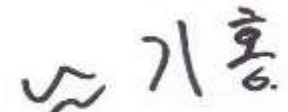


ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

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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Revision History

| Issued Report No. | Issued Date | Revisions | Effect Section |
|-------------------|--------------------|---------------|----------------|
| W159R-D009 | September 09, 2015 | Initial Issue | All |
| | | | |
| | | | |

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.

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

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 |

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.

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.

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 |

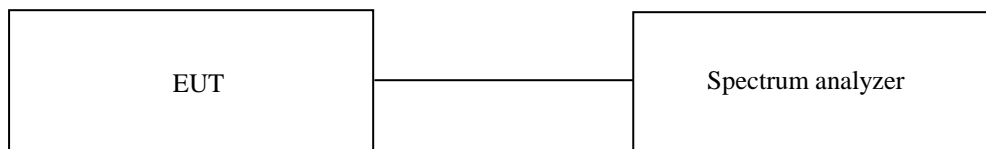
7. MIMIMUM 6 dB BANDWIDTH

7.1 Operating environment

Temperature : 21.4 °C
 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.

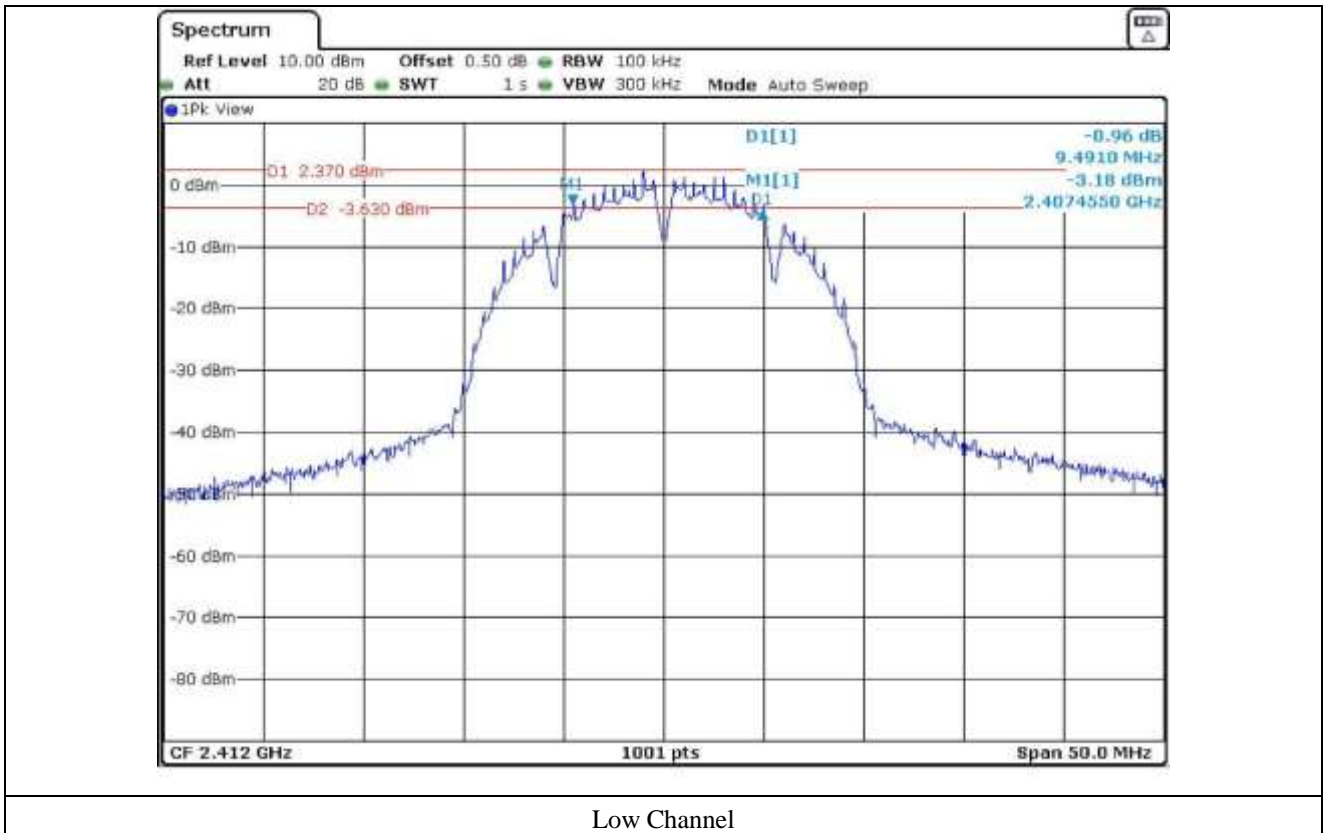
7.4 Test data for 802.11b

- 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

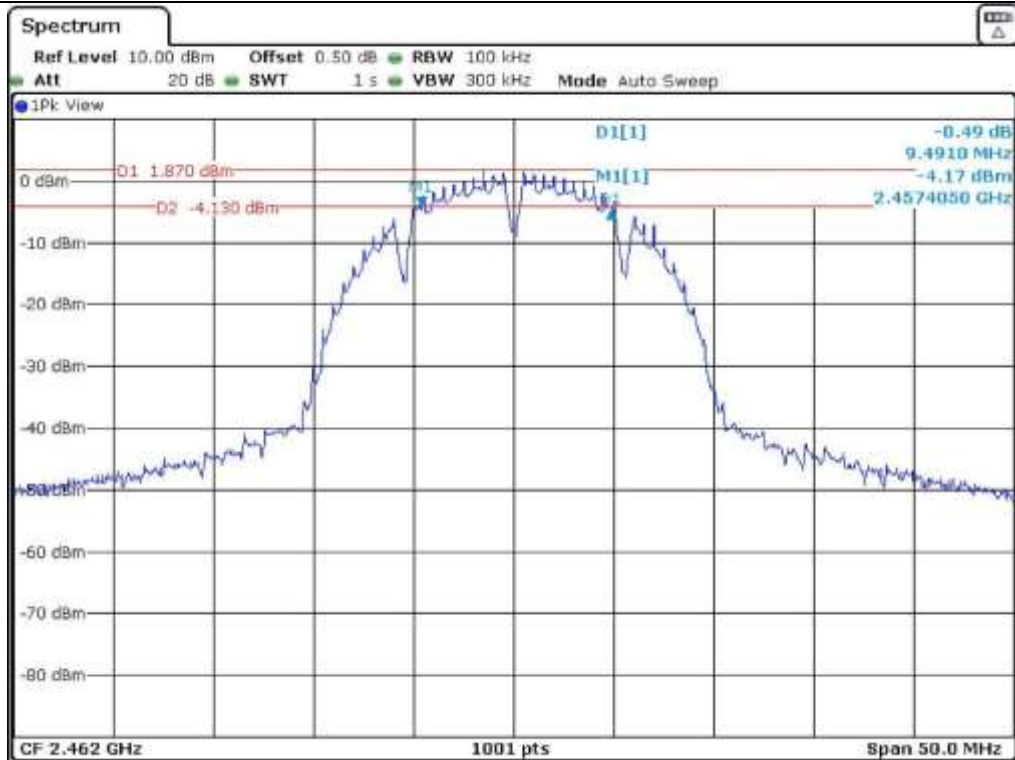
Tested by: Hyung-Kwon, Oh / Engineer



Low Channel



Middle Channel



High Channel

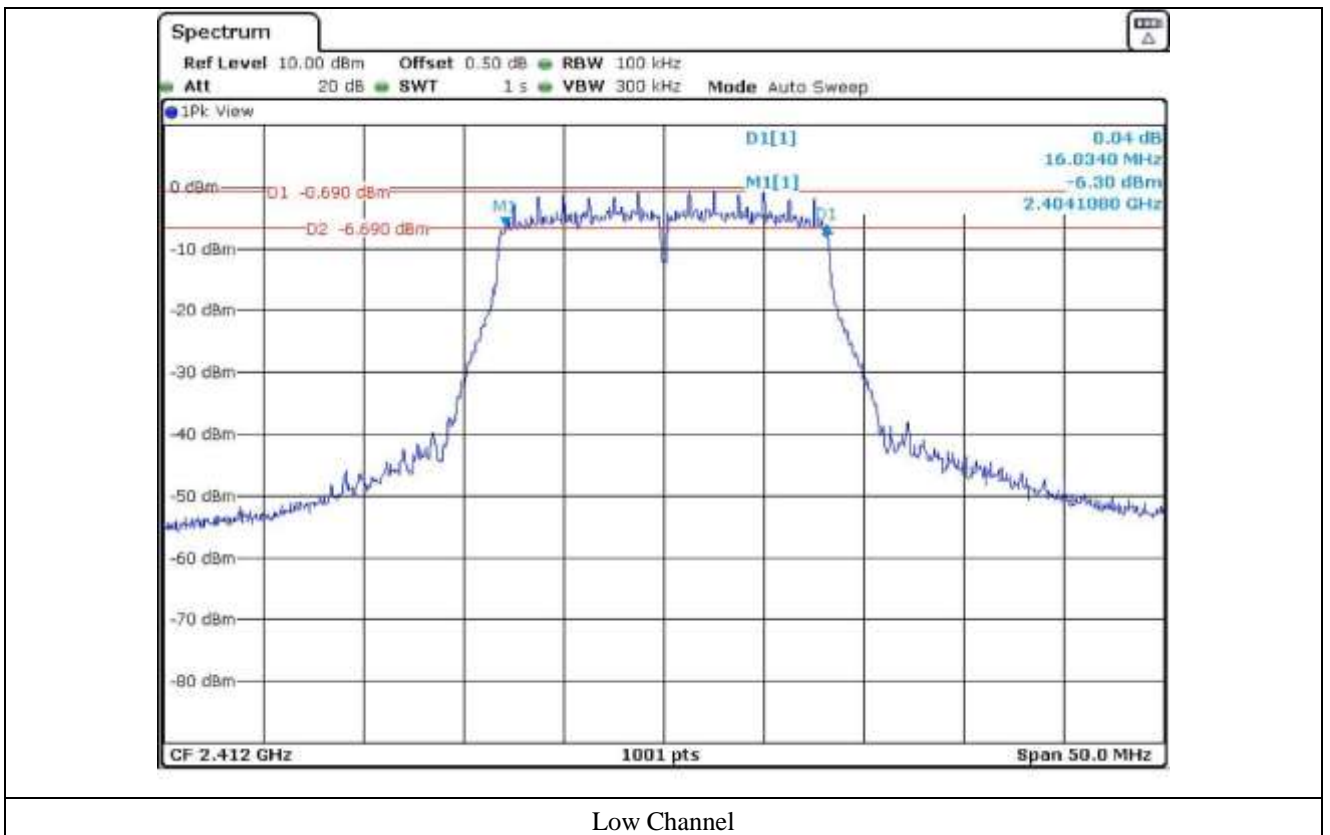
7.5 Test data for 802.11g

- Test Date : September 07, 2015
- Test Result : Pass

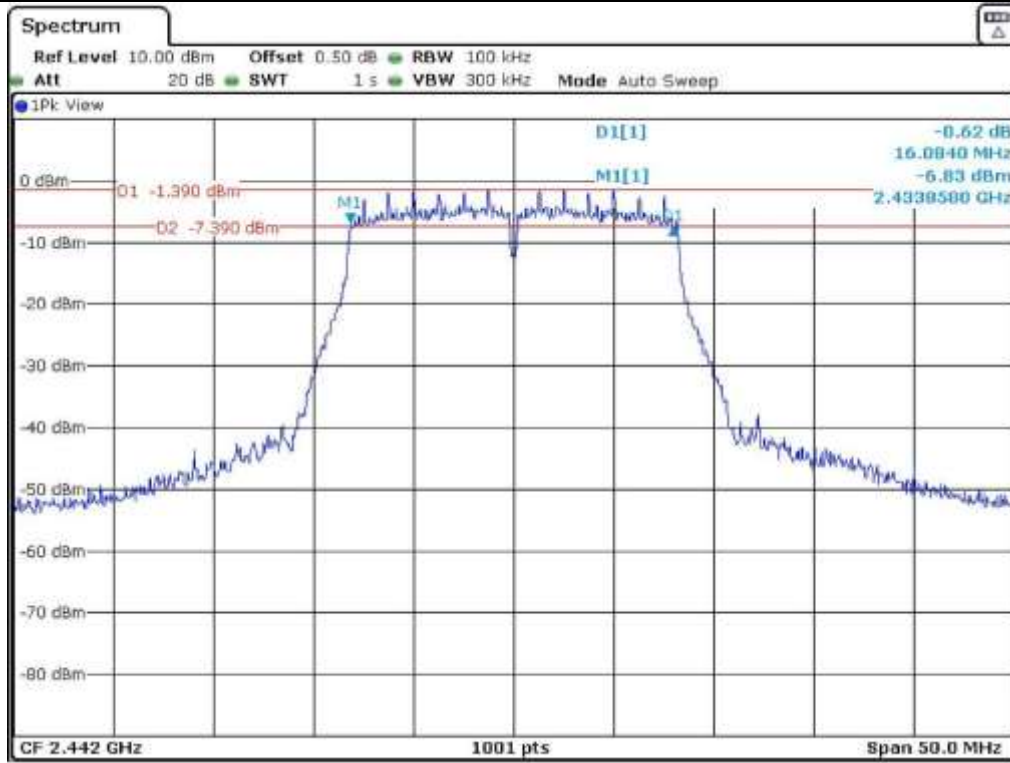
| CHANNEL | FREQUENCY (MHz) | 6 dB Bandwidth (MHz) | LIMIT (MHz) | Margin (MHz) |
|---------|-----------------|----------------------|-------------|--------------|
| Low | 2 412 | 16.03 | 0.50 | 15.53 |
| Middle | 2 442 | 16.08 | 0.50 | 15.58 |
| High | 2 462 | 16.03 | 0.50 | 15.53 |

Remark. Margin = Measured Value - Limit

Tested by: Hyung-Kwon, Oh / Engineer



Low Channel



Middle Channel



High Channel

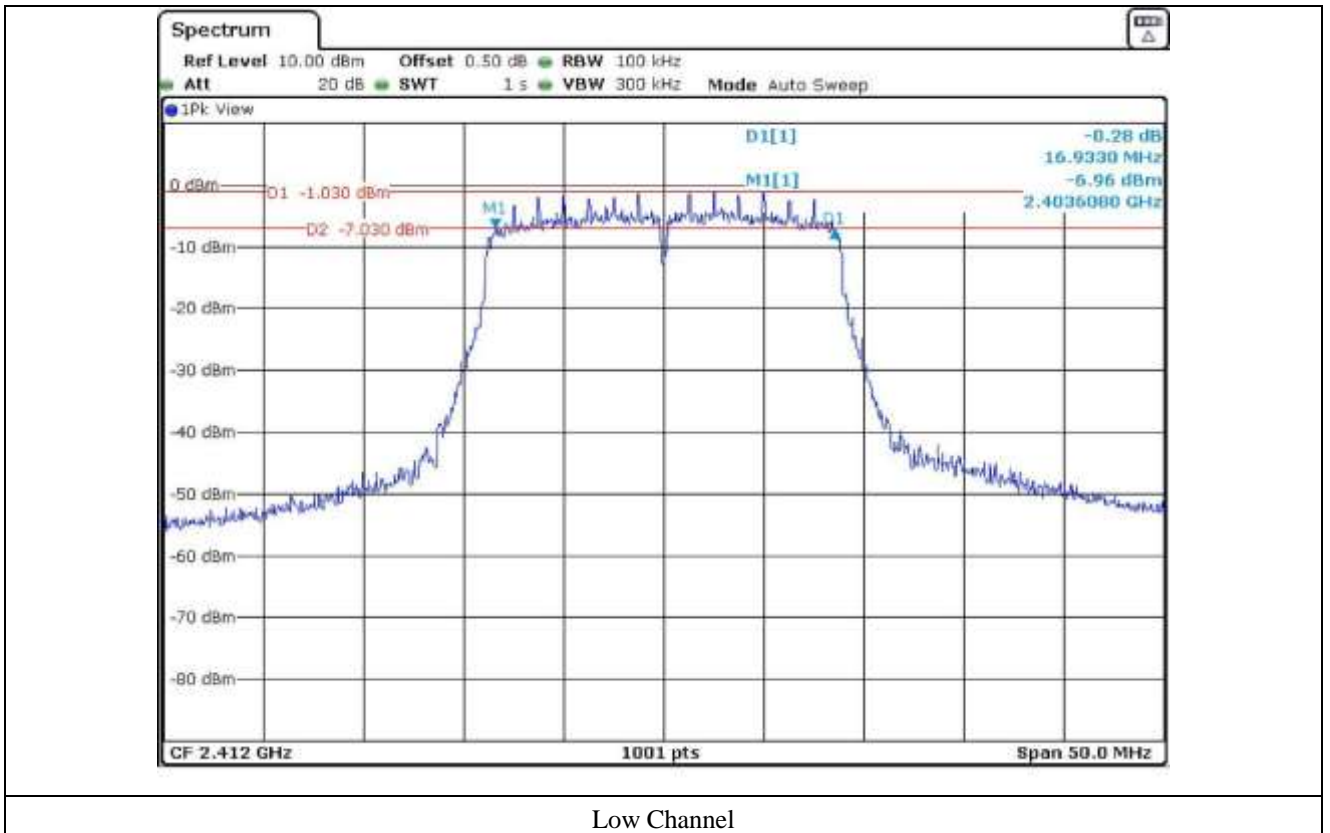
7.6 Test data for 802.11n_HT20

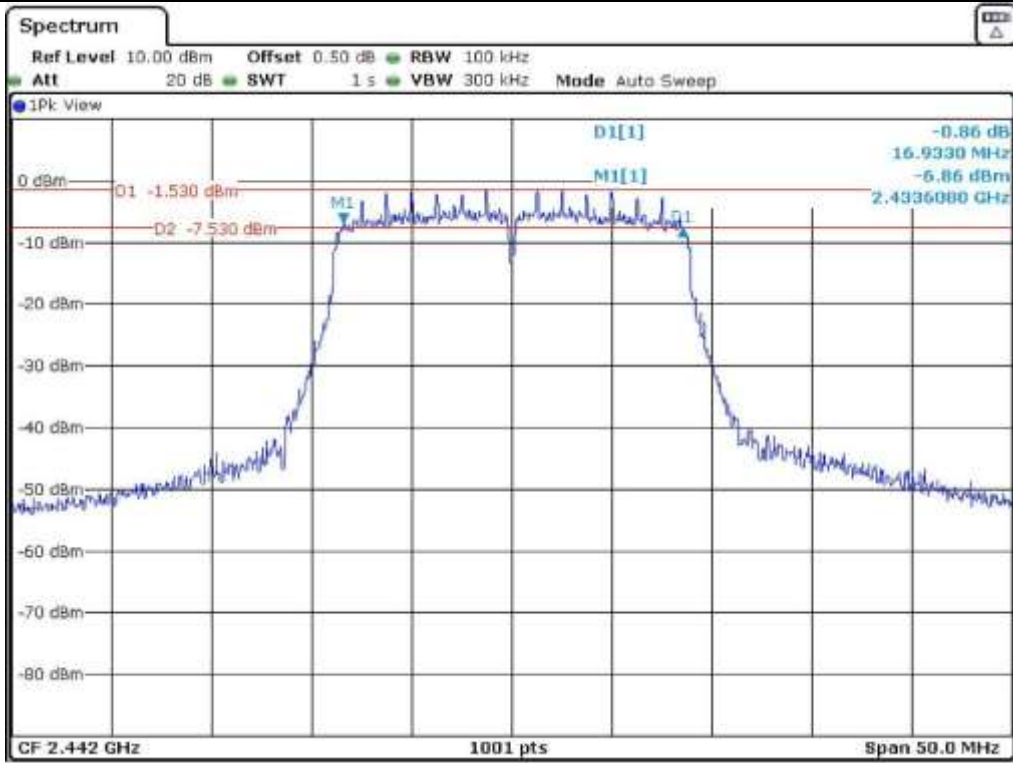
- Test Date : September 07, 2015
- Test Result : Pass

| 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 |

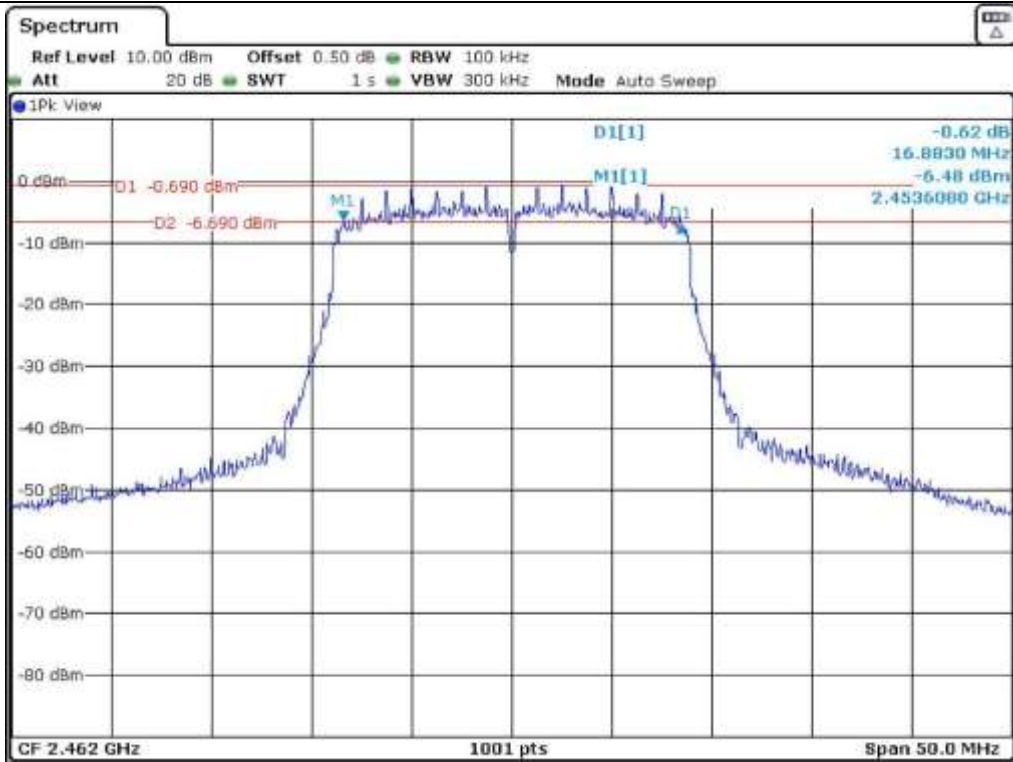
Remark. Margin = Measured Value - Limit

Tested by: Hyung-Kwon, Oh / Engineer





Middle Channel



High Channel

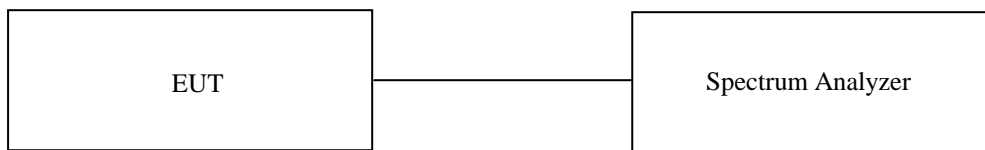
8. MAXIMUM PEAK OUTPUT POWER

8.1 Operating environment

Temperature : 21.4 °C
 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.

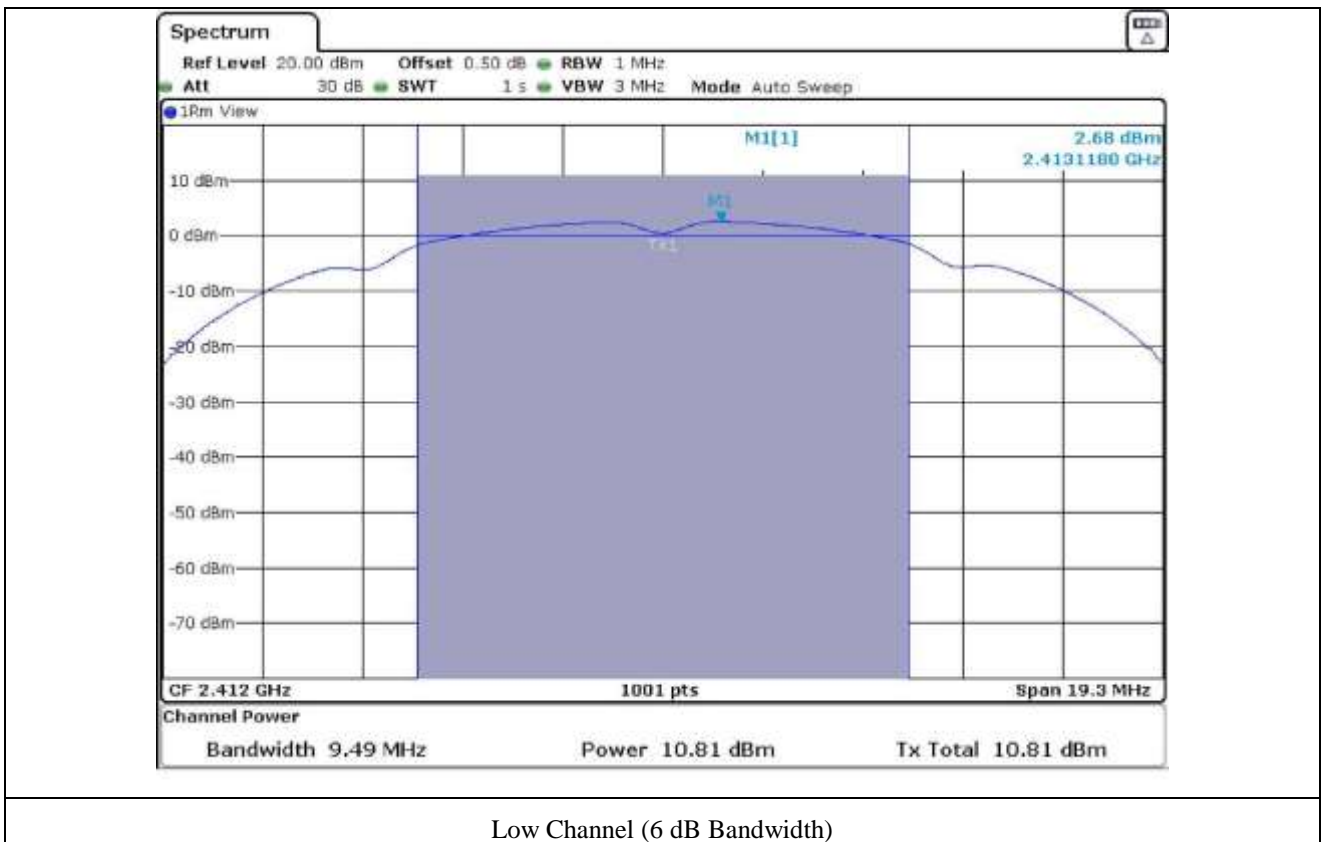
8.4 Test data for 802.11b

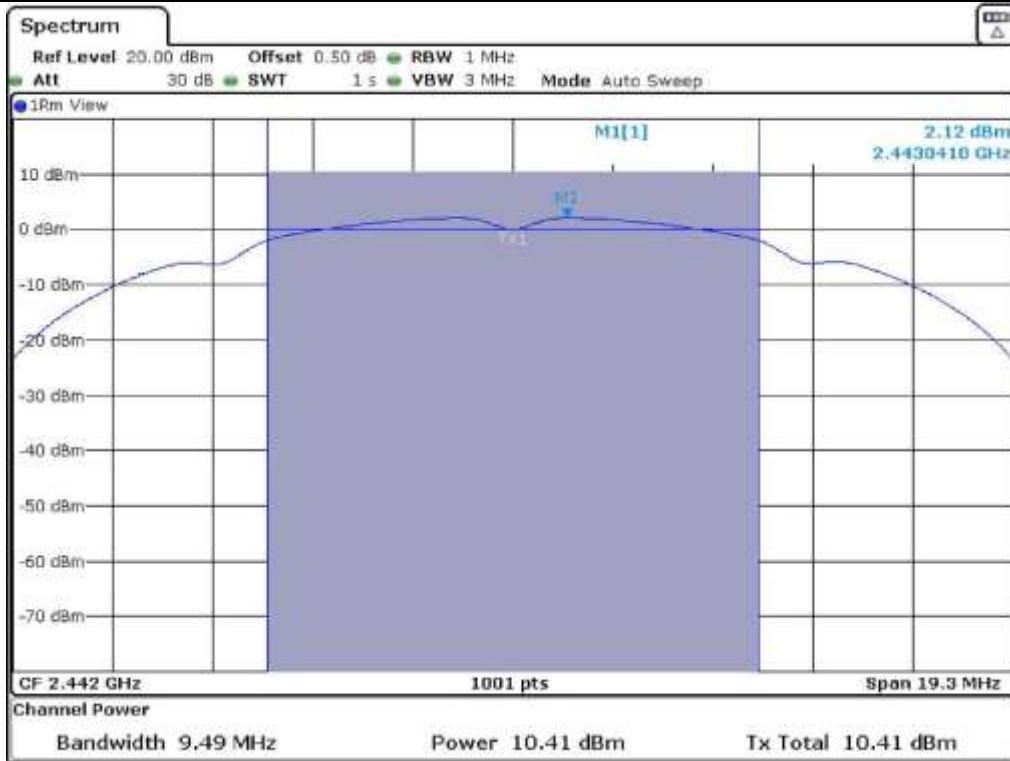
- Test Date : September 07, 2015
- Test Result : Pass

| 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 |

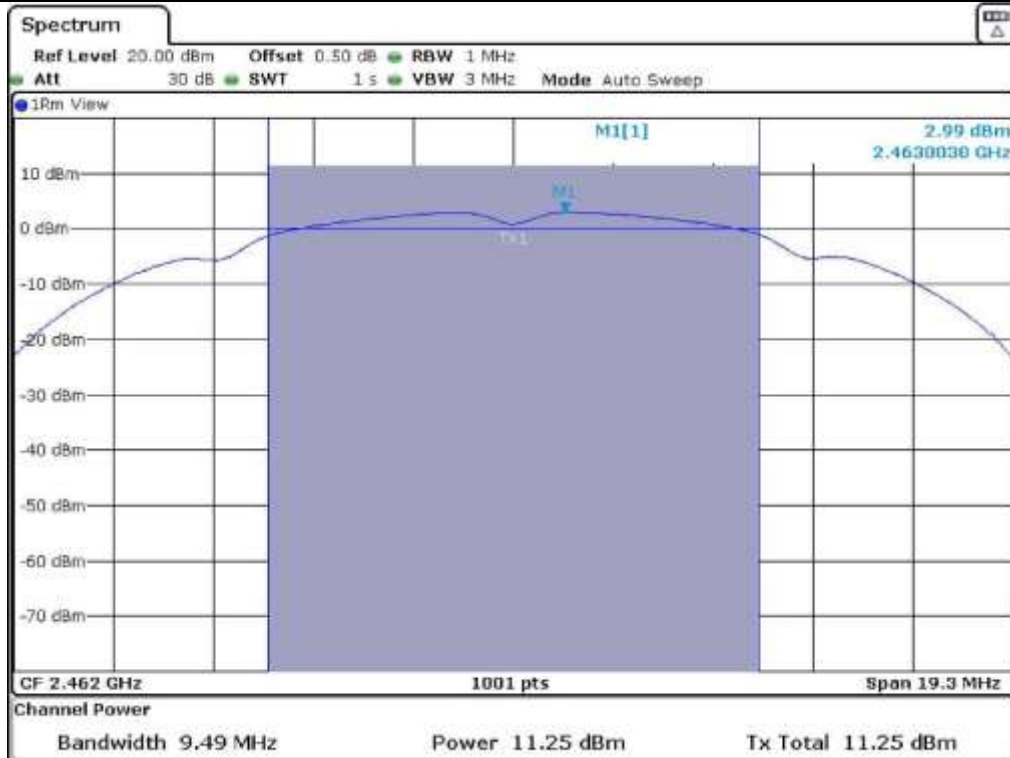
Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

Tested by: Hyung-Kwon, Oh / Engineer





Middle Channel (6 dB Bandwidth)



High Channel (6 dB Bandwidth)

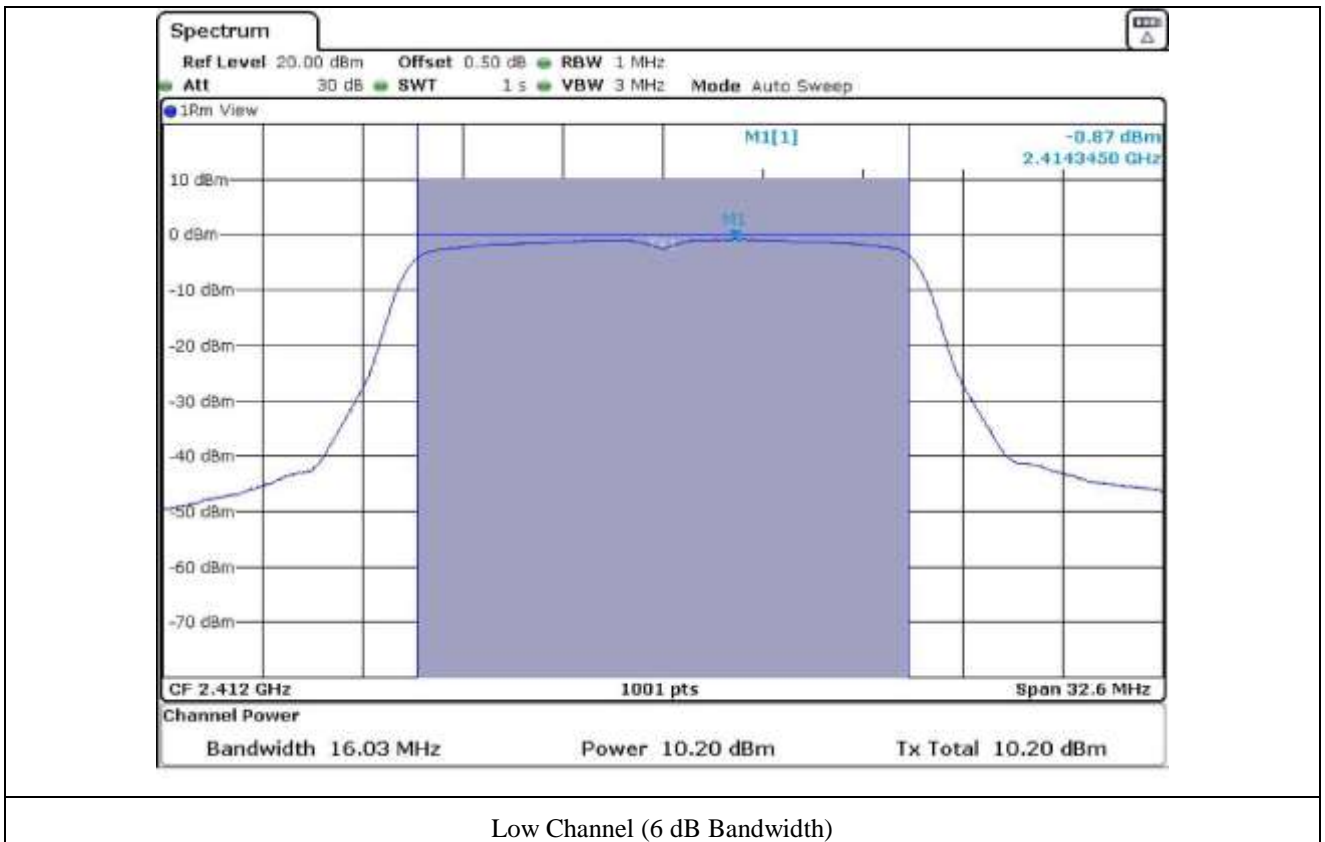
8.5 Test data for 802.11g

- Test Date : September 07, 2015
- Test Result : Pass

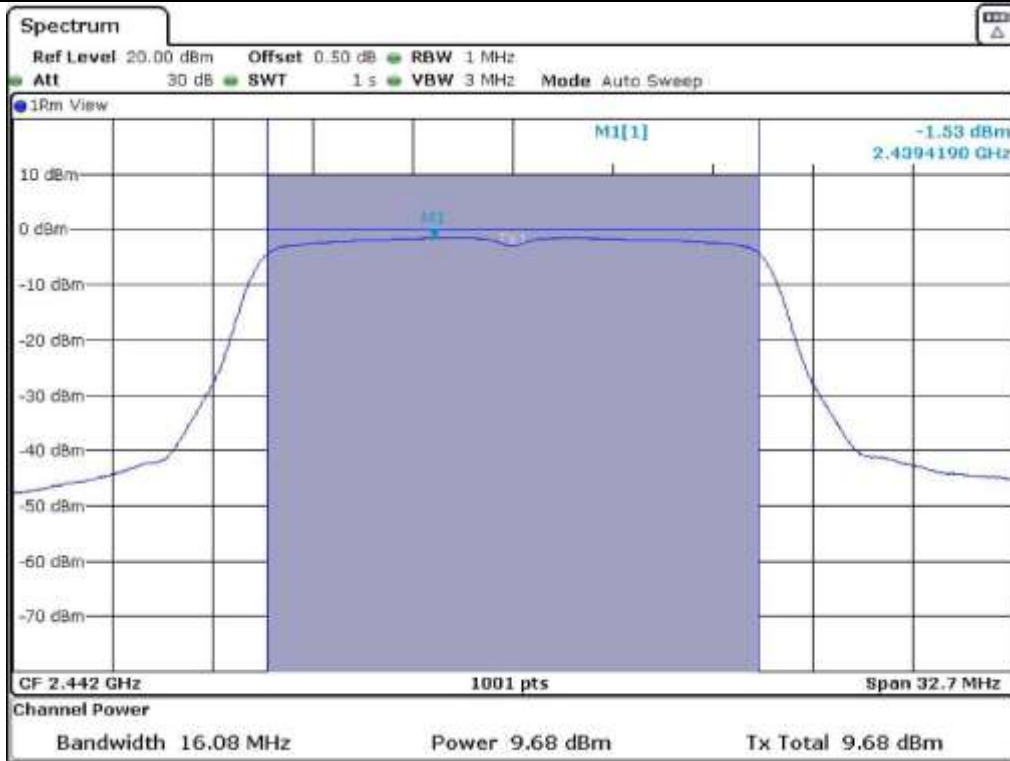
| CHANNEL | FREQUENCY (MHz) | 6 dB Bandwidth (MHz) | MEASURED VLAUE (dBm) | LIMIT (dBm) | MARGIN (dB) |
|---------|-----------------|----------------------|----------------------|-------------|-------------|
| LOW | 2 412 | 16.03 | 10.20 | 30.00 | 19.80 |
| MIDDLE | 2 442 | 16.08 | 9.68 | 30.00 | 20.32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

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

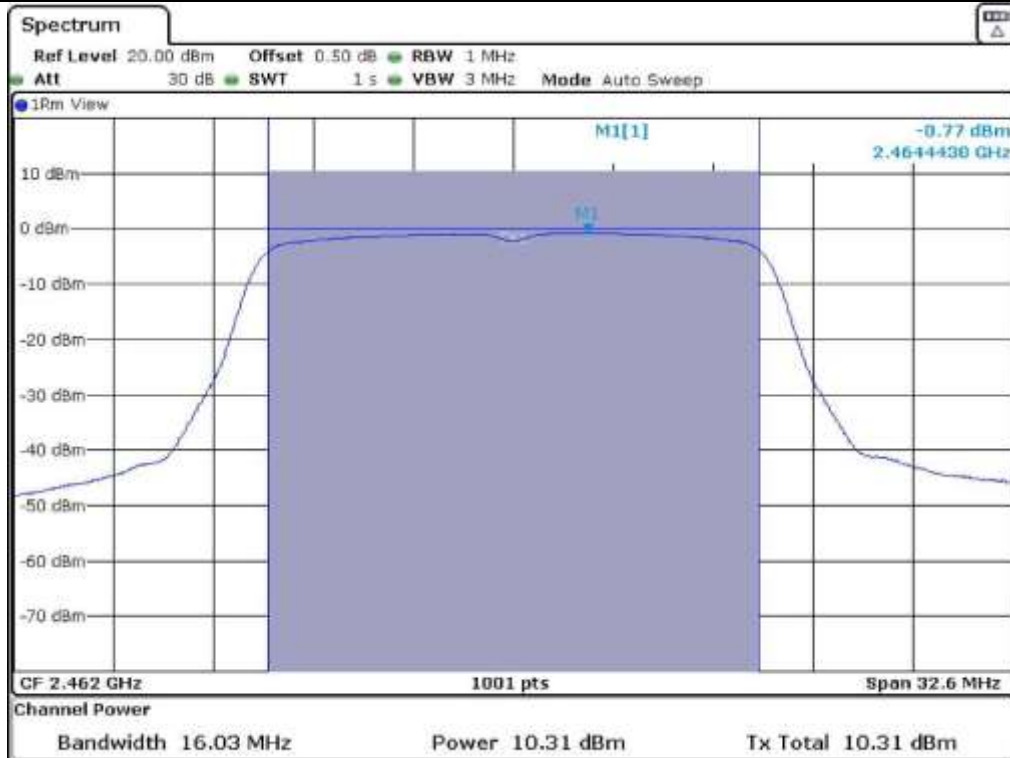
Tested by: Hyung-Kwon, Oh / Engineer



Low Channel (6 dB Bandwidth)



Middle Channel (6 dB Bandwidth)



High Channel (6 dB Bandwidth)

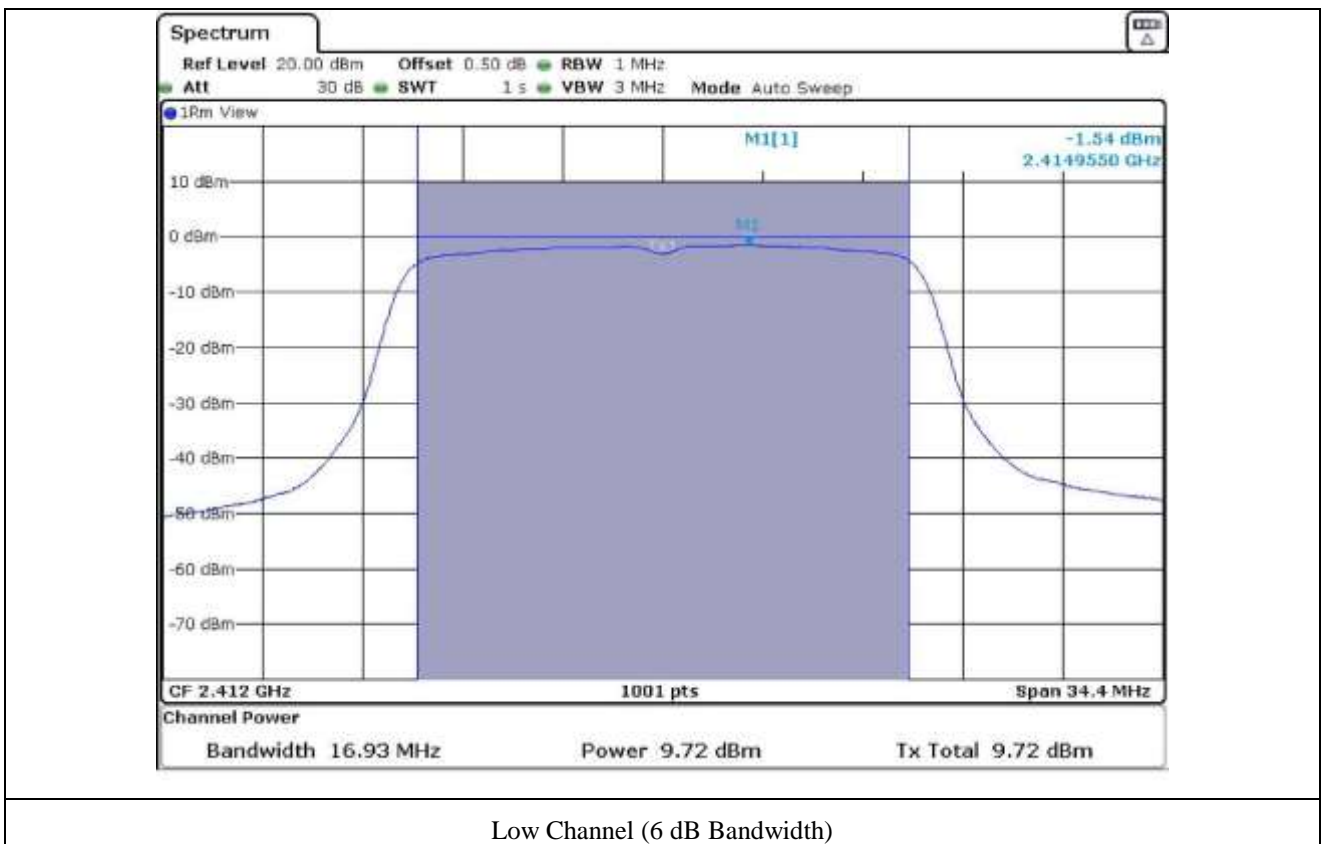
8.6 Test data for 802.11n_HT20

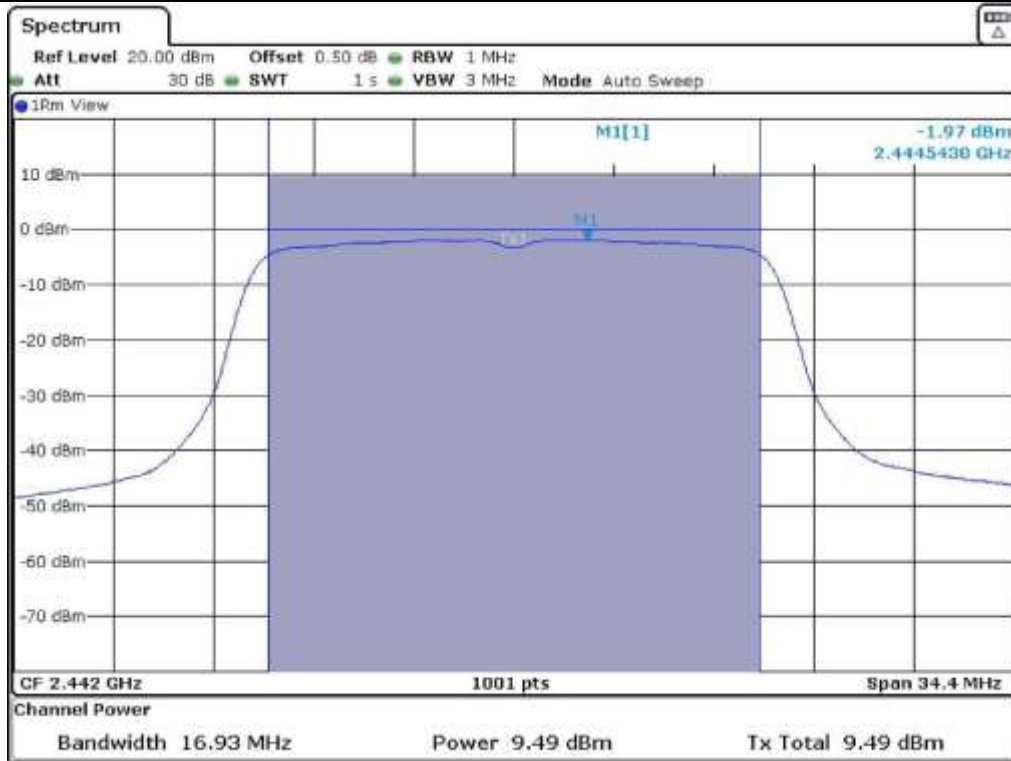
- Test Date : September 07, 2015
- Test Result : Pass

| 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 |

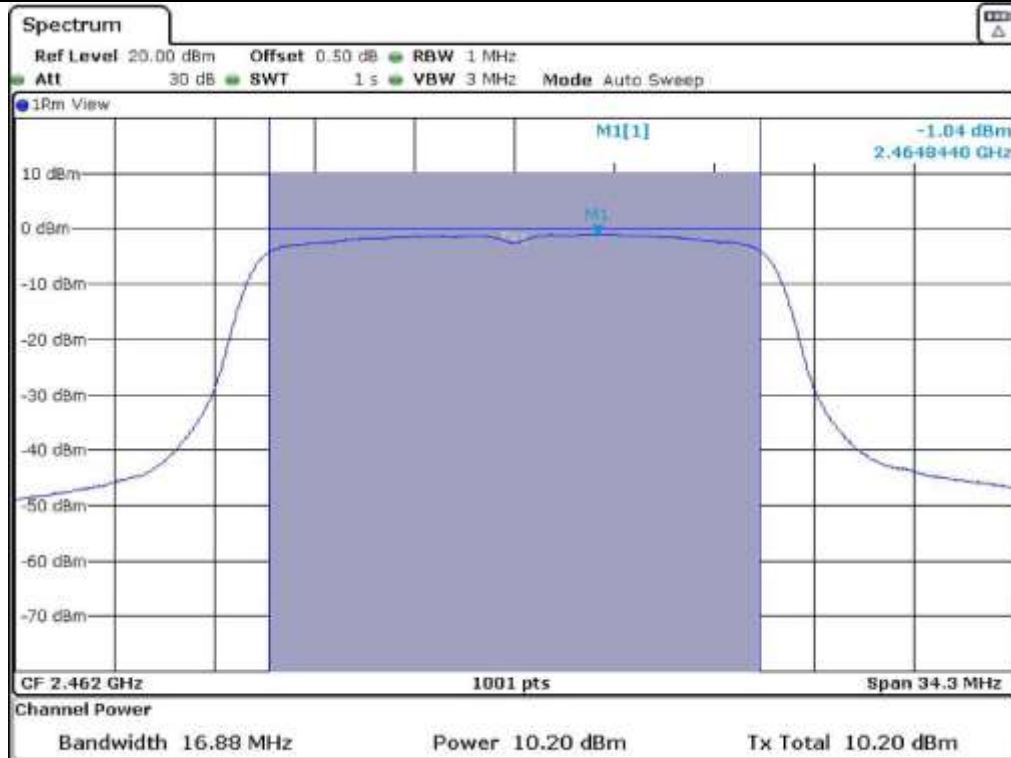
Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

Tested by: Hyung-Kwon, Oh / Engineer





Middle Channel (6 dB Bandwidth)



High Channel (6 dB Bandwidth)

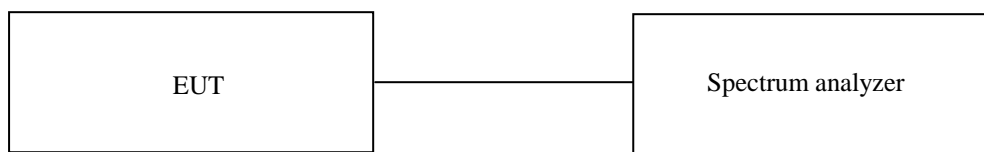
9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

9.1 Operating environment

Temperature : 21.4 °C
 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) |

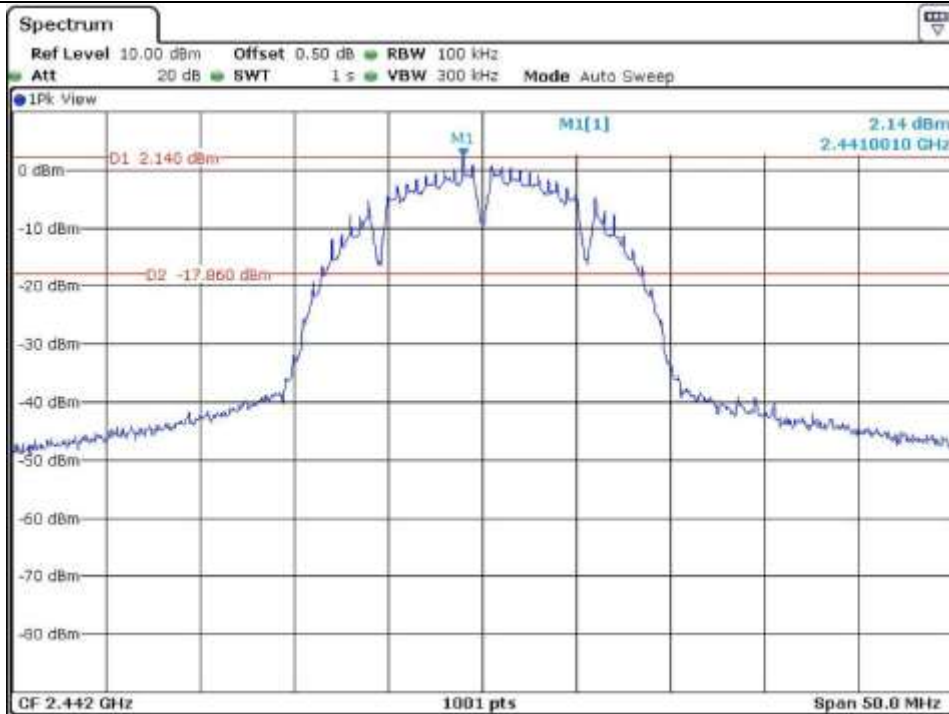
All test equipment used is calibrated on a regular basis.

9.5 Test data for conducted emission

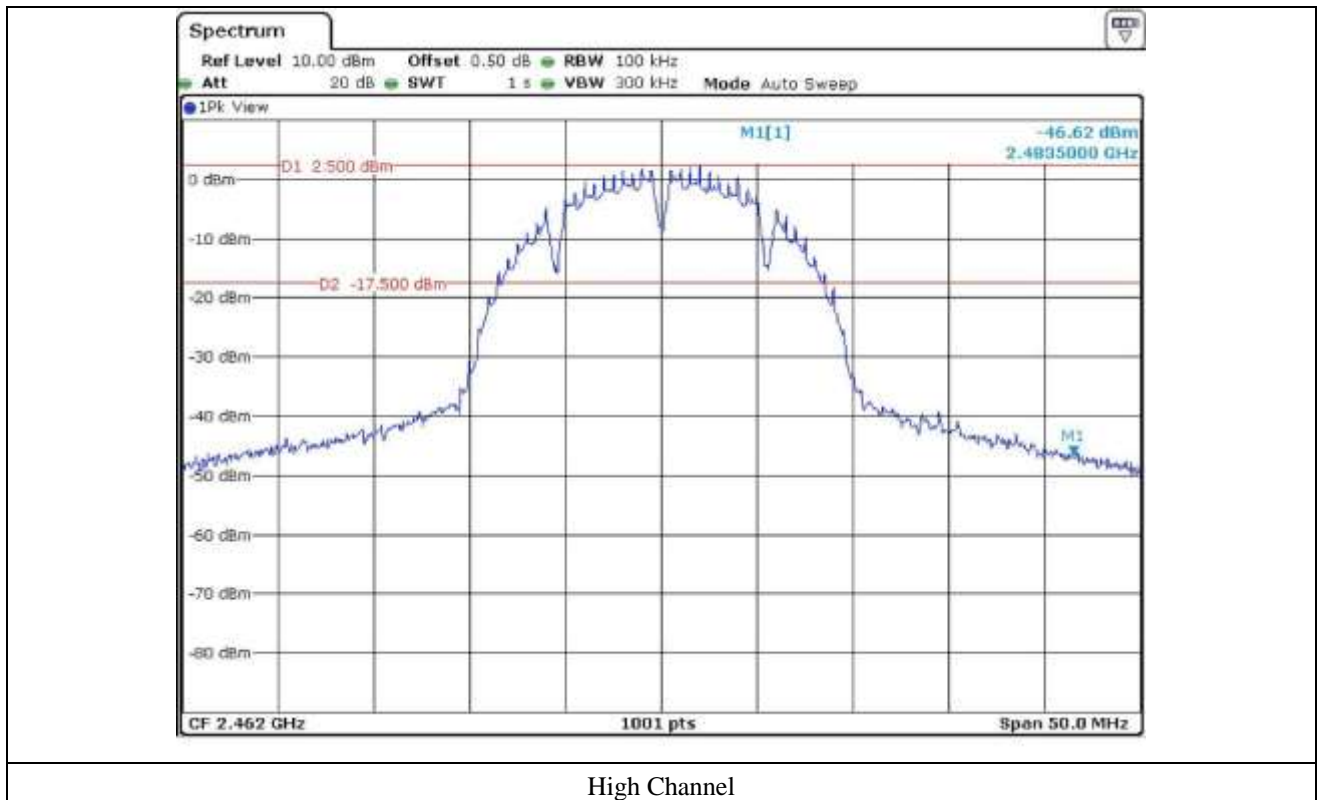
9.5.1 Test data for 802.11b

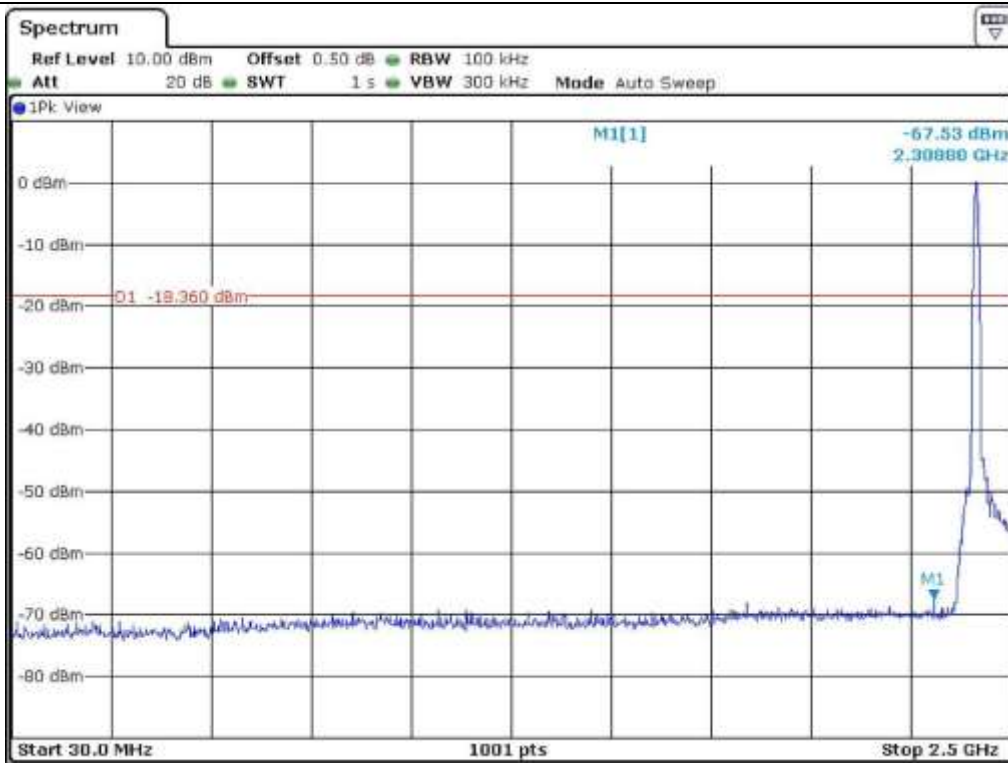


Low Channel

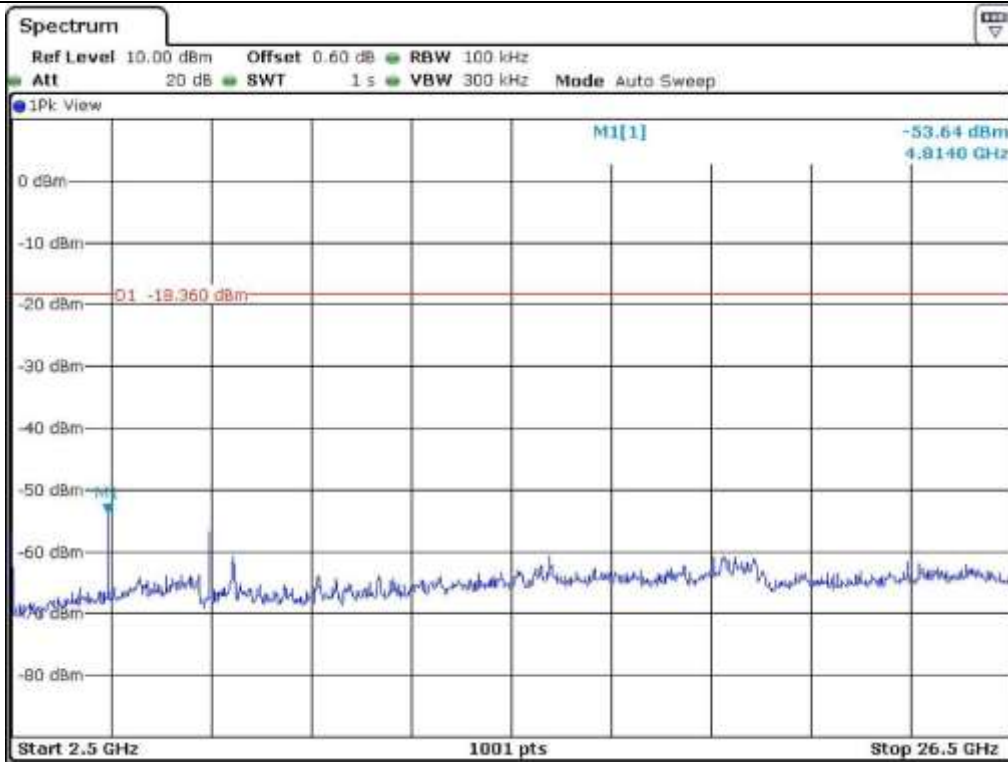


Middle Channel

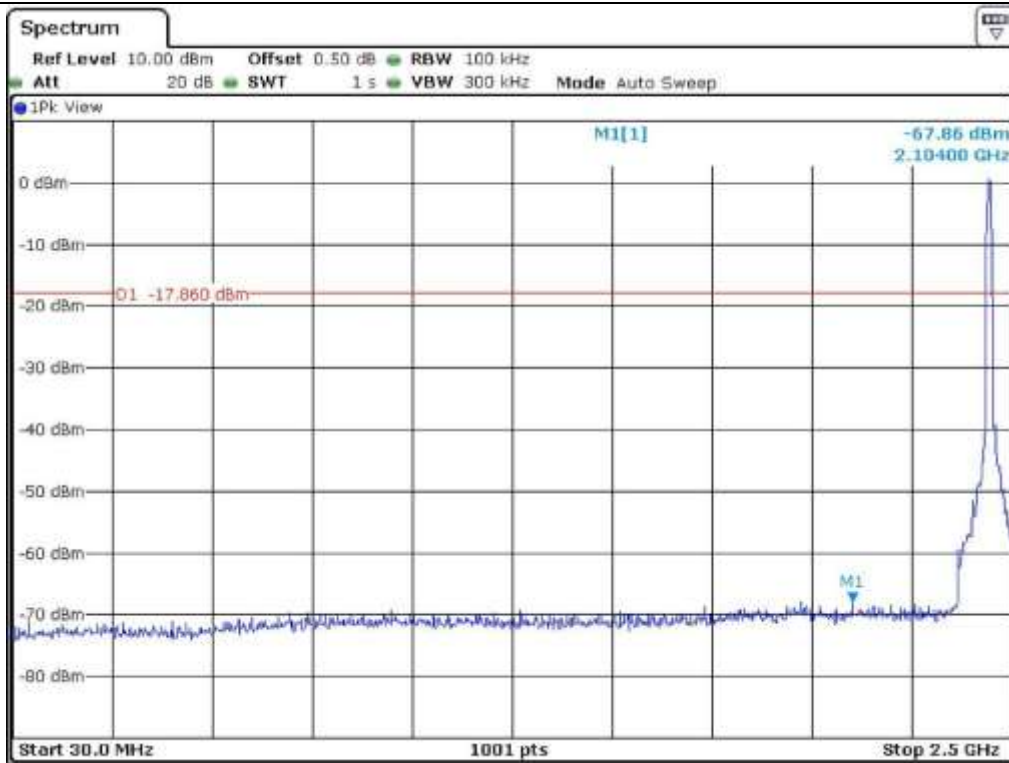




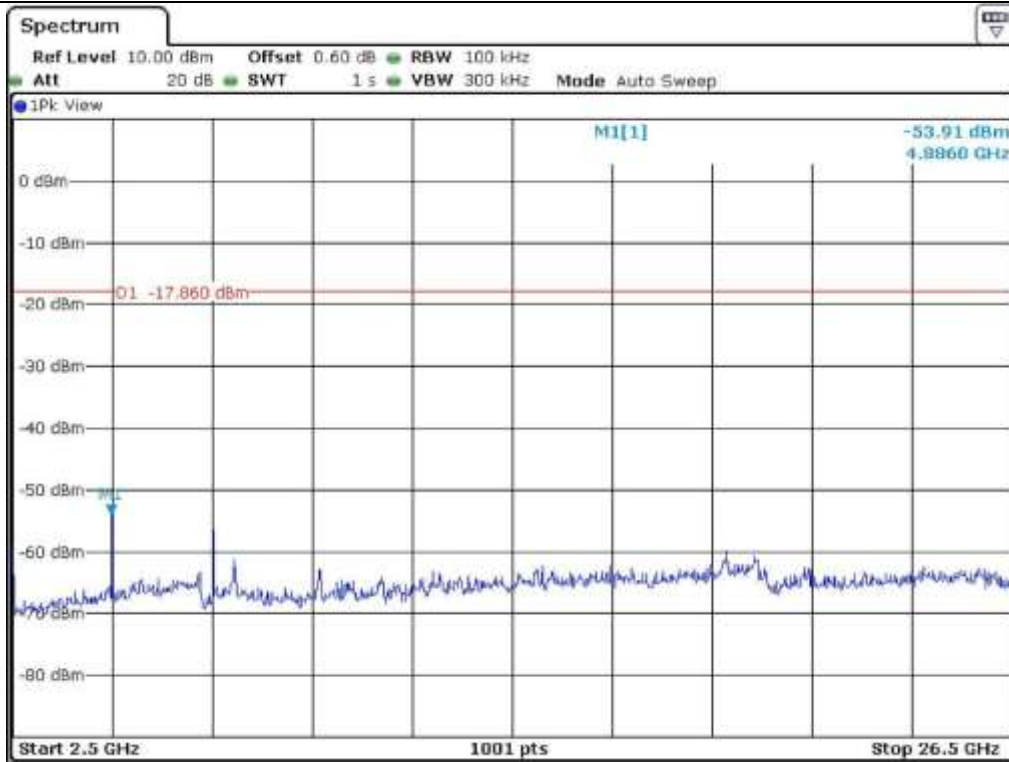
Low Channel



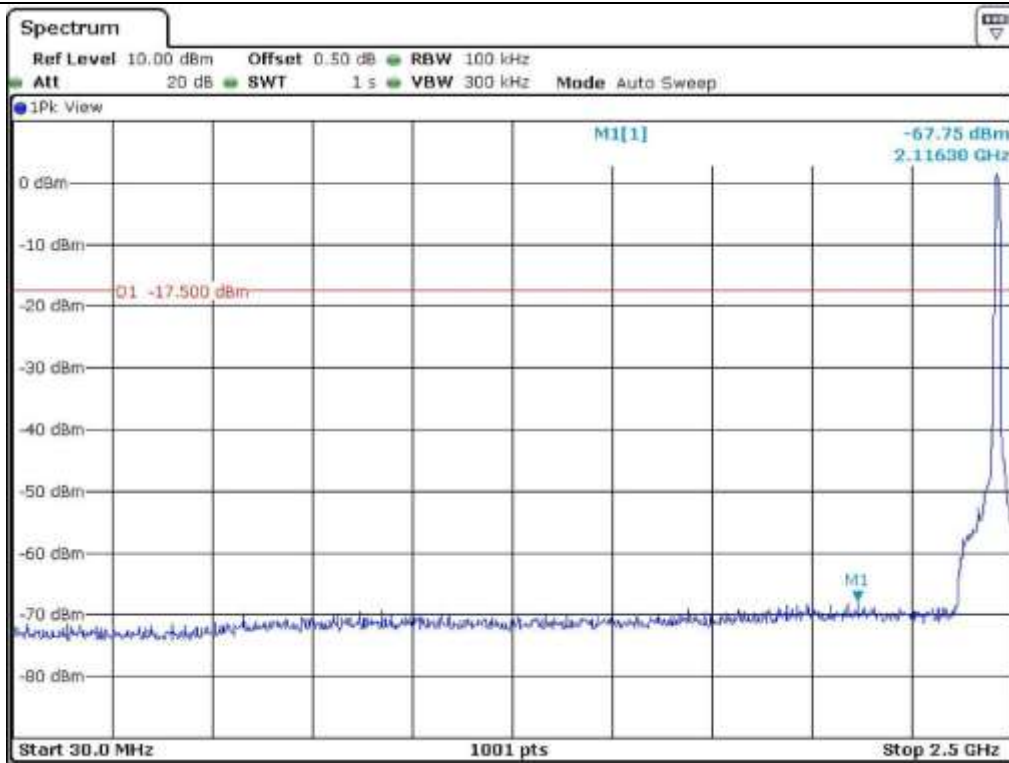
Low Channel



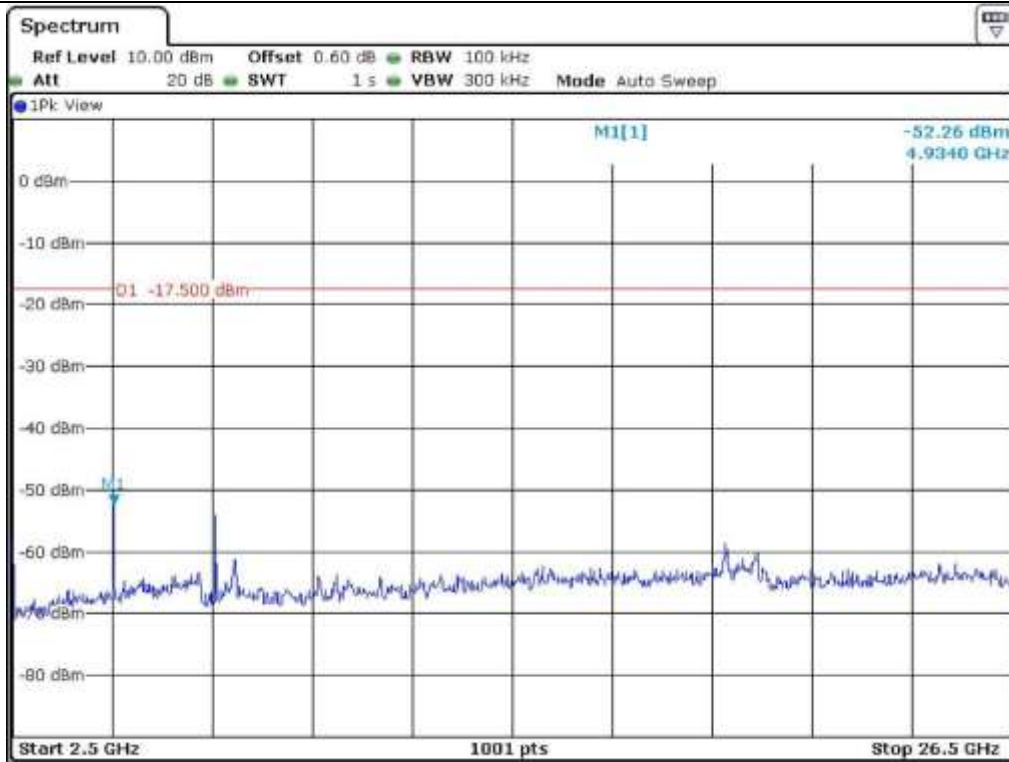
Middle Channel



Middle Channel

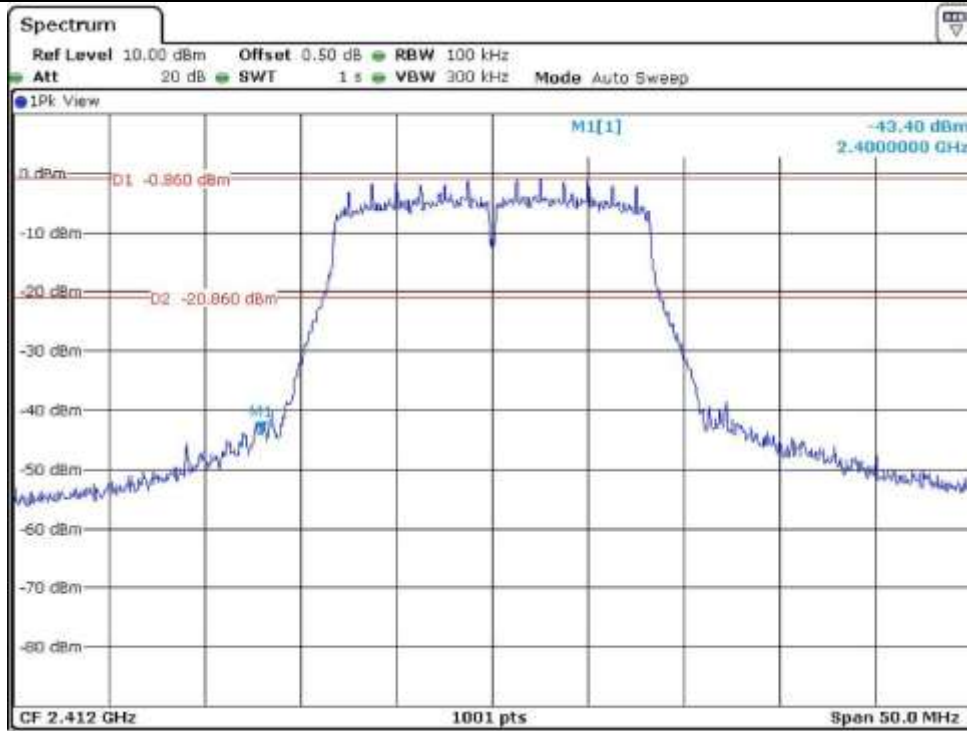


High Channel

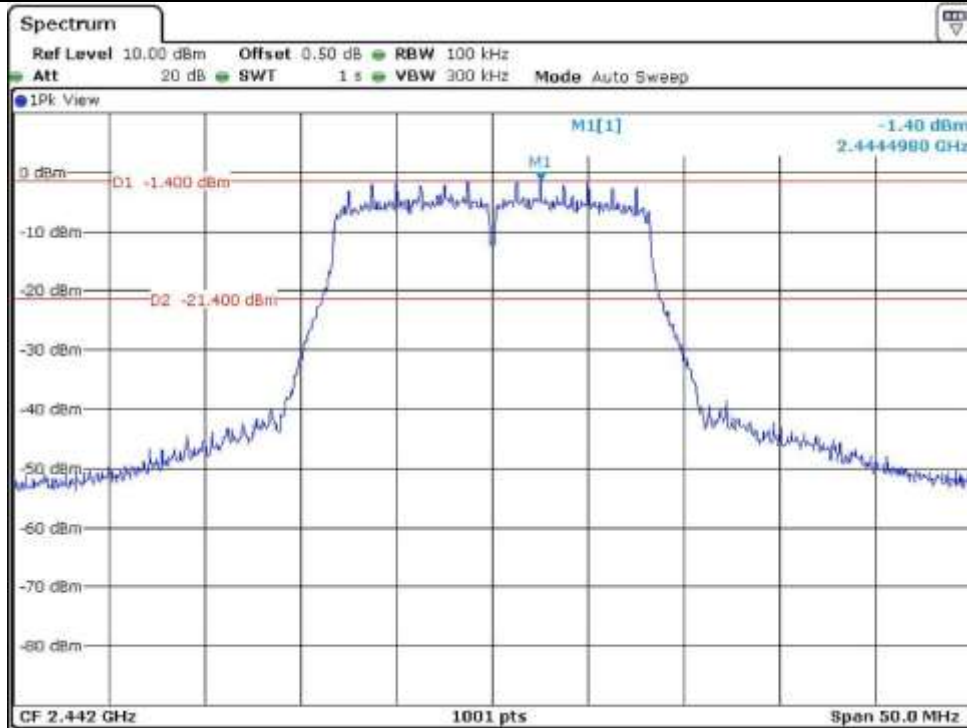


High Channel

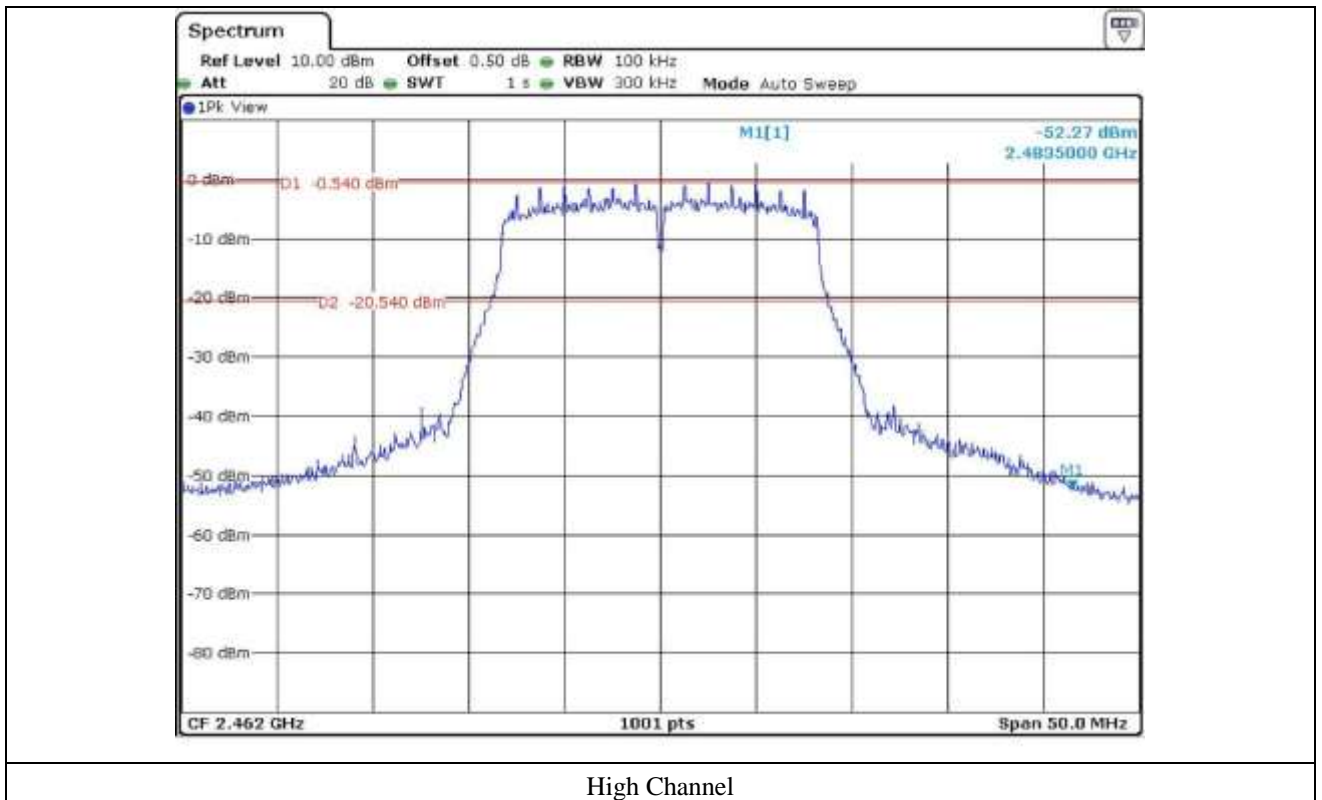
9.5.2 Test data for 802.11g



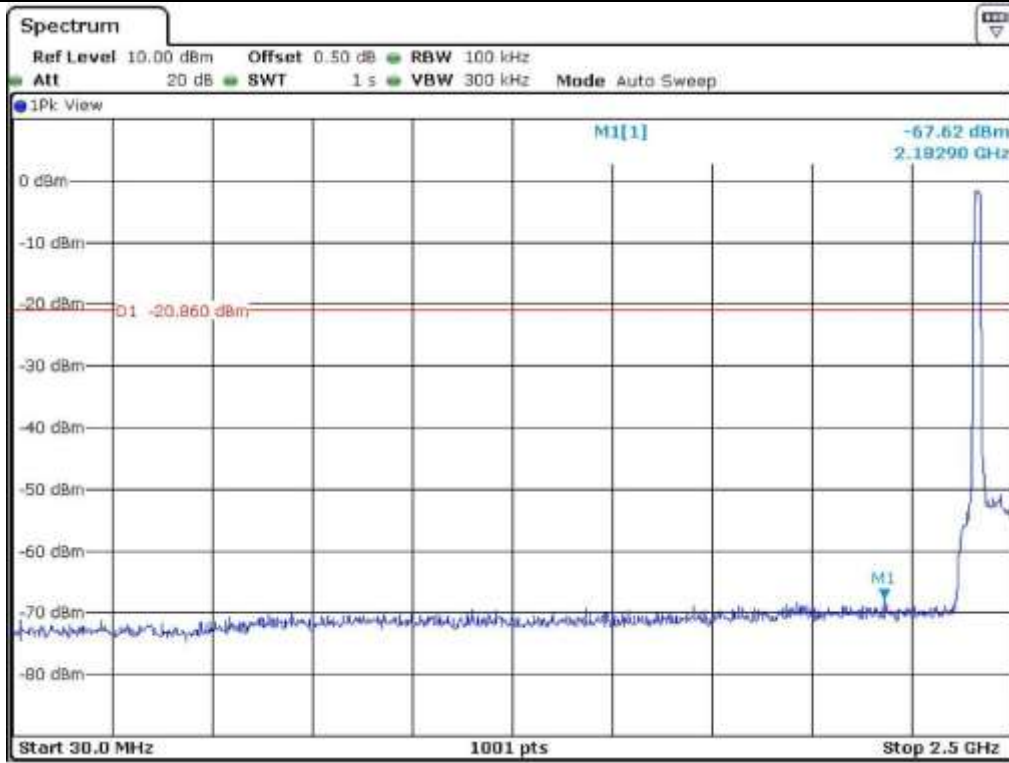
Low Channel



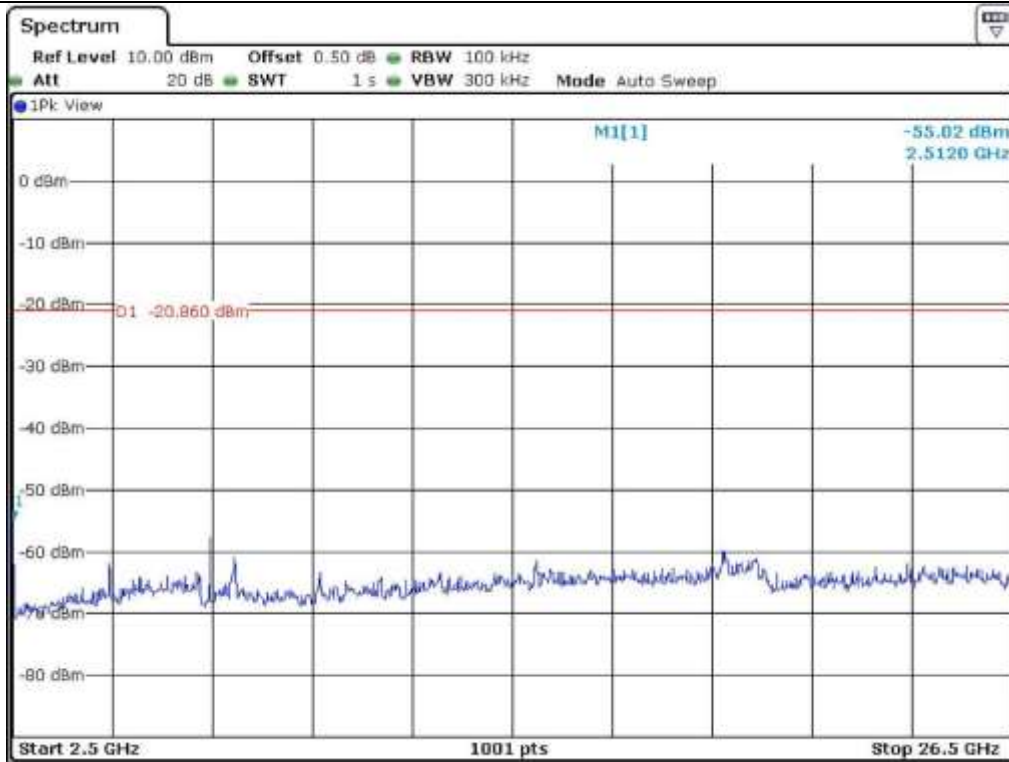
Middle Channel



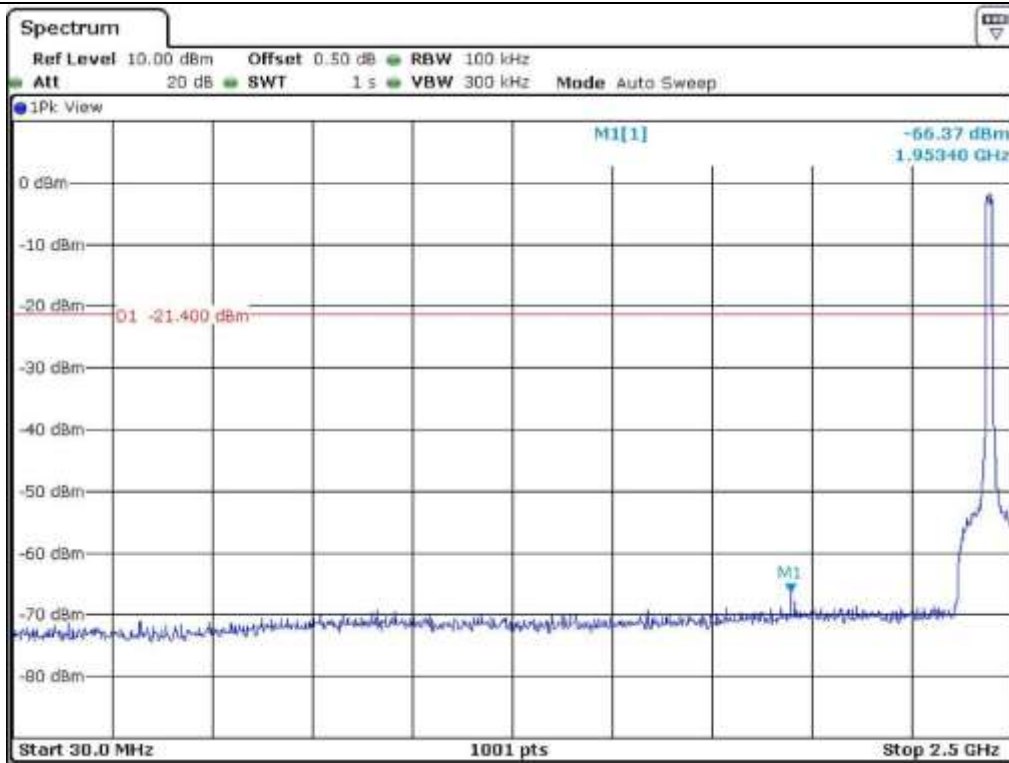
High Channel



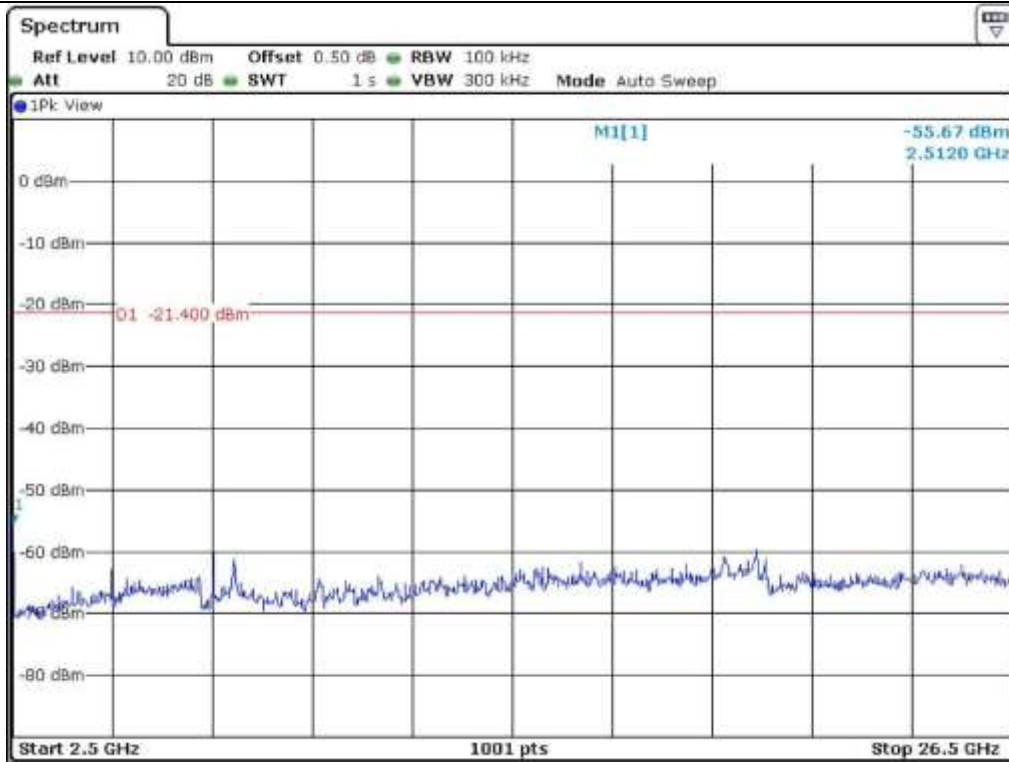
Low Channel



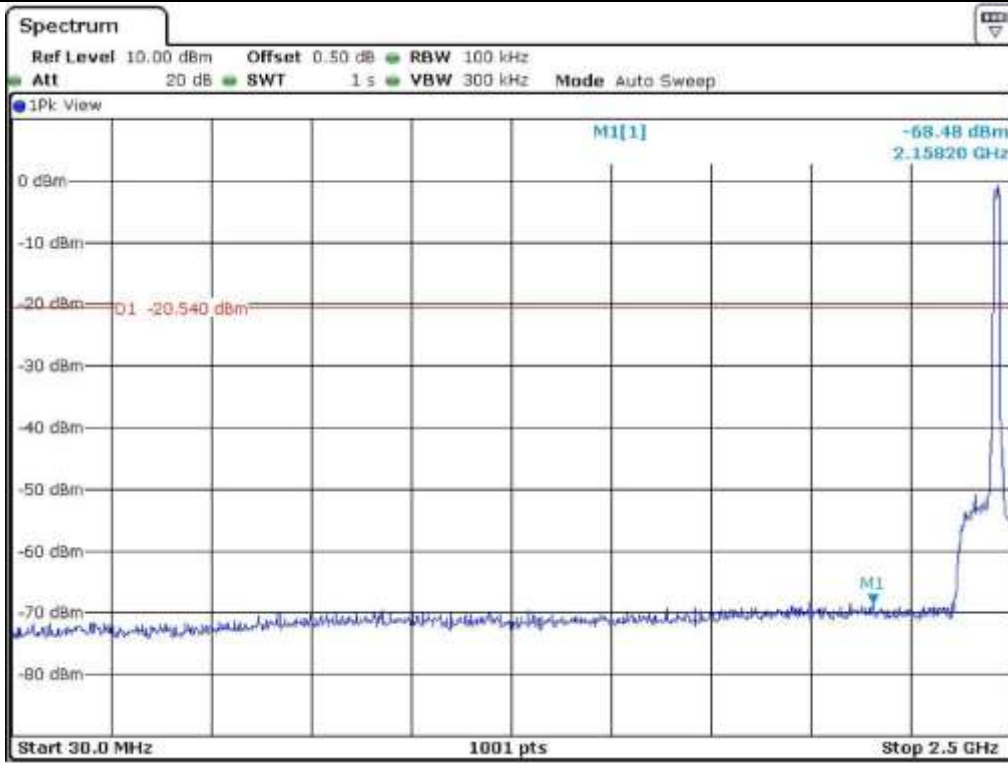
Low Channel



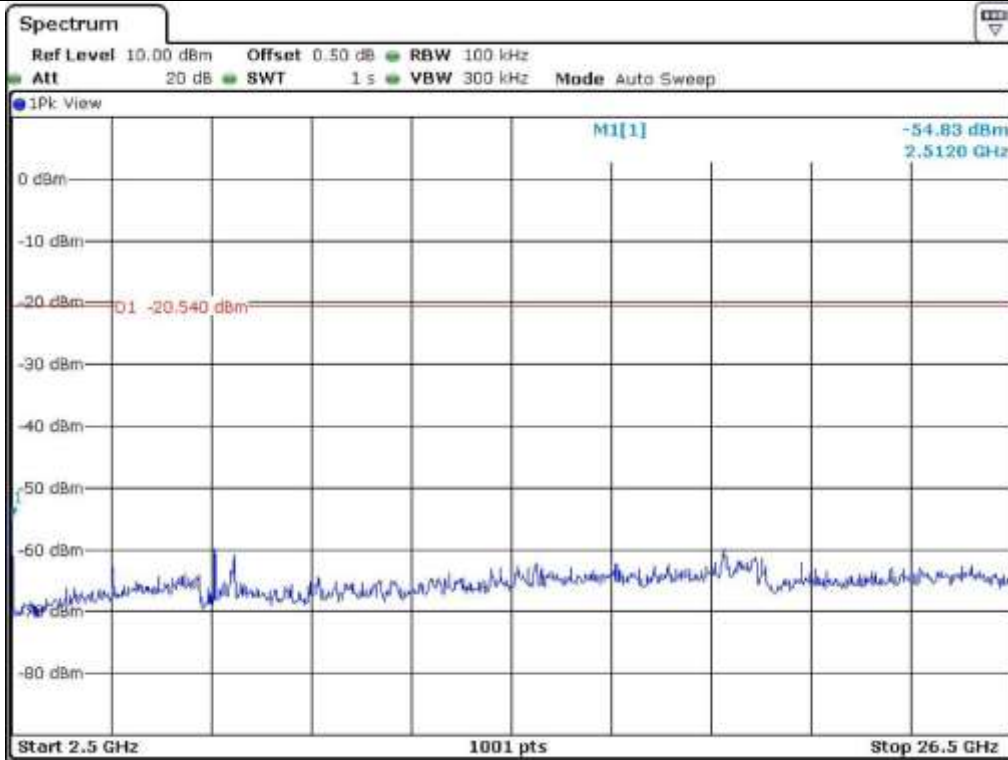
Middle Channel



Middle Channel



High Channel

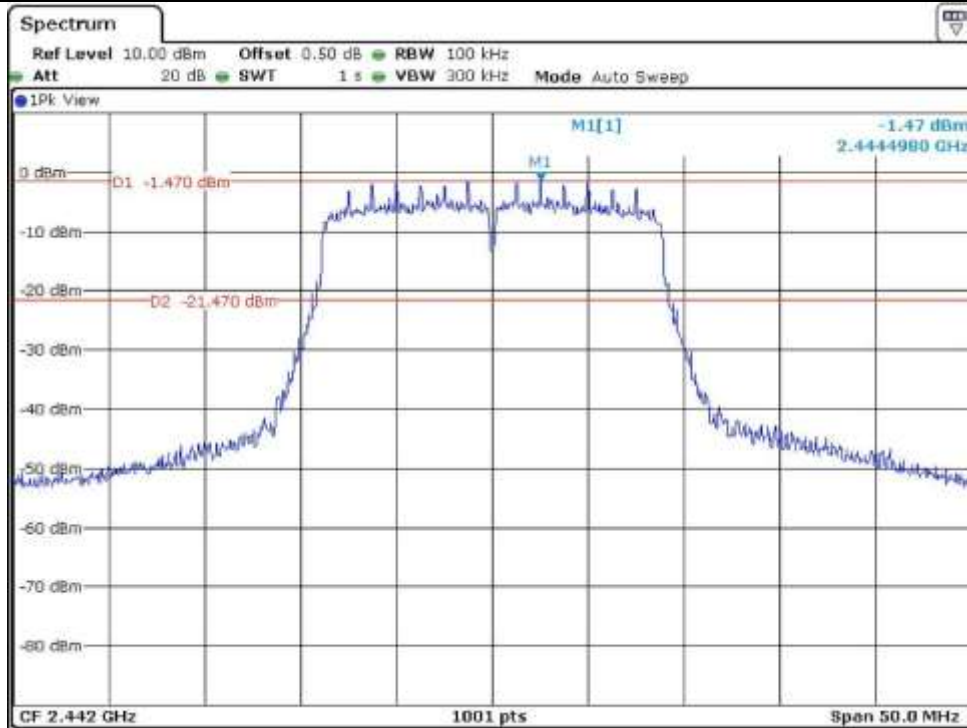


High Channel

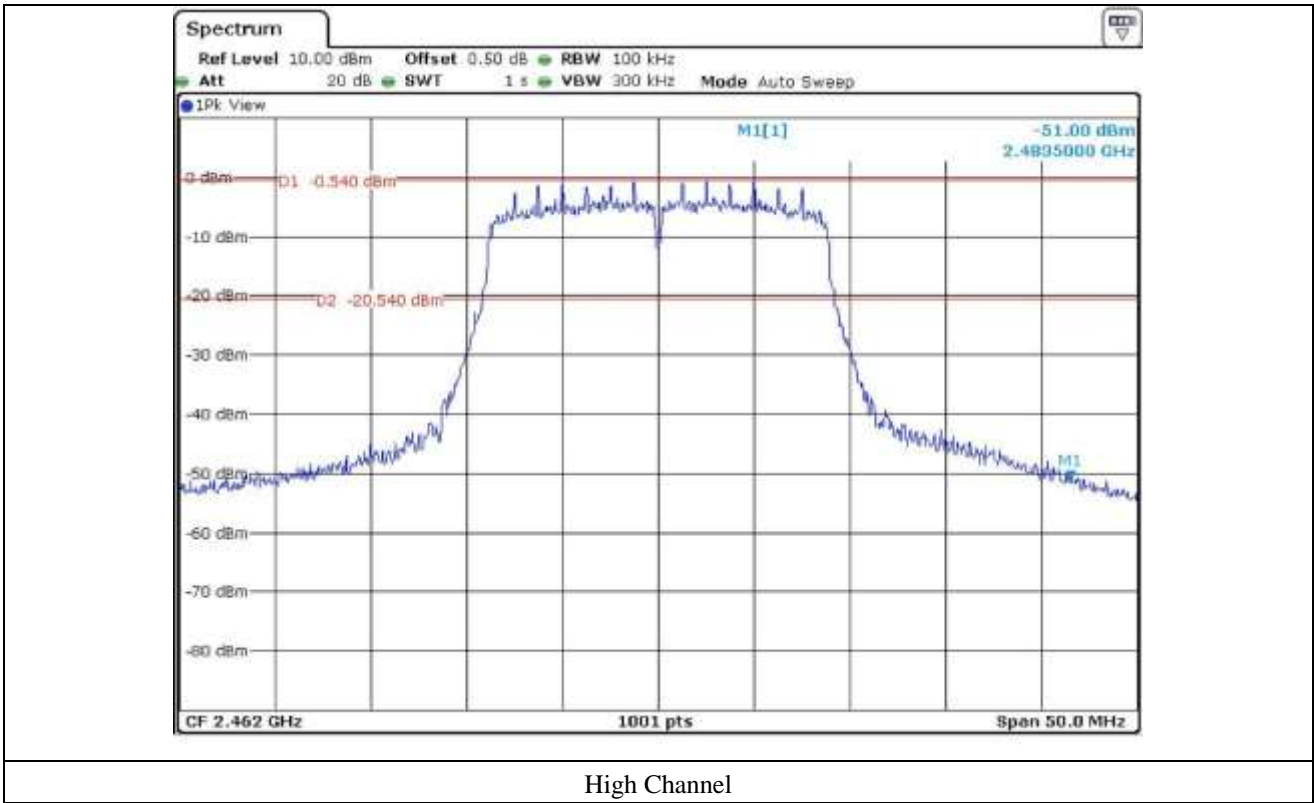
9.5.3 Test data for 802.11n_HT20



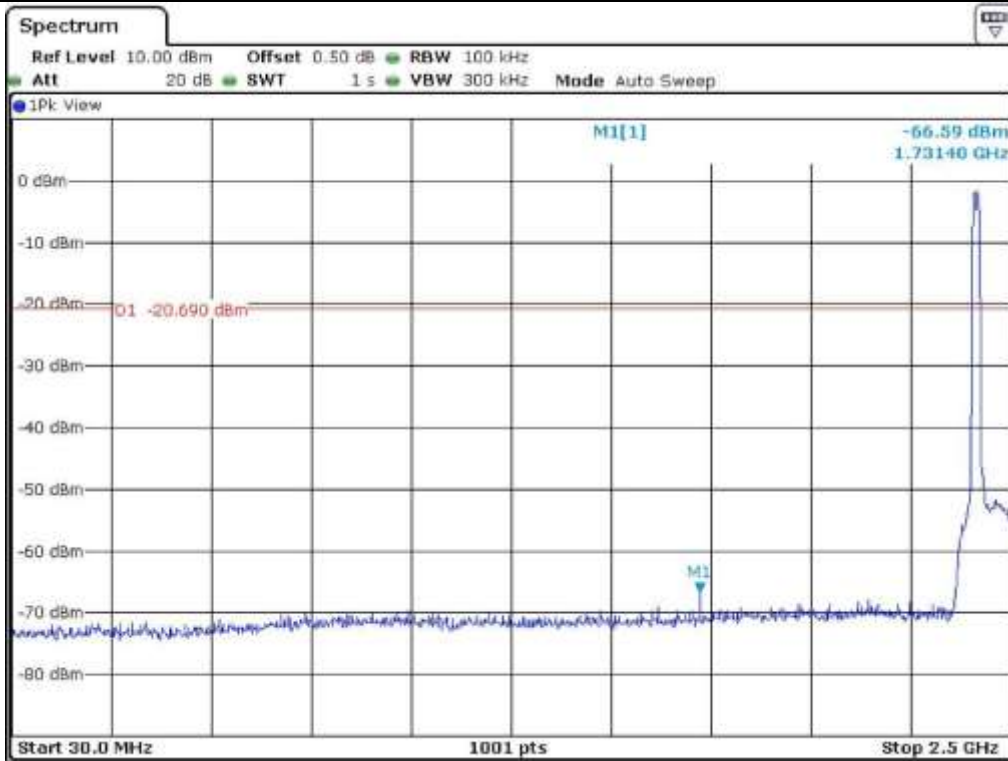
Low Channel



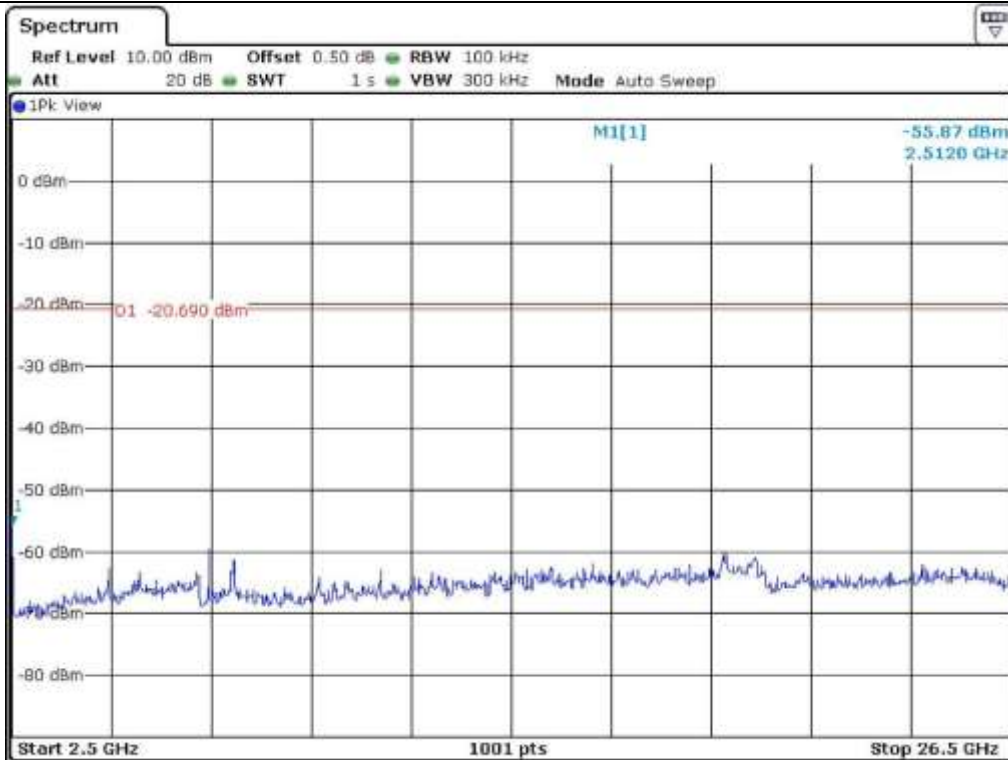
Middle Channel



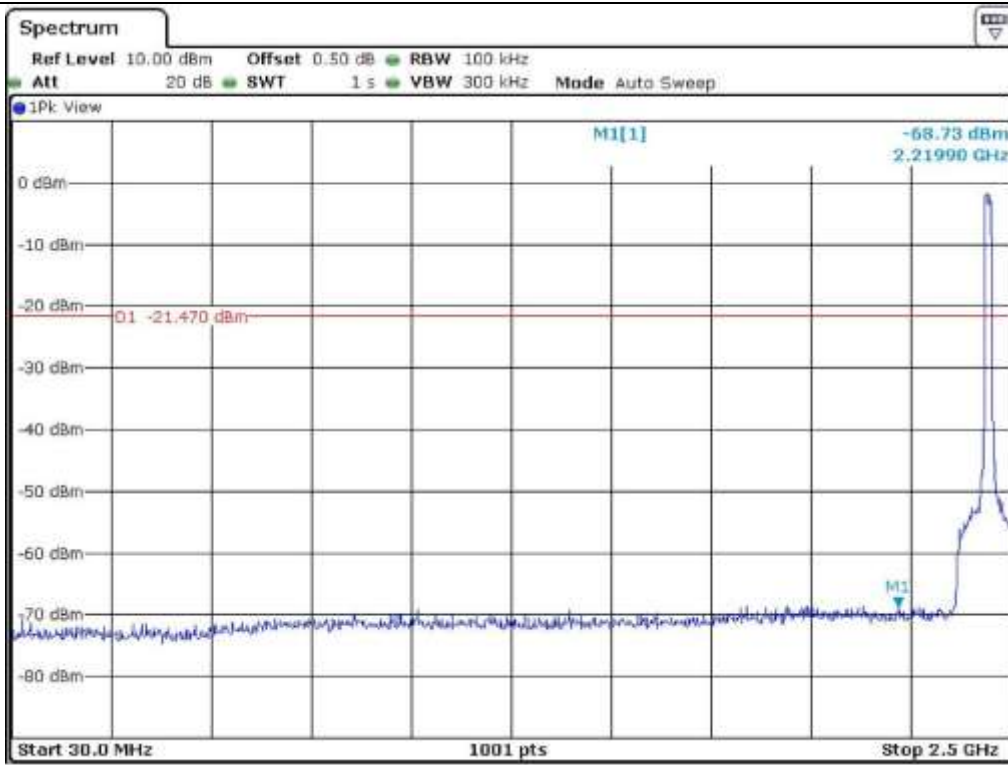
High Channel



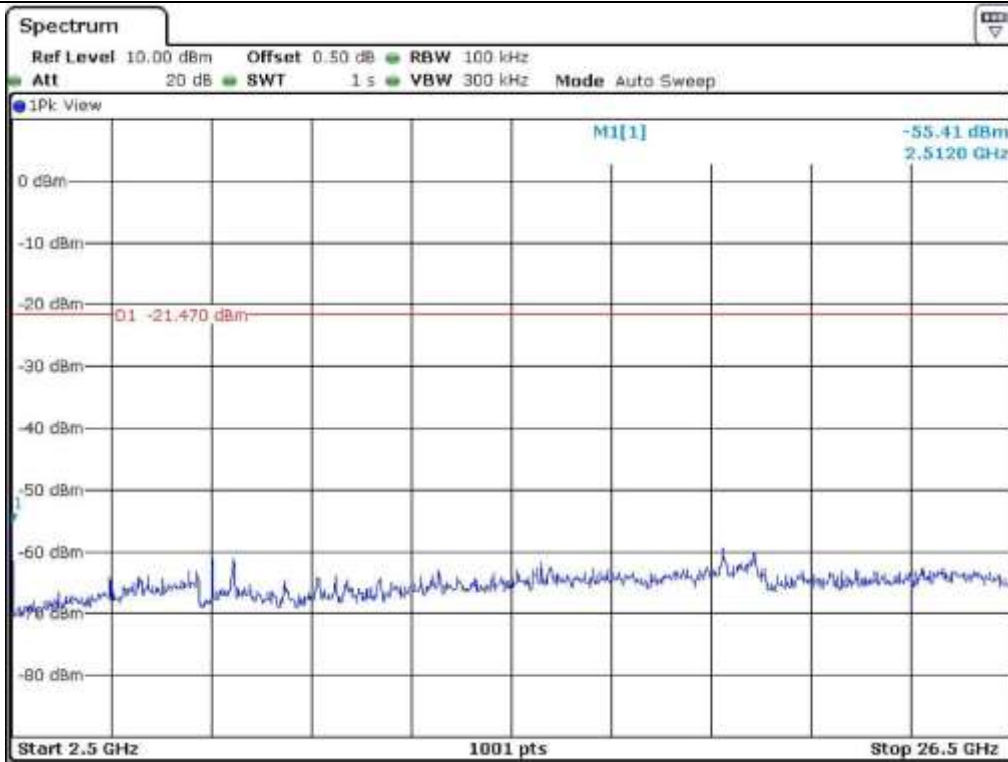
Low Channel



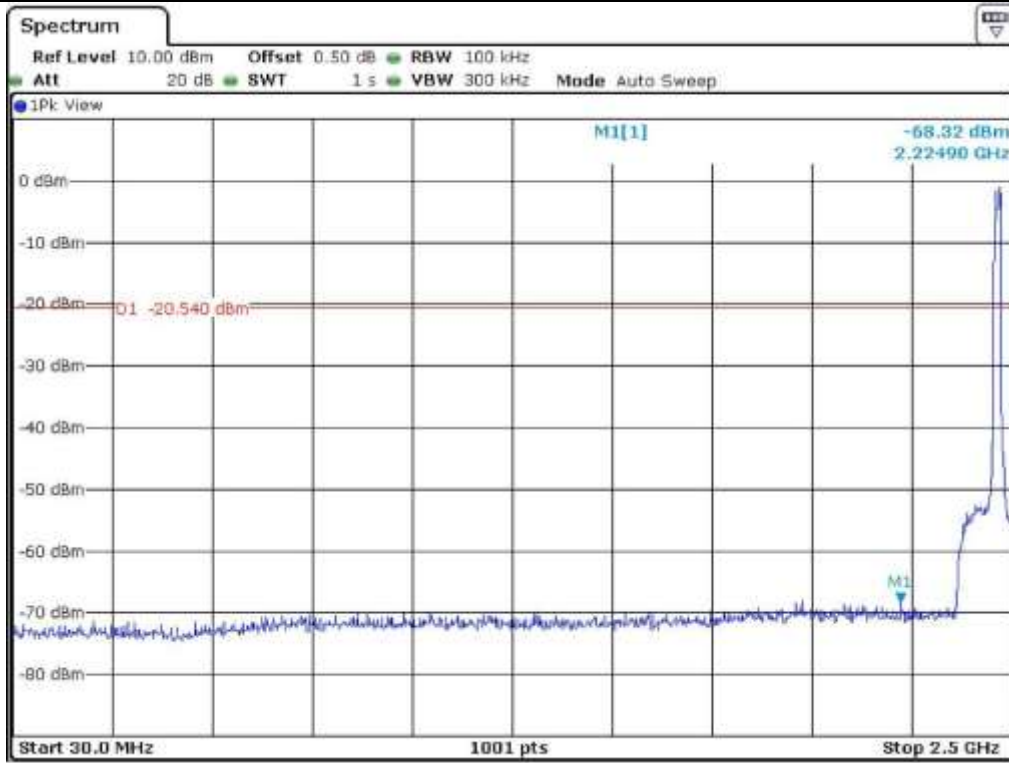
Low Channel



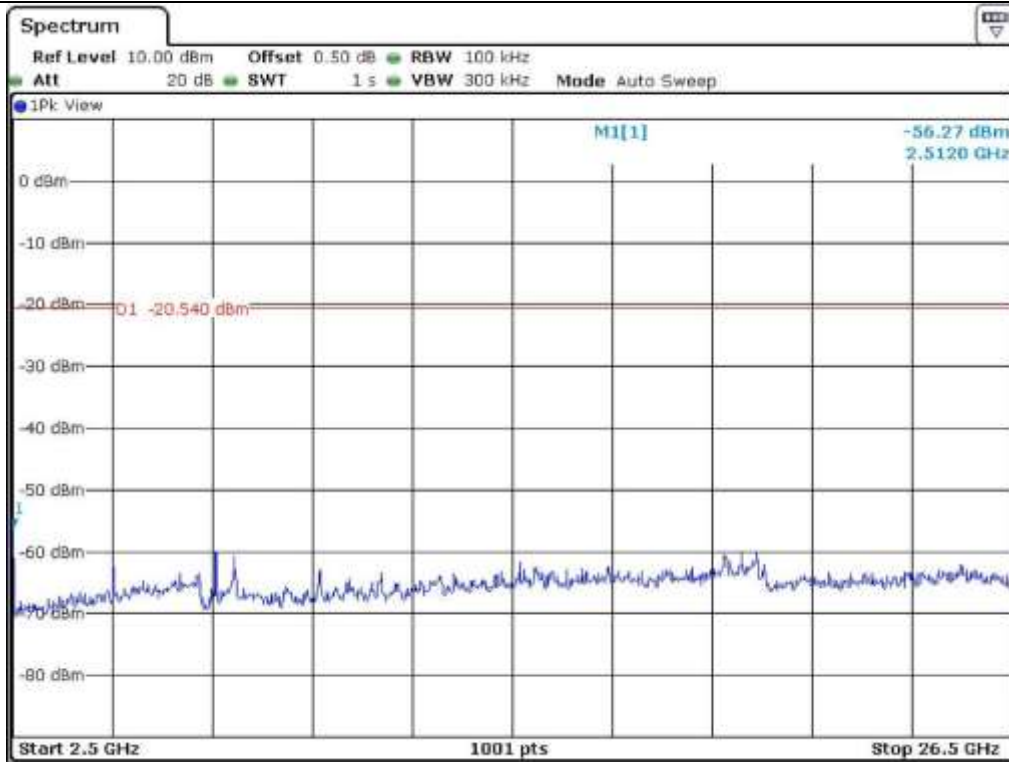
Middle Channel



Middle Channel



High Channel



High Channel

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

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$


Tested by: Hyung-Kwon, Oh / Engineer

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

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$



Tested by: Hyung-Kwon, Oh / Engineer

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

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$



Tested by: Hyung-Kwon, Oh / Engineer

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

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$

Tested by: Hyung-Kwon, Oh / Engineer

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

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$



Tested by: Hyung-Kwon, Oh / Engineer

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

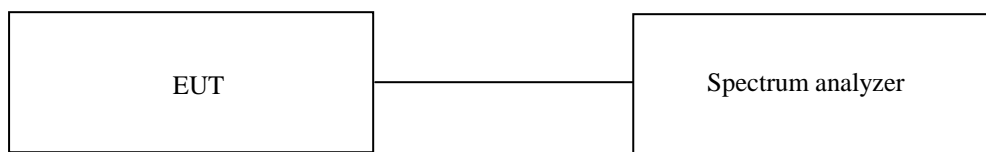
10. PEAK POWER SPECTRUL DENSITY

10.1 Operating environment

Temperature : 21.4 °C
 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.

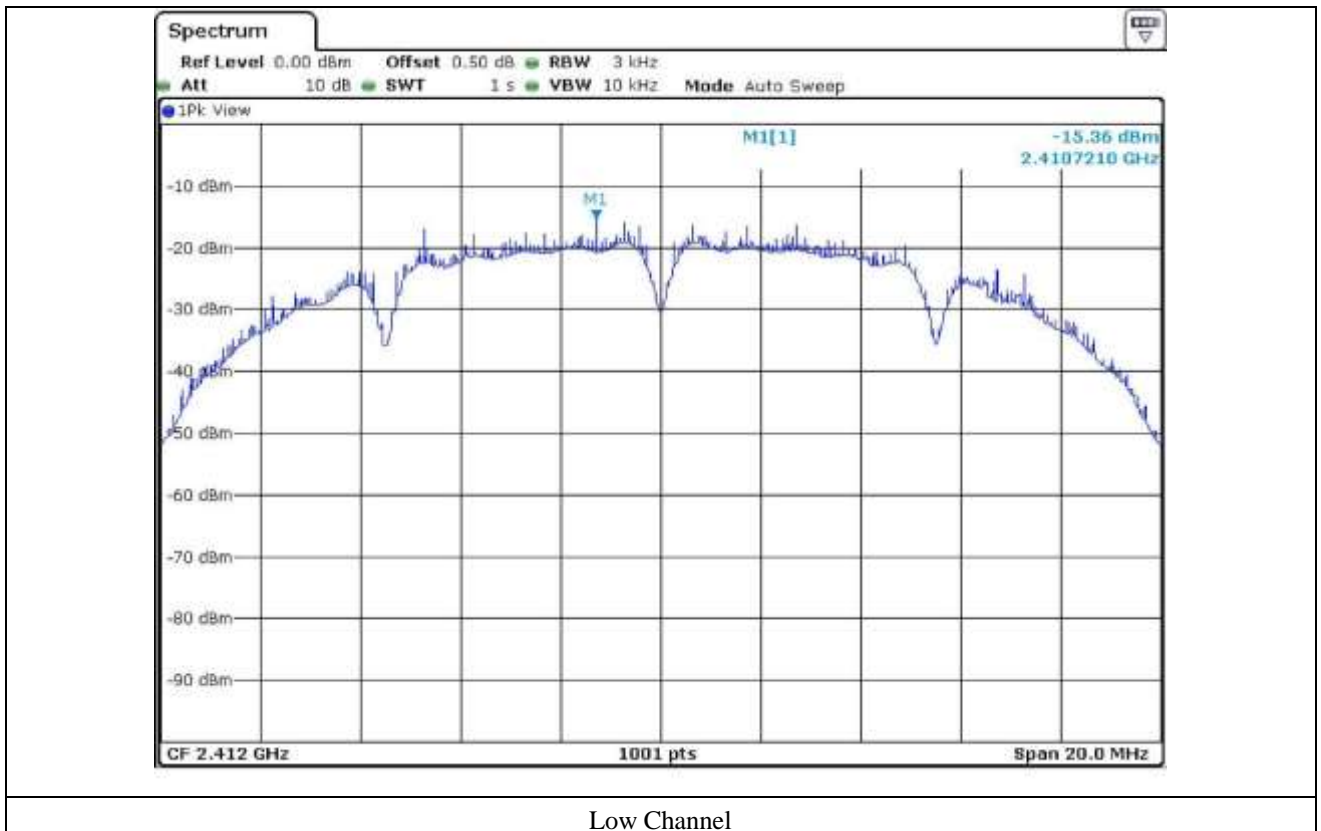
10.4 Test data for 802.11b

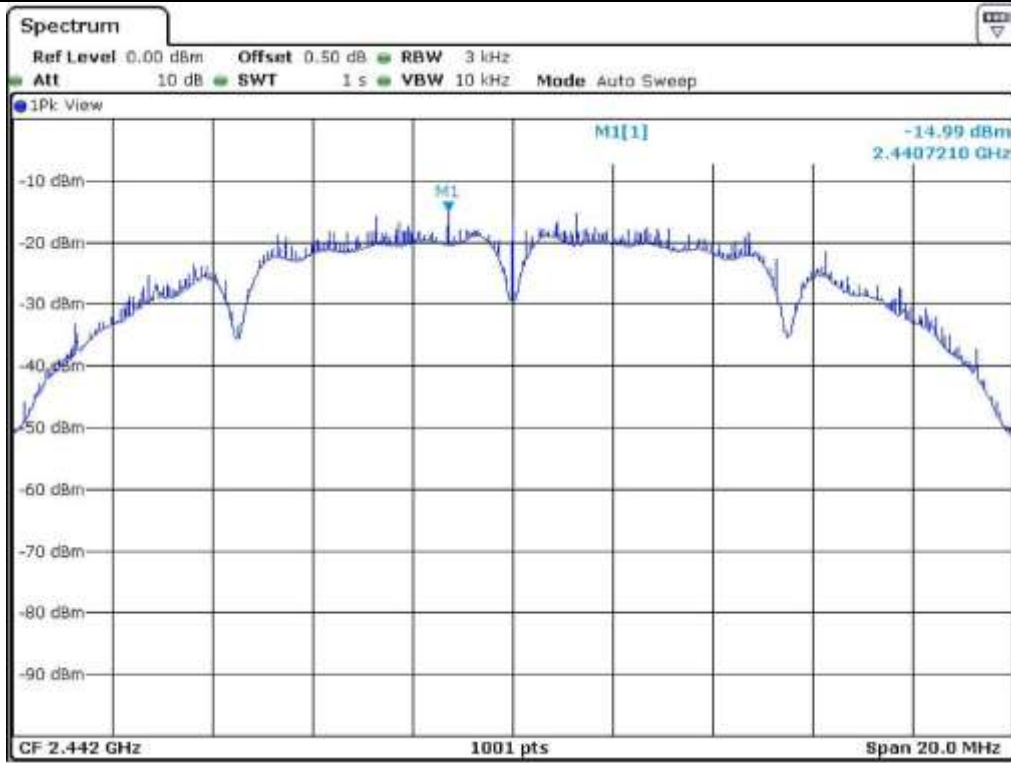
- Test Date : September 08, 2015
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

| 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 |

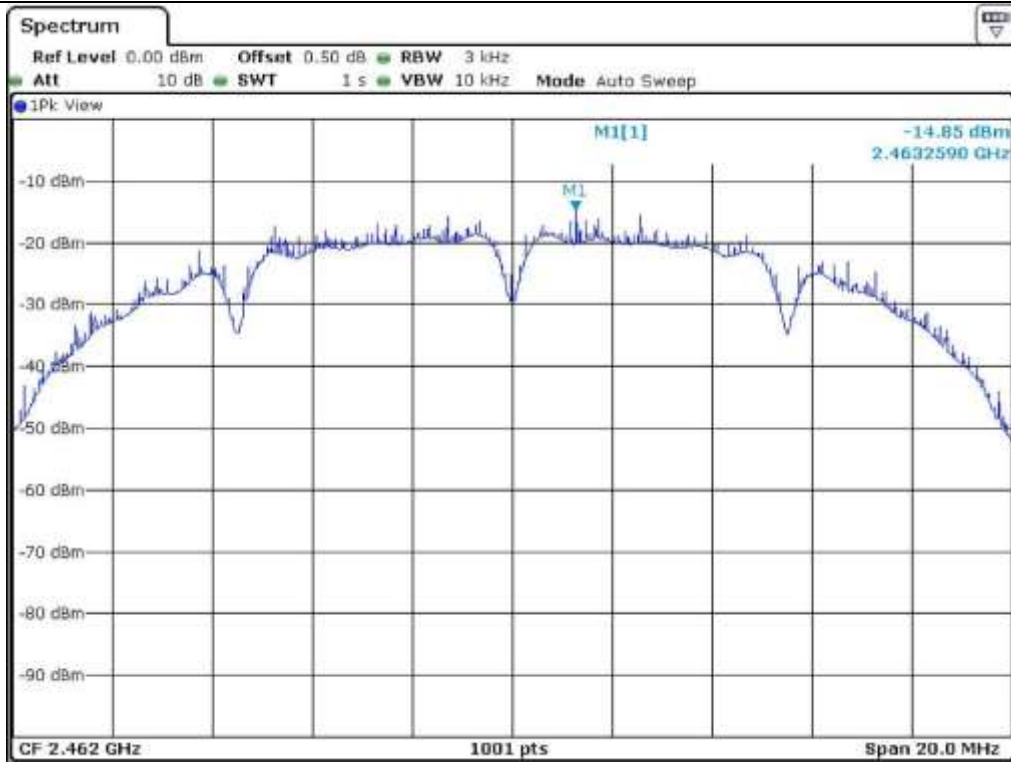
Remark. Margin = Limit – Measured value

Tested by: Hyung-Kwon, Oh / Engineer





Middle Channel



High Channel

10.5 Test data for 802.11g

- Test Date : September 08, 2015

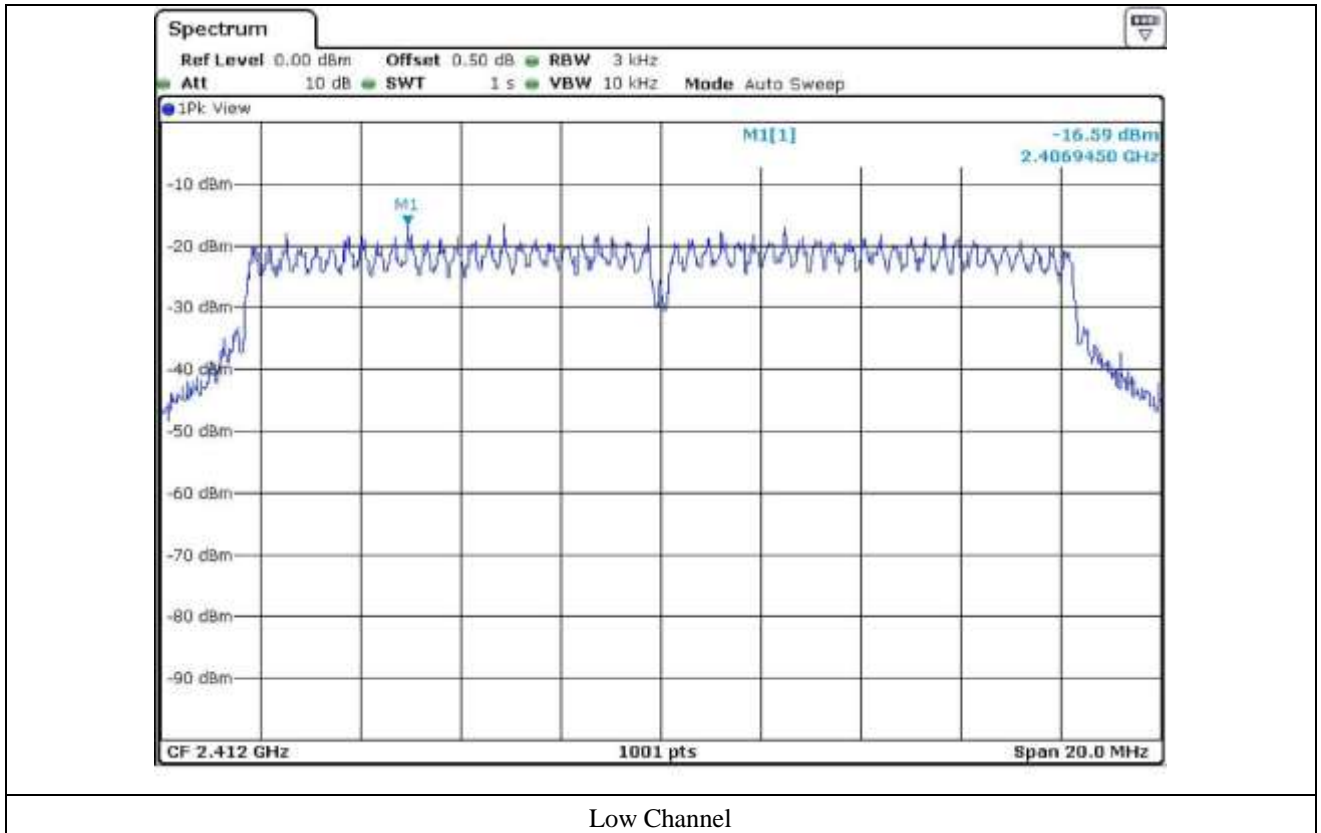
- Test Result : Pass

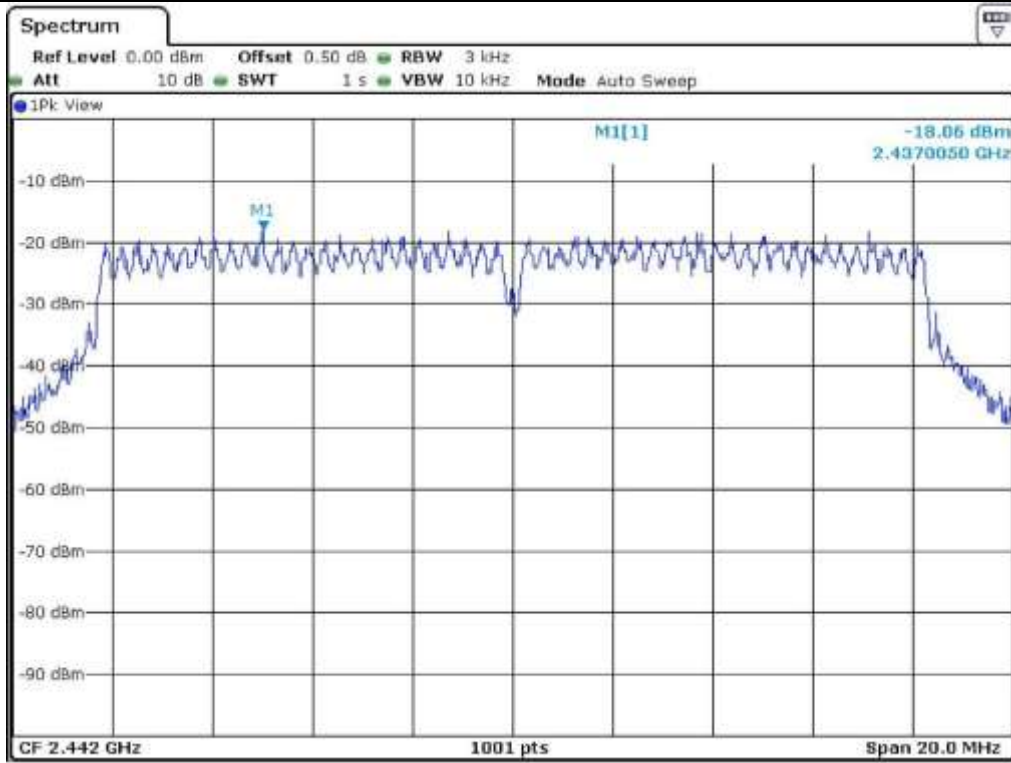
- Operating Condition : Continuous transmitting mode

| 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 |

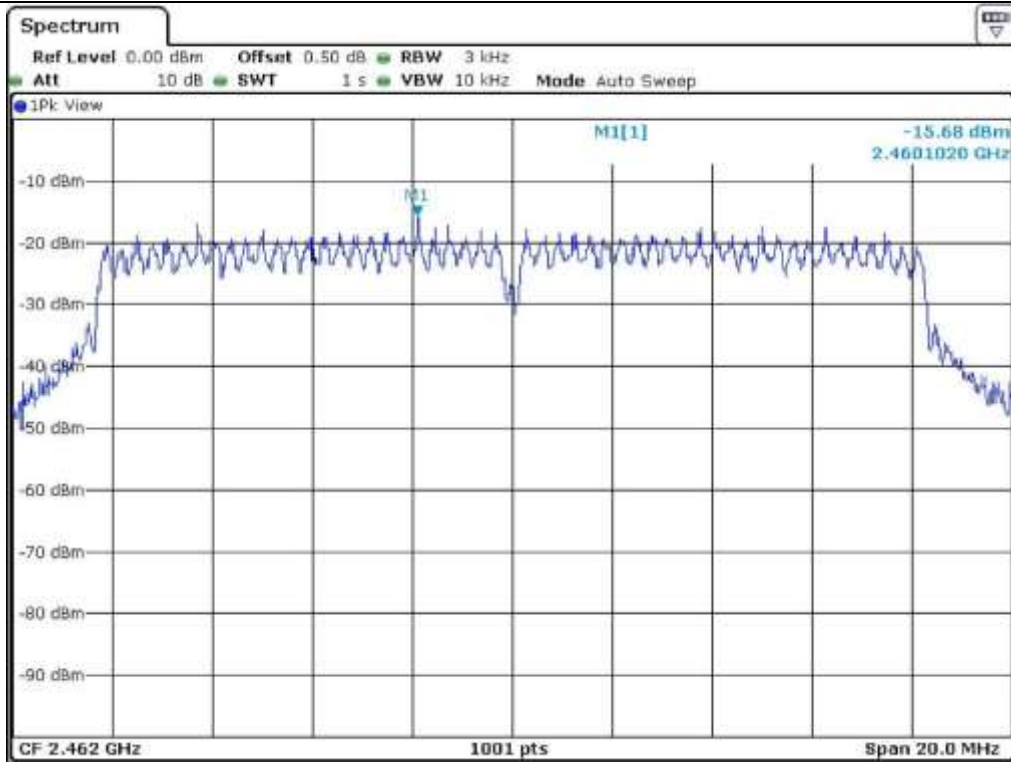
Remark. Margin = Limit – Measured value

Tested by: Hyung-Kwon, Oh / Engineer





Middle Channel



High Channel

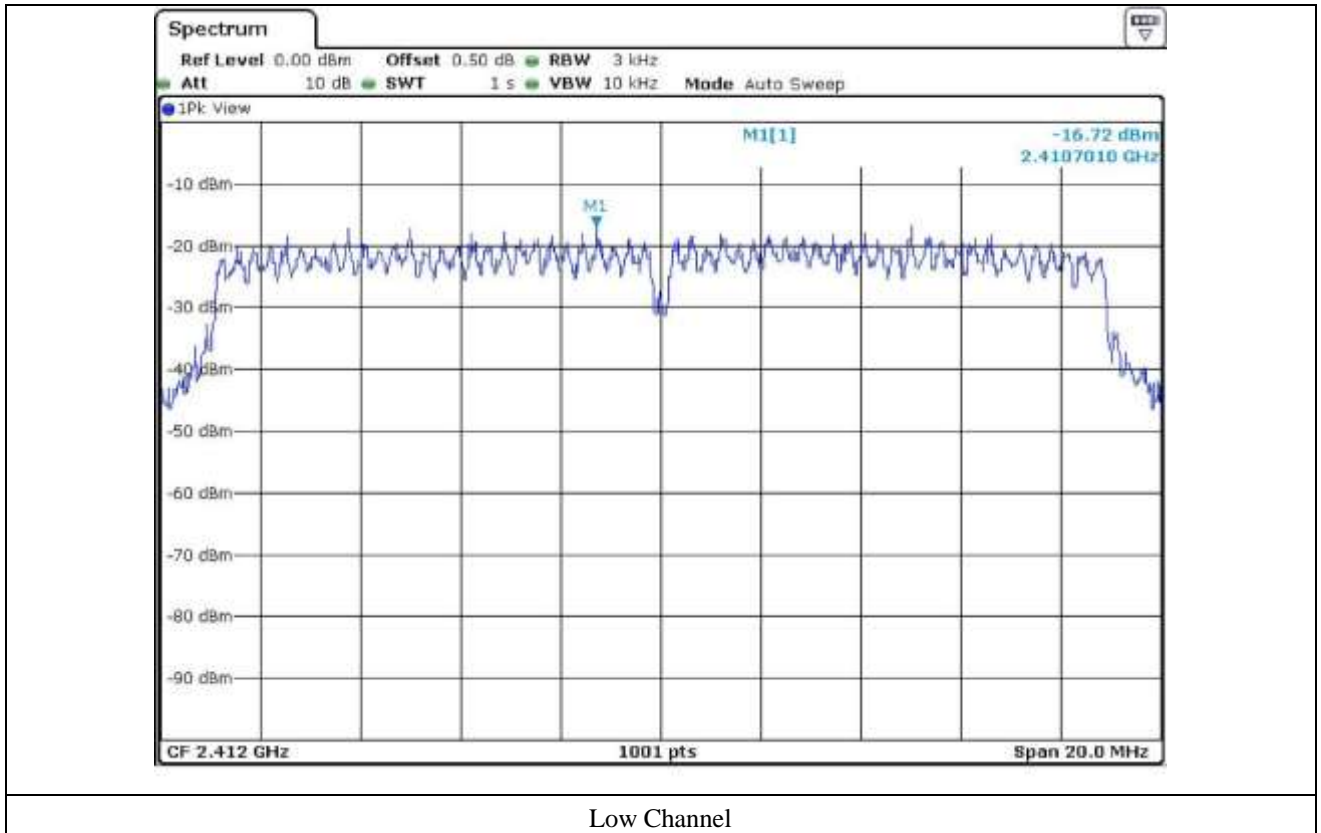
10.6 Test data for 802.11n_HT20

- Test Date : September 08, 2015
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

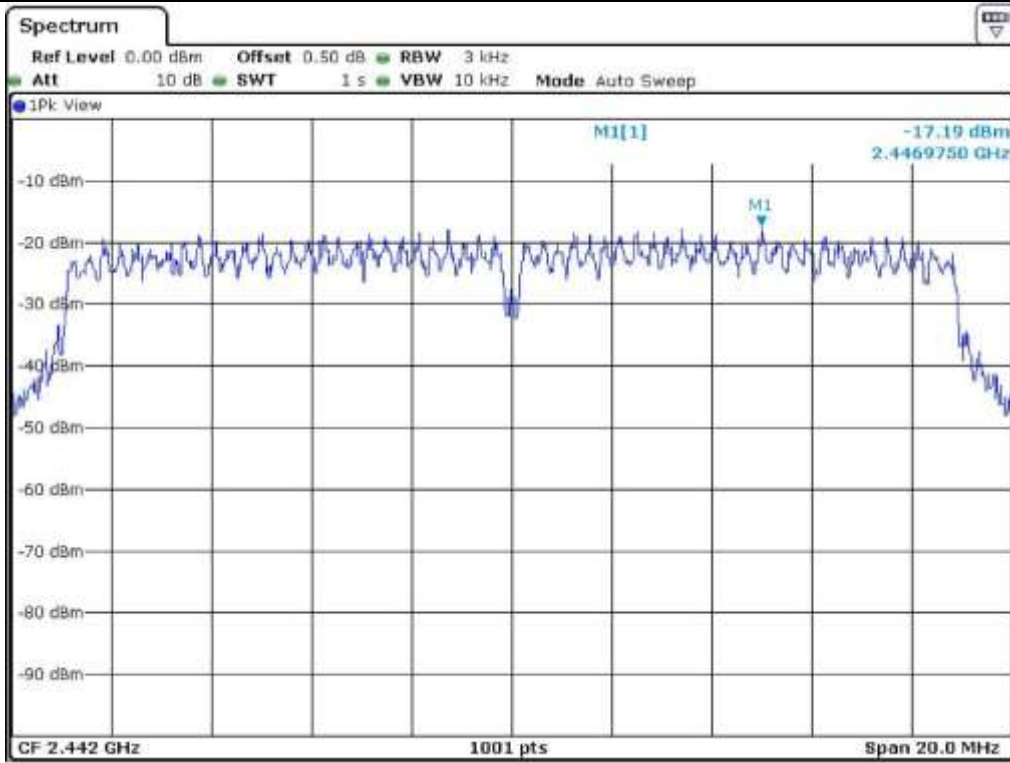
| CHANNEL | FREQUENCY(MHz) | MEASURED VLAUE (dBm) | LIMIT (dBm) | MARGIN (dB) |
|---------|----------------|----------------------|-------------|-------------|
| Low | 2 412 | -16.72 | 8.00 | 24.72 |
| Middle | 2 442 | -17.19 | 8.00 | 25.19 |
| High | 2 462 | -16.53 | 8.00 | 24.53 |

Remark. Margin = Limit – Measured value

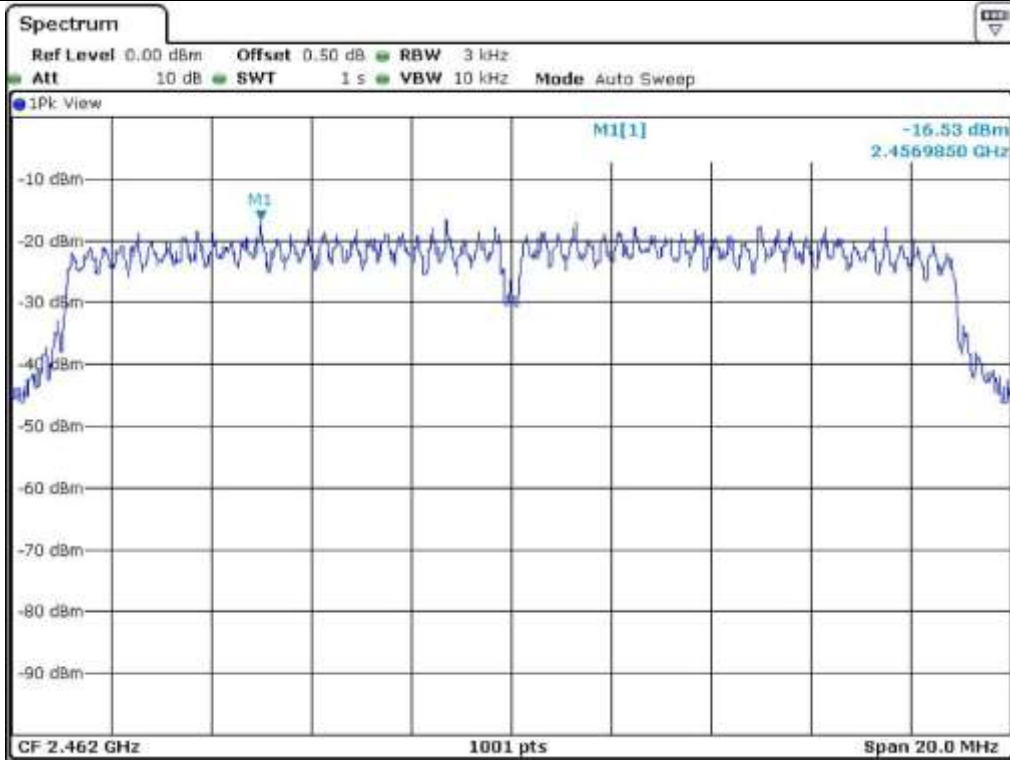
Tested by: Hyung-Kwon, Oh / Engineer



Low Channel



Middle Channel



High Channel

11. RADIATED EMISSION TEST

11.1 Operating environment

Temperature : 21.4 °C
 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.

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 °C

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

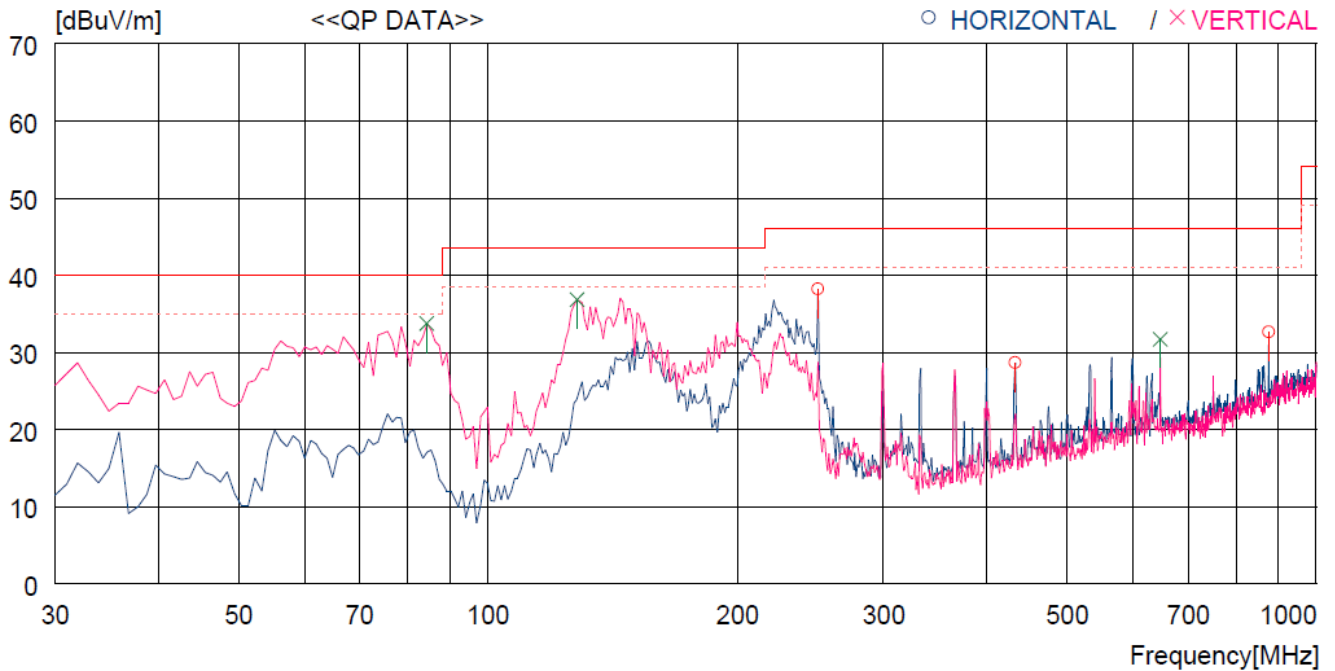
Result : PASSED

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 |

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

11.5 Test data for 802.11g

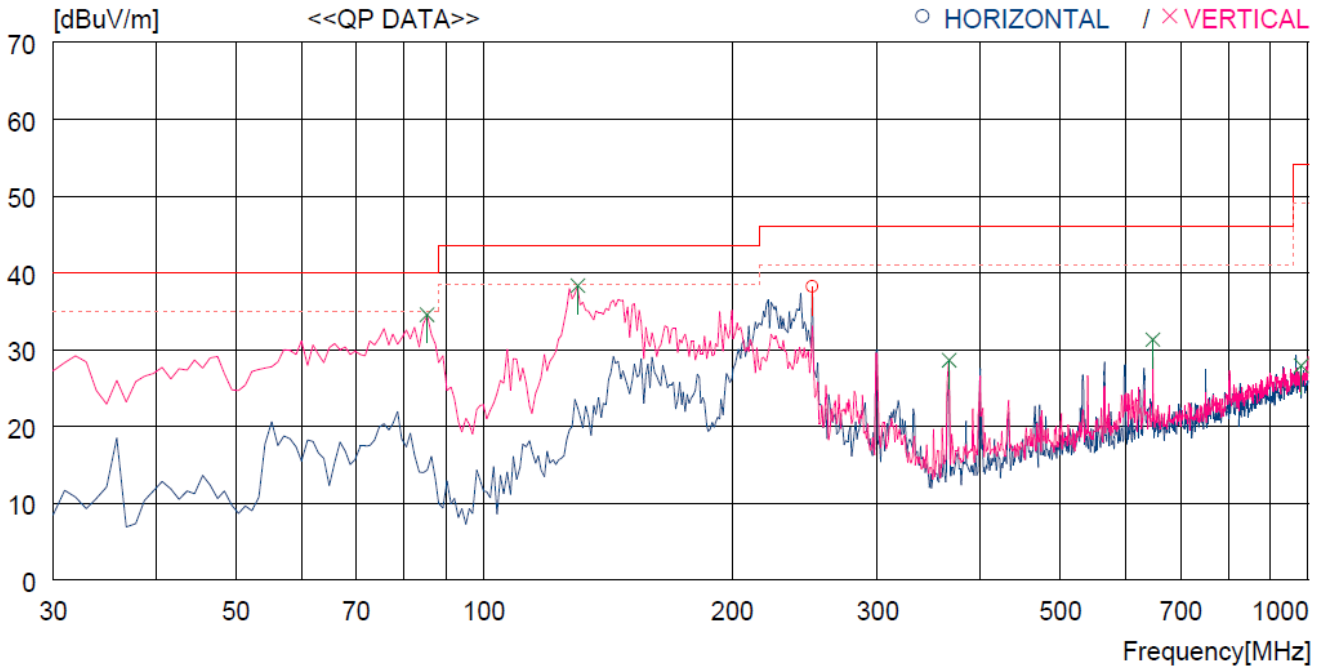
11.5.1 Test data for 30 MHz ~ 1 000 MHz

Humidity Level : 45.1 % R.H. Temperature: 21.4 °C
 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 |

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

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 °C

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

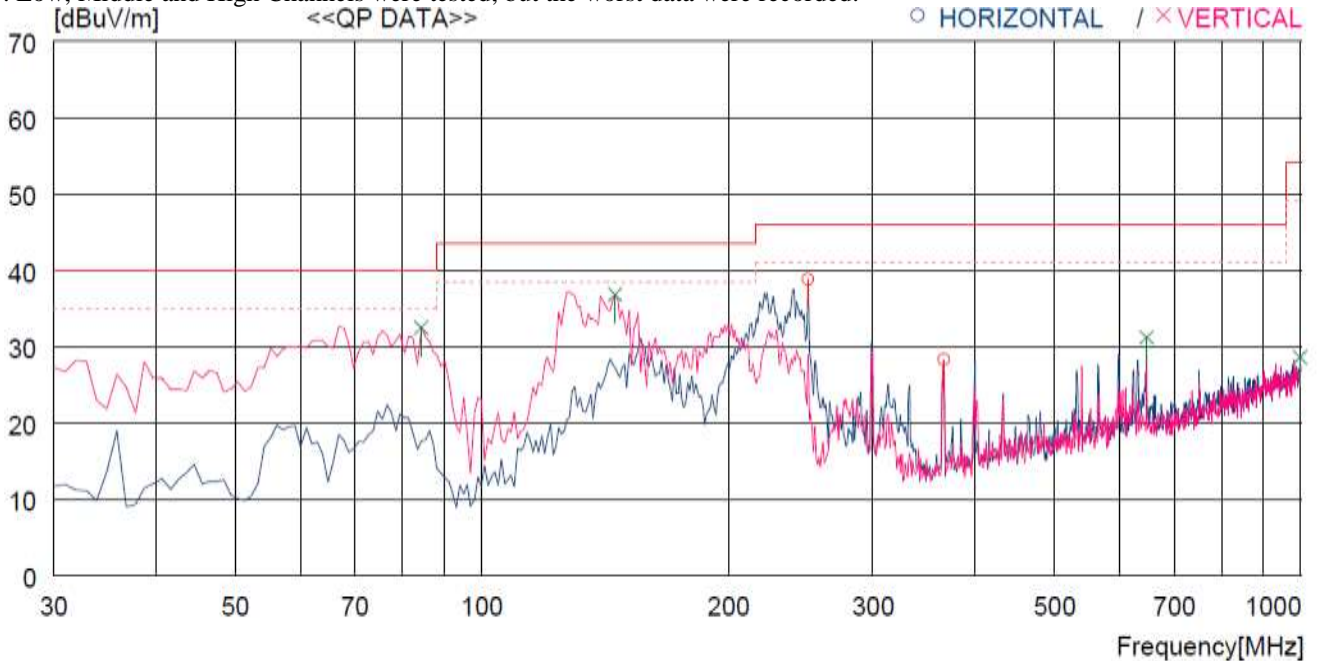
Result : PASSED

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 |

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

12. CONDUCTED EMISSION TEST

12.1 Operating environment

Temperature : 21.4 °C
 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.

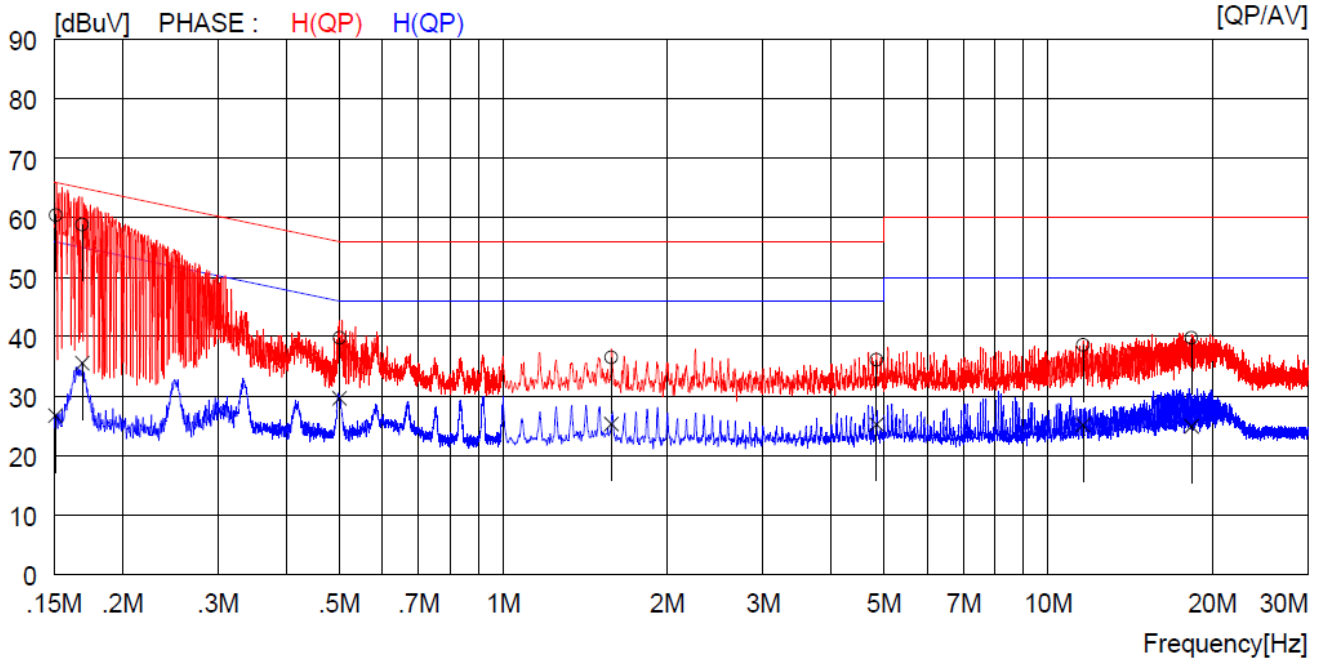
12.3 Test equipment used

| 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.

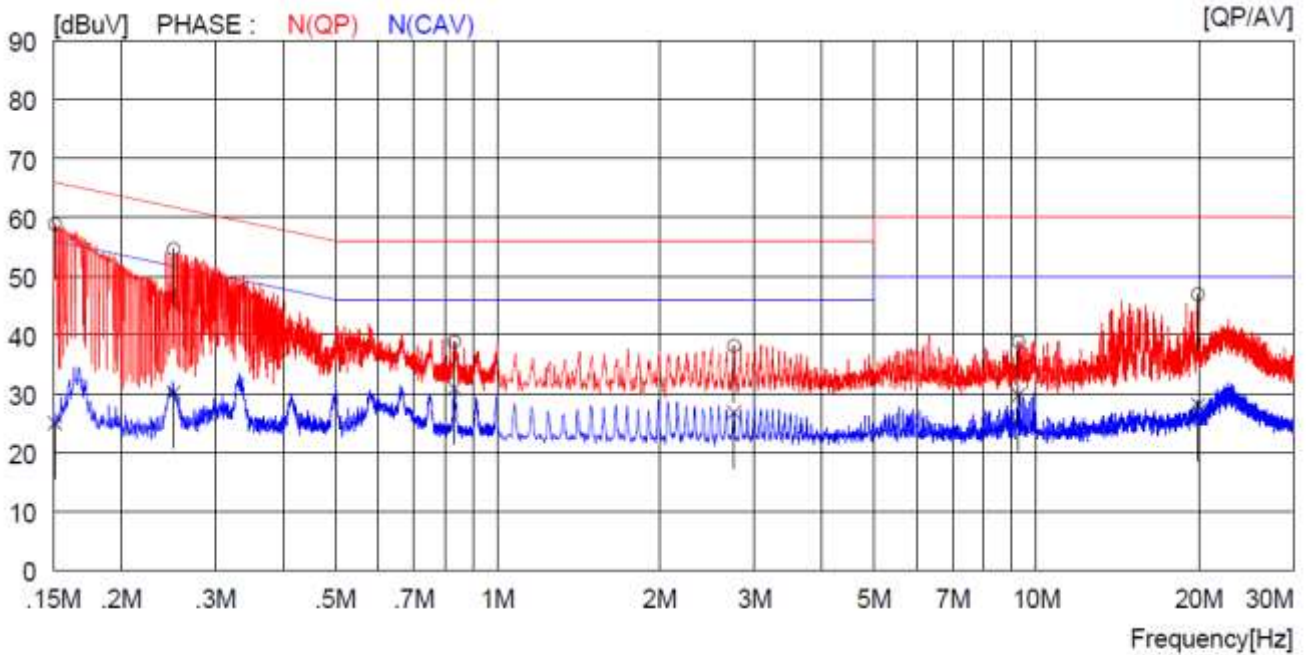
12.4 Test data

- Test Date : September 09, 2015
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



| NO | FREQ [MHz] | READING | | C.FACTOR [dB] | RESULT | | LIMIT | MARGIN | PHASE | | | |
|----|---------------|--------------|--------------|------------------|--------------|--------------|-------|--------|-------|------|------|--------|
| | | QP [dBuV] | AV [dBuV] | | QP [dBuV] | AV [dBuV] | | | | | | |
| 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) |

- Tested Line : NEUTRAL LINE



| NO | FREQ [MHz] | READING | | C.FACTOR [dB] | RESULT | | LIMIT | | MARGIN | PHASE | | |
|----|---------------|--------------|--------------|------------------|--------------|--------------|--------------|--------------|--------|-------|------|--------|
| | | QP [dBuV] | AV [dBuV] | | QP [dBuV] | AV [dBuV] | QP [dBuV] | AV [dBuV] | | | | |
| 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.

Tested by: Hyung-Kwon, Oh / Engineer