temperature : 21.4 ℃

Relative humidity : 45.1 % R.H.

10.2 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.



10.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jul. 22, 2015 (1Y)

All test equipment used is calibrated on a regular basis.

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10.4 Test data for 802.11b

-. Test Date : September 08, 2015

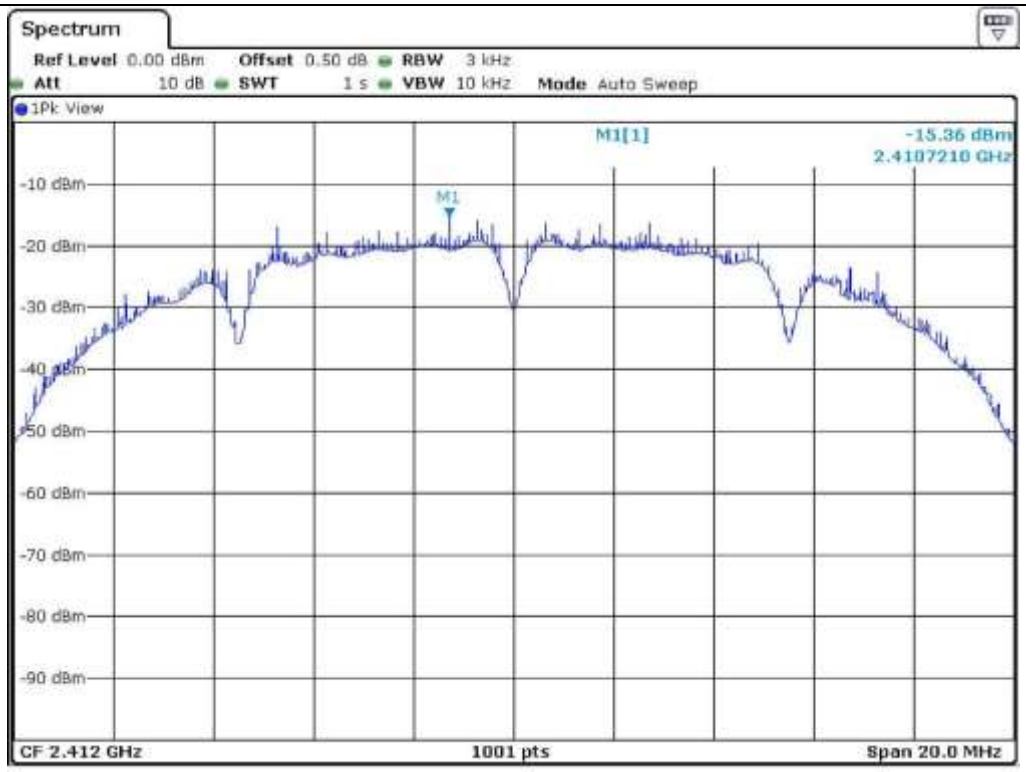
-. Test Result : Pass

-. Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412	-15.36	8.00	23.36
Middle	2 442	-14.99	8.00	22.99
High	2 462	-14.85	8.00	22.85

Remark. Margin = Limit – Measured value

Tested by: Hyung-Kwon, Oh / Engineer



Low Channel

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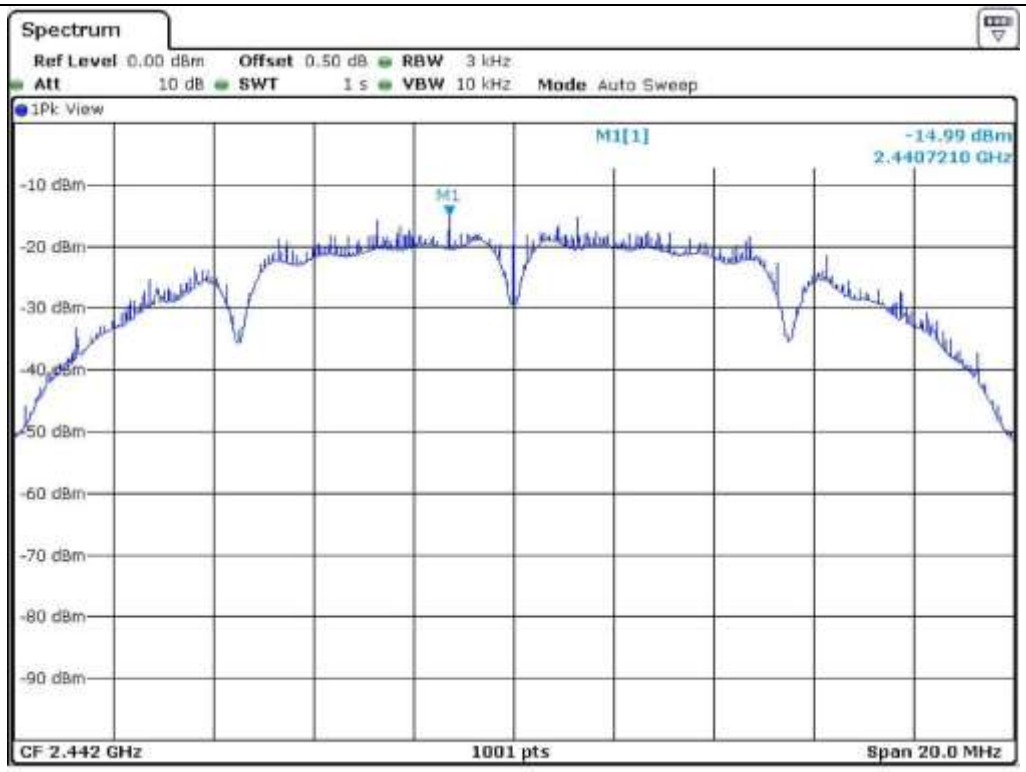
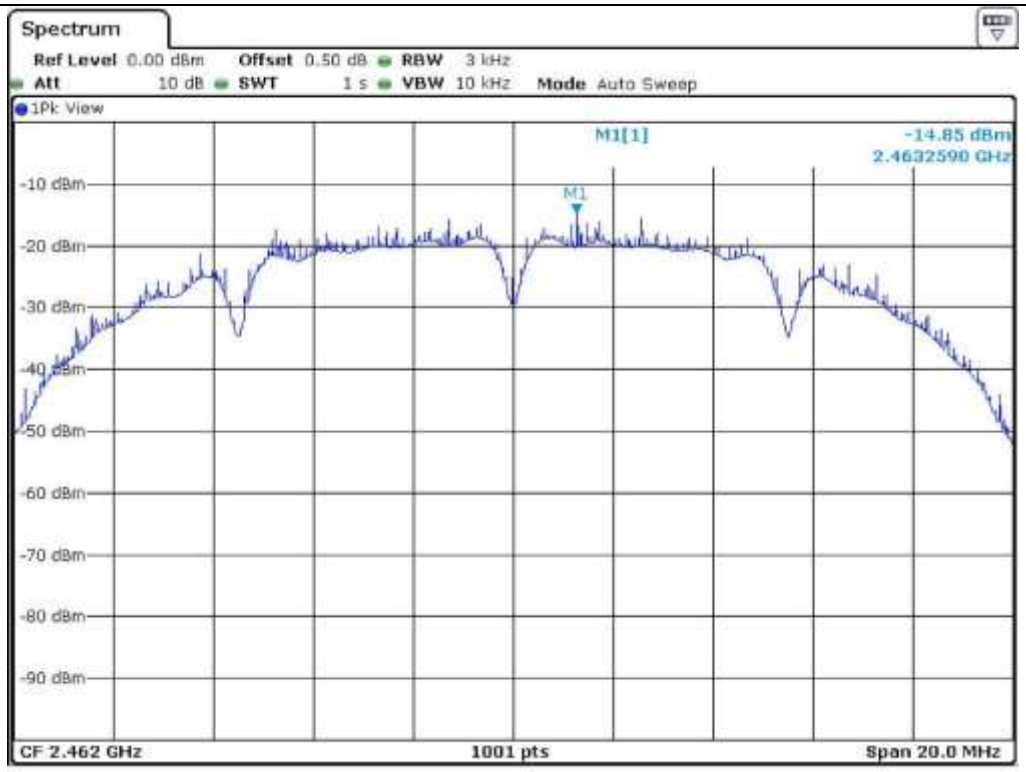


Middle Channel



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)

10.5 Test data for 802.11g

-. Test Date : September 08, 2015

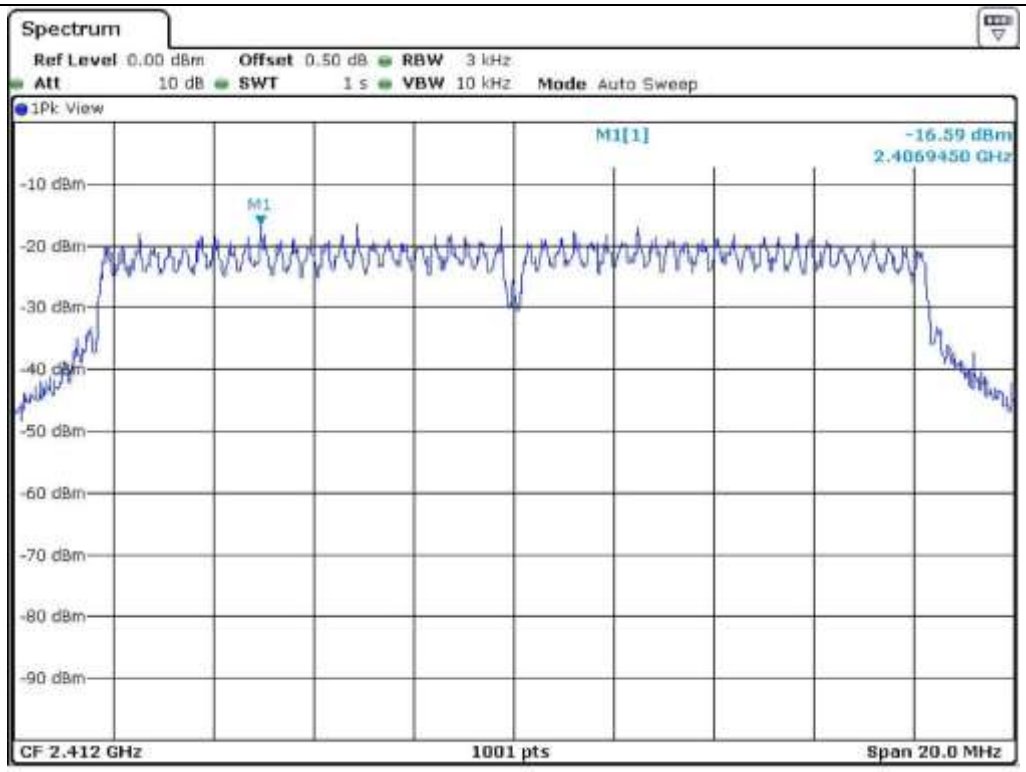
-. Test Result : Pass

-. Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412	-16.59	8.00	24.59
Middle	2 442	-18.06	8.00	26.06
High	2 462	-15.68	8.00	23.68

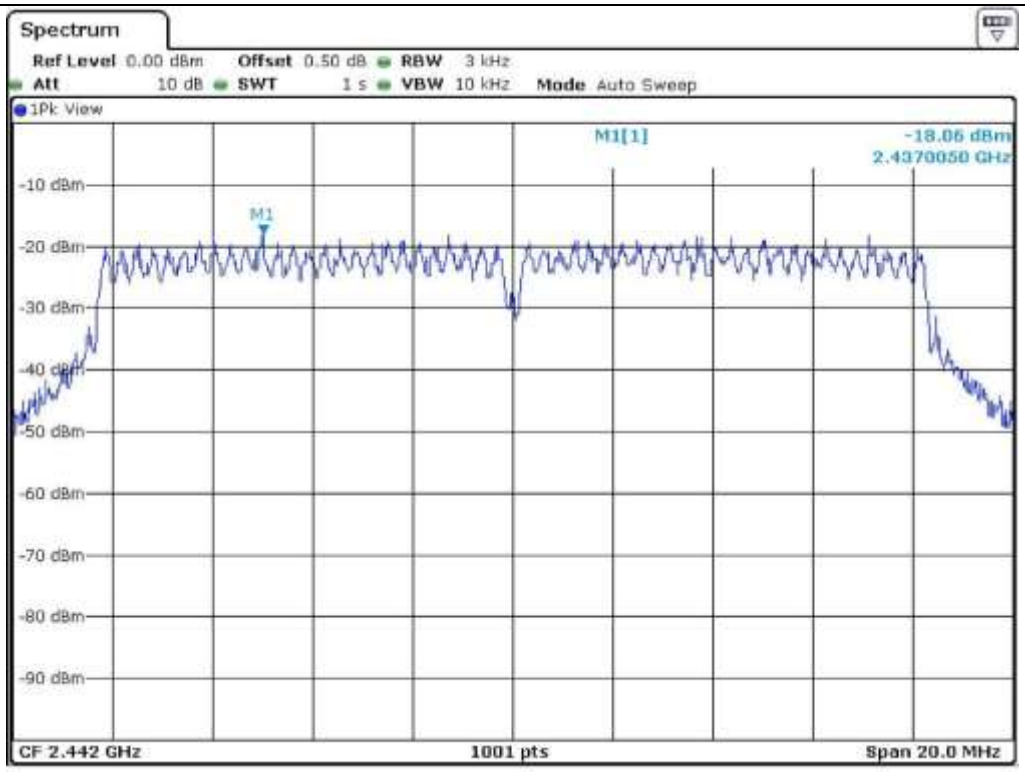
Remark. Margin = Limit – Measured value

Tested by: Hyung-Kwon, Oh / Engineer

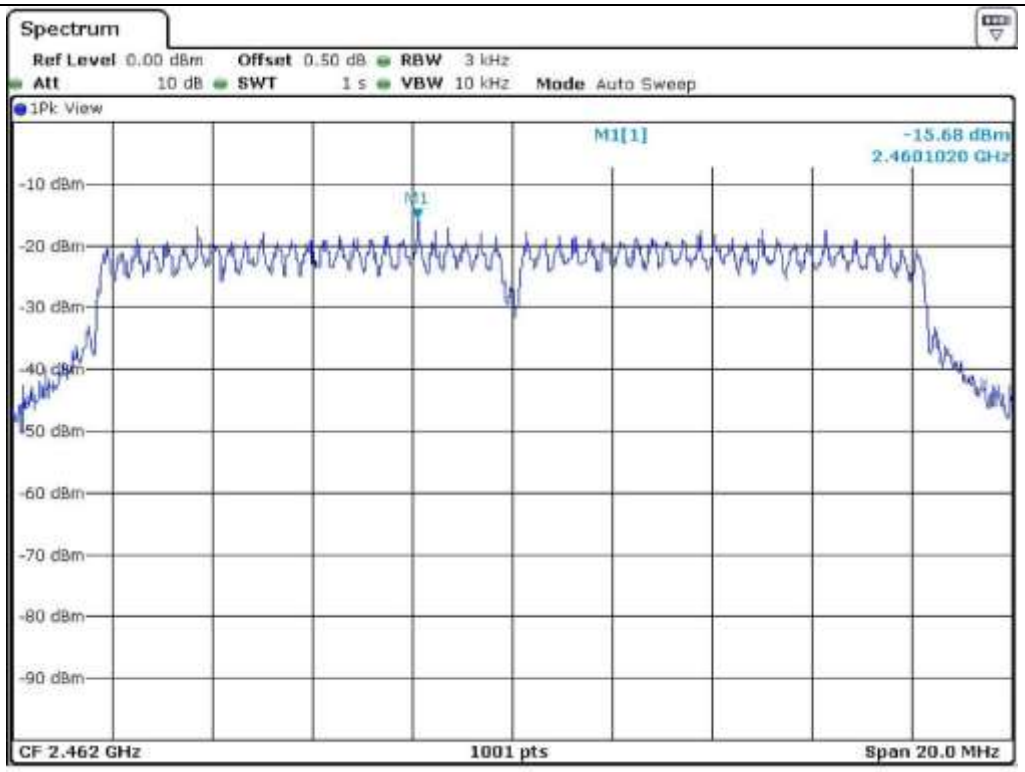


Low Channel

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)
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)



Middle Channel



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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10.6 Test data for 802.11n_HT20

-. Test Date : September 08, 2015

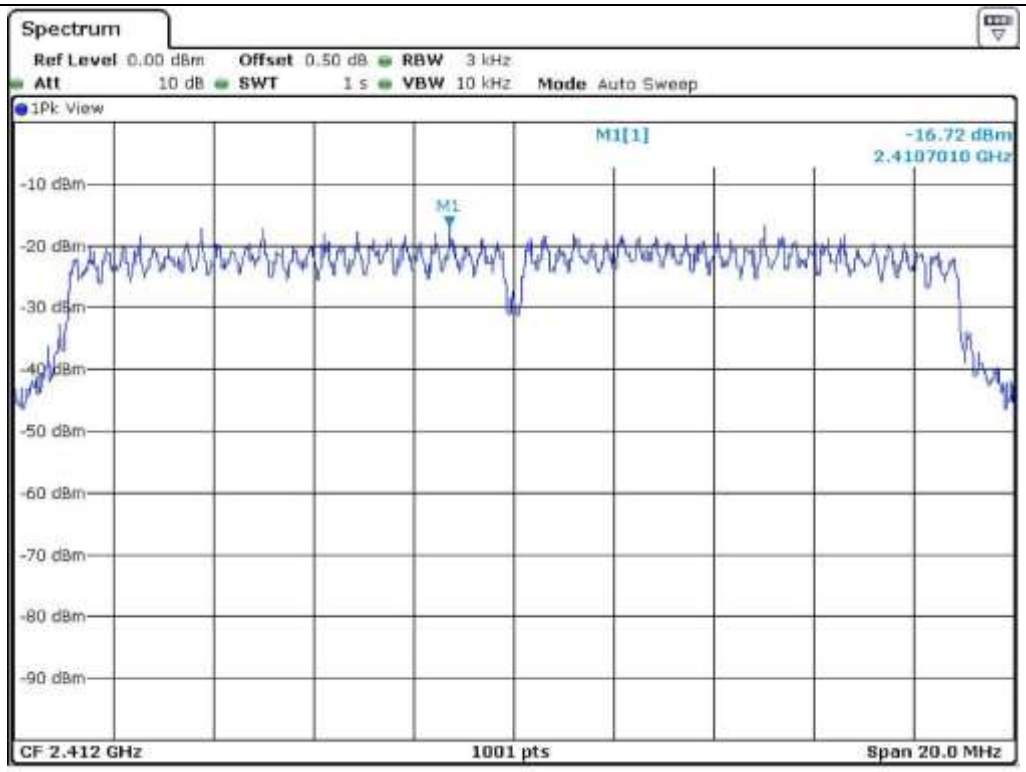
-. Test Result : Pass

-. Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412	-16.72	8.00	24.72
Middle	2 442	-17.19	8.00	25.19
High	2 462	-16.53	8.00	24.53

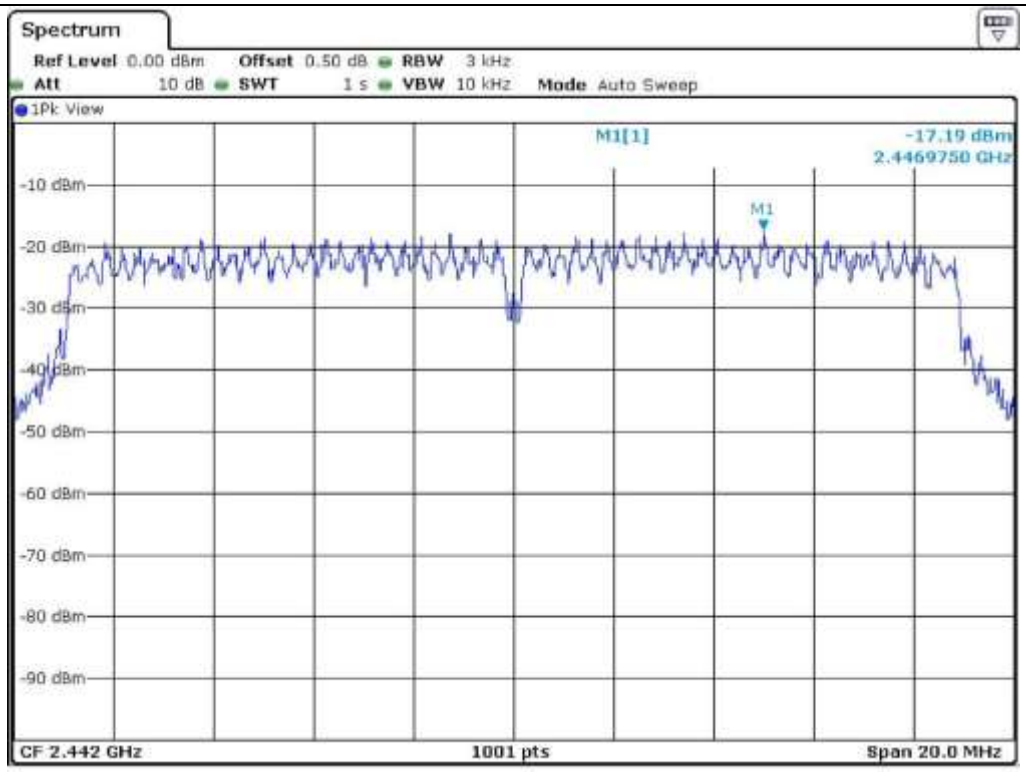
Remark. Margin = Limit – Measured value

Tested by: Hyung-Kwon, Oh / Engineer

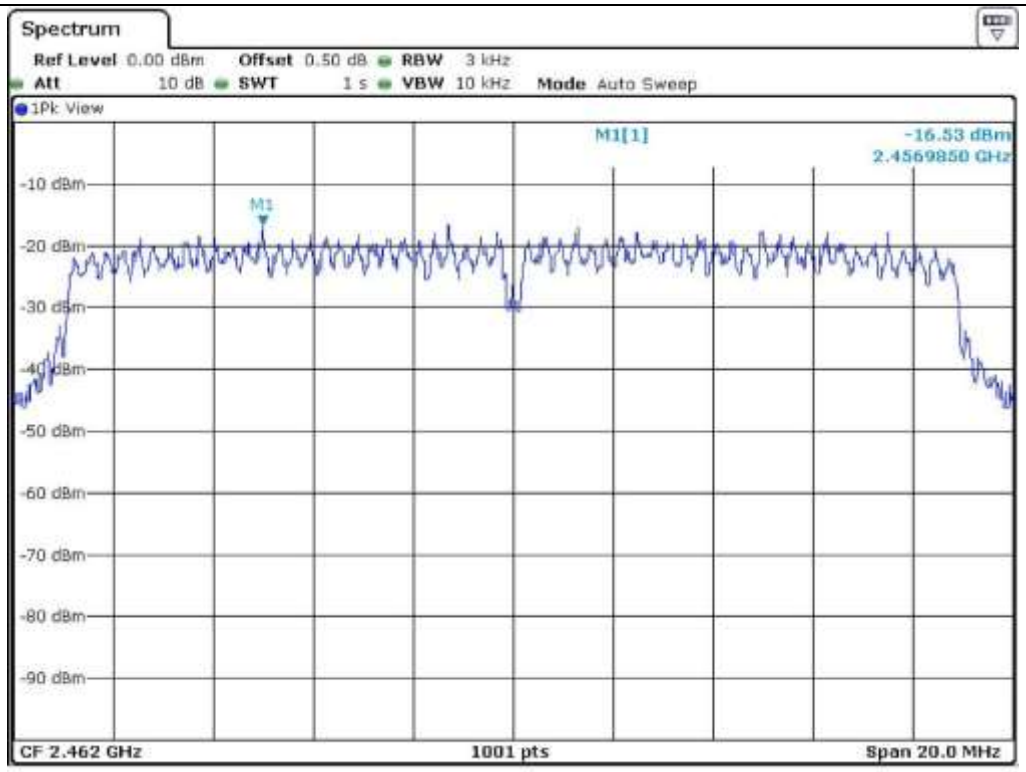


Low Channel

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)
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)



Middle Channel



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)
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)

11. RADIATED EMISSION TEST

11.1 Operating environment

Temperature : 21.4 ℃

Relative humidity : 45.1 % R.H.

11.2 Test set-up

The radiated emissions measurements were on the 3 m semi anechoic chamber. 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.

11.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jul. 22, 2015 (1Y)
■ -	ESCI	Rohde & Schwarz	Test Receiver	101012	Nov. 03, 2014 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Apr. 29, 2015 (1Y)
■ -	SCU-18	Rohde & Schwarz	Pre-Amplifier	10041	Nov. 25, 2014 (1Y)
■ -	DT3000	Innco System	Turn Table	930611	N/A
■ -	MA4000-EP	Innco System	Antenna Master	3320611	N/A
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-421	Jul. 10, 2014 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 31, 2015 (2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Apr. 30, 2015 (2Y)

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)

11.4 Test data for 802.11b

11.4.1 Test data for 30 MHz ~ 1 000 MHz

Humidity Level : 45.1 % R.H. Temperature: 21.4 ℃

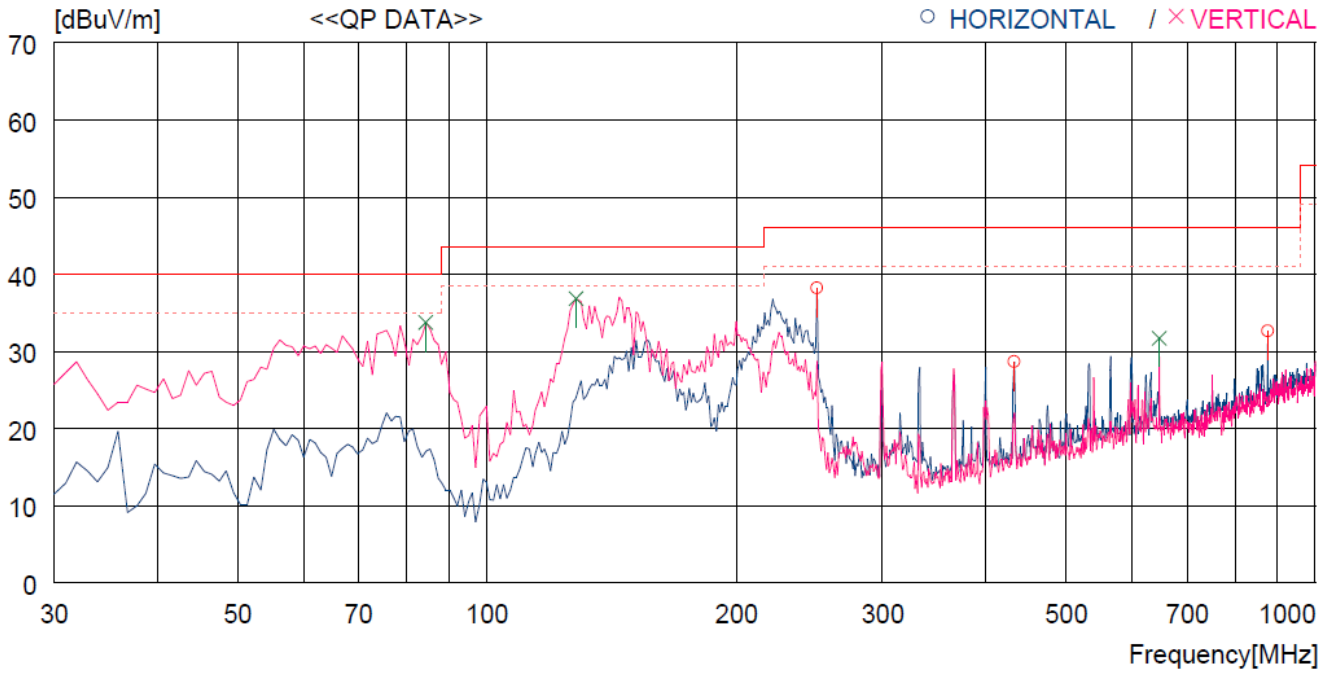
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT : Bluetooth/WLAN Combo Module for Automotive Date: September 09, 2015

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

-. Low, Middle and High Channels were tested, but the worst data were recorded.



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	250.190	54.0	12.4	4.6	32.8	38.2	46.0	7.8	100	89
2	432.551	38.8	16.4	6.1	32.7	28.6	46.0	17.4	100	89
3	875.830	34.7	21.9	9.1	33.1	32.6	46.0	13.4	100	89
----- Vertical ------										
4	84.320	55.7	8.6	2.6	33.2	33.7	40.0	6.3	100	20
5	127.970	57.2	9.4	3.3	33.1	36.8	43.5	6.7	100	20
6	647.887	38.0	19.4	7.7	33.4	31.7	46.0	14.3	100	12

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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)

11.4.2 Test data for Below 30 MHz

-. Test Date : September 09, 2015

-. 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.									

11.4.3 Test data for above 1 GHz

-. Test Date : September 09, 2015

-. 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: Hyung-Kwon, Oh / 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)
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)

11.5 Test data for 802.11g

11.5.1 Test data for 30 MHz ~ 1 000 MHz

Humidity Level : 45.1 % R.H. Temperature: 21.4 ℃

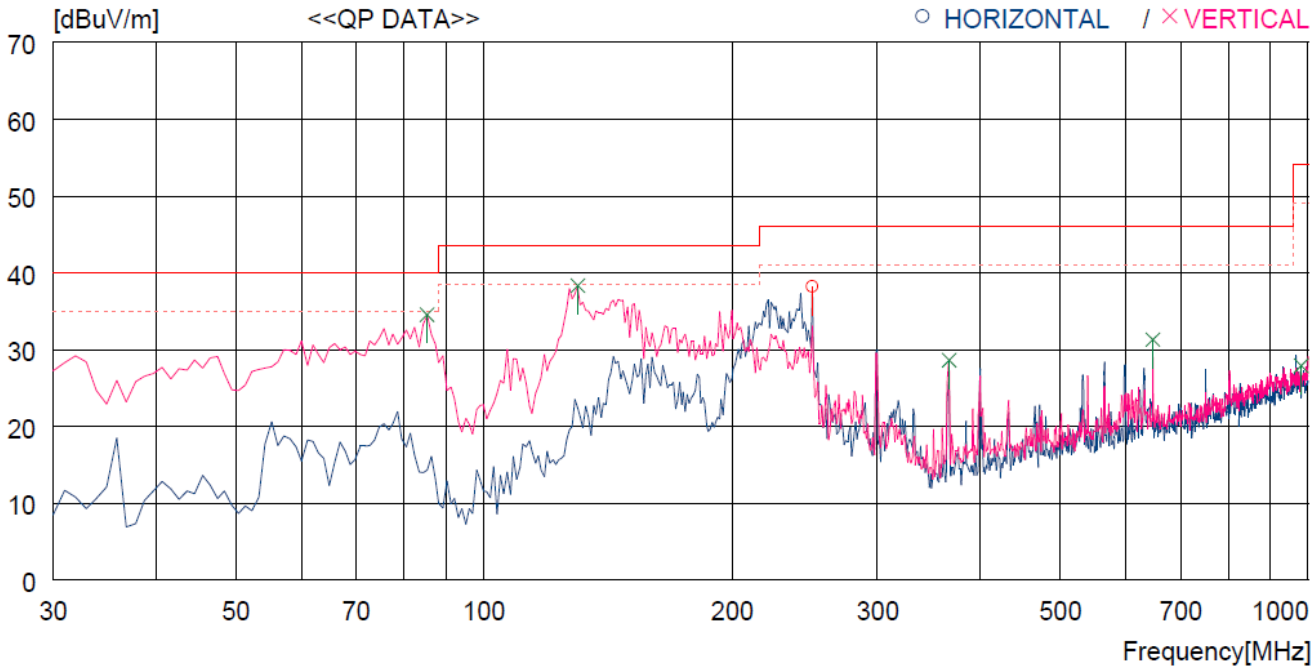
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT : Bluetooth/WLAN Combo Module for Automotive Date: September 09, 2015

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

-. Low, Middle and High Channels were tested, but the worst data were recorded.



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	250.190	54.0	12.4	4.6	32.8	38.2	46.0	7.8	100	12
----- Vertical ------										
2	85.290	56.2	8.8	2.7	33.2	34.5	40.0	5.5	100	82
3	129.910	58.9	9.2	3.3	33.1	38.3	43.5	5.2	100	48
4	366.590	40.5	15.1	5.6	32.6	28.6	46.0	17.4	100	82
5	647.887	37.6	19.4	7.7	33.4	31.3	46.0	14.7	100	82
6	979.617	27.6	22.6	9.6	31.9	27.9	54.0	26.1	100	82

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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)

11.5.2 Test data for Below 30 MHz

-. Test Date : September 09, 2015

-. 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.									

11.5.3 Test data for above 1 GHz

-. Test Date : September 09, 2015

-. 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: Hyung-Kwon, Oh / 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)
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)

11.6 Test data for 802.11n_HT20

11.6.1 Test data for 30 MHz ~ 1 000 MHz

Humidity Level : 45.1 % R.H. Temperature: 21.4 ℃

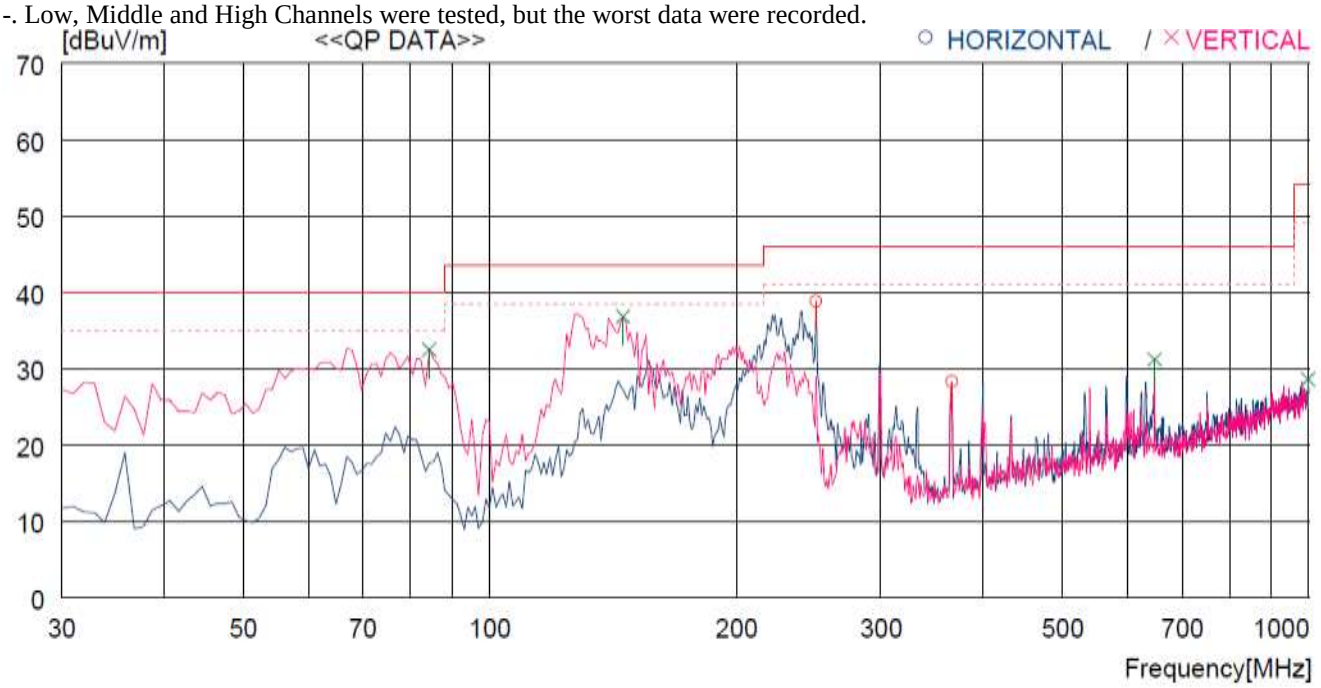
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT : Bluetooth/WLAN Combo Module for Automotive Date: September 09, 2015

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

-. Low, Middle and High Channels were tested, but the worst data were recorded.



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	250.190	54.6	12.4	4.6	32.8	38.8	46.0	7.2	100	26
2	366.590	40.2	15.1	5.6	32.6	28.3	46.0	17.7	100	26
----- Vertical ------										
3	84.320	54.5	8.6	2.6	33.2	32.5	40.0	7.5	100	12
4	145.430	58.1	8.2	3.5	33.0	36.8	43.5	6.7	100	2
5	647.887	37.5	19.4	7.7	33.4	31.2	46.0	14.8	100	12
6	997.076	28.0	22.6	9.7	31.7	28.6	54.0	25.4	100	2

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11.6.2 Test data for Below 30 MHz

-. Test Date : September 09, 2015

-. 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.									

11.6.3 Test data for above 1 GHz

-. Test Date : September 09, 2015

-. 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: Hyung-Kwon, Oh / 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)
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. CONDUCTED EMISSION TEST

12.1 Operating environment

Temperature : 21.4 ℃

Relative humidity : 45.1 % R.H.

12.2 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.

12.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	ESPI	Rohde & Schwarz	Test Receiver	101012	Nov. 03, 2014 (1Y)
□ -	ESHS10	Rohde & Schwarz	Test Receiver	834467/007	Apr. 29, 2015 (1Y)
□ -	NSLK8128	Schwarzbeck	AMN	8128-216	Apr. 06, 2015 (1Y)
■ -	NSLK8126	Schwarzbeck	AMN	8126-404	Apr. 29, 2015 (1Y)
□ -	3825/2	EMCO	AMN	9109-1869	Apr. 29, 2015 (1Y)
■ -	3825/2	EMCO	AMN	9109-1867	Apr. 29, 2015 (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)

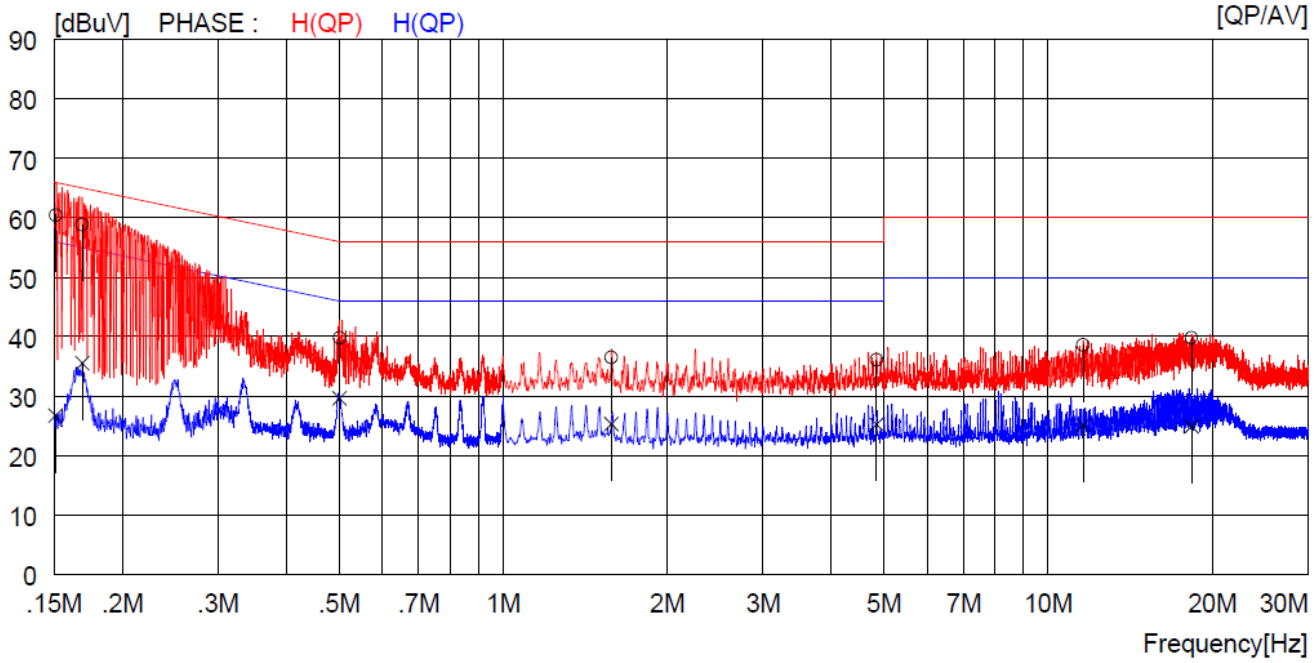
12.4 Test data

-. Test Date : September 09, 2015

-. Resolution bandwidth : 9 kHz

-. Frequency range : 0.15 MHz ~ 30 MHz

-. Tested Line : HOT LINE



NO	FREQ [MHz]	READING QP [dBuV]	READING AV [dBuV]	C.FACTOR QP [dB]	C.FACTOR AV [dBuV]	RESULT QP [dBuV]	RESULT AV [dBuV]	LIMIT QP [dBuV]	LIMIT AV [dBuV]	MARGIN QP [dBuV]	MARGIN AV [dBuV]	PHASE
1	0.15100	40.2	----	20.2		60.4	----	65.9	----	5.5	----	H(QP)
2	0.16900	38.6	----	20.2		58.8	----	65.0	----	6.2	----	H(QP)
3	0.50100	19.6	----	20.2		39.8	----	56.0	----	16.2	----	H(QP)
4	1.58000	16.3	----	20.2		36.5	----	56.0	----	19.5	----	H(QP)
5	4.84400	15.8	----	20.3		36.1	----	56.0	----	19.9	----	H(QP)
6	11.59000	18.3	----	20.3		38.6	----	60.0	----	21.4	----	H(QP)
7	18.34000	19.5	----	20.3		39.8	----	60.0	----	20.2	----	H(QP)
8	0.15100	----	6.5	20.2		----	26.7	----	55.9	----	29.2	H(CAV)
9	0.16900	----	15.3	20.2		----	35.5	----	55.0	----	19.5	H(CAV)
10	0.50100	----	9.4	20.2		----	29.6	----	46.0	----	16.4	H(CAV)
11	1.58000	----	5.1	20.2		----	25.3	----	46.0	----	20.7	H(CAV)
12	4.84400	----	4.9	20.3		----	25.2	----	46.0	----	20.8	H(CAV)
13	11.59000	----	4.8	20.3		----	25.1	----	50.0	----	24.9	H(CAV)
14	18.34000	----	4.6	20.3		----	24.9	----	50.0	----	25.1	H(CAV)

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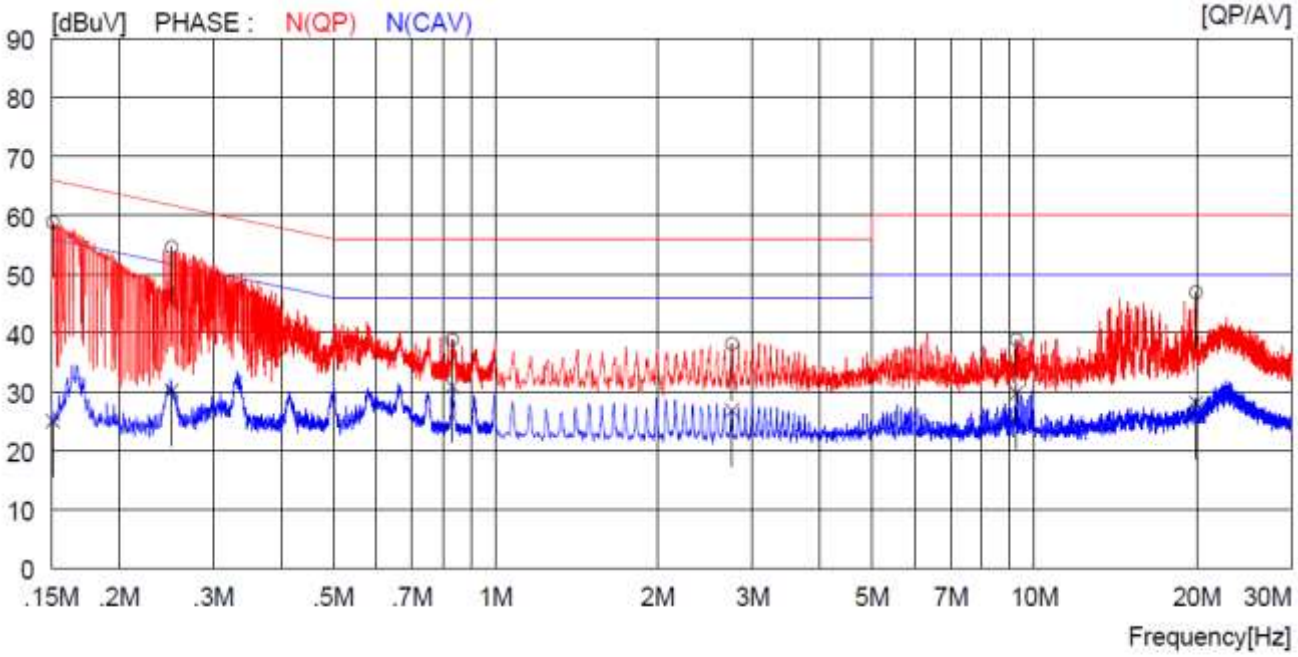
-. Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING QP [dBuV]	READING AV [dBuV]	C.FACTOR QP [dB]	C.FACTOR AV [dBuV]	RESULT QP [dBuV]	RESULT AV [dBuV]	LIMIT QP [dBuV]	LIMIT AV [dBuV]	MARGIN QP [dBuV]	MARGIN AV [dBuV]	PHASE
1	0.15100	38.6	----	20.2		58.8	----	65.9	----	7.1	----	N(QP)
2	0.25100	34.4	----	20.2		54.6	----	61.7	----	7.1	----	N(QP)
3	0.83200	18.6	----	20.2		38.8	----	56.0	----	17.2	----	N(QP)
4	2.74800	17.9	----	20.2		38.1	----	56.0	----	17.9	----	N(QP)
5	9.27000	18.6	----	20.3		38.9	----	60.0	----	21.1	----	N(QP)
6	19.95000	26.7	----	20.2		46.9	----	60.0	----	13.1	----	N(QP)
7	0.15100	----	4.8	20.2		----	25.0	----	55.9	----	30.9	N(CAV)
8	0.25100	----	10.0	20.2		----	30.2	----	51.7	----	21.5	N(CAV)
9	0.83200	----	10.7	20.2		----	30.9	----	46.0	----	15.1	N(CAV)
10	2.74800	----	6.6	20.2		----	26.8	----	46.0	----	19.2	N(CAV)
11	9.27000	----	9.5	20.3		----	29.8	----	50.0	----	20.2	N(CAV)
12	19.95000	----	7.9	20.2		----	28.1	----	50.0	----	21.9	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.

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