

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

**Test Report No.** : OT-199-RWD-045  
**AGR No.** : A195A-069  
**Applicant** : BBB Inc.  
**Address** : 28, Yatap-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea  
**Manufacturer** : BBB Inc.  
**Address** : 28, Yatap-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea  
**Type of Equipment** : Immunoassay Analyzer  
**FCC ID.** : 2AKGP-MB100  
**Model Name** : MB-100  
**Multiple Model Name** : N/A  
**Serial number** : N/A  
**Total page of Report** : 72 pages (including this page)  
**Date of Incoming** : May 13, 2019  
**Date of issue** : September 24, 2019

## 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:



Ha-Ram Lee / Assistant Manager  
ONETECH Corp.

Approved by:



Jae-Ho Lee / Chief Engineer  
ONETECH Corp.

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**Revision History**

| Issued Report No. | Issued Date        | Revisions     | Effect Section |
|-------------------|--------------------|---------------|----------------|
| OT-199-RWD-045    | September 24, 2019 | Initial Issue | All            |
|                   |                    |               |                |
|                   |                    |               |                |

## 1. VERIFICATION OF COMPLIANCE

Applicant : BBB Inc.  
Address : 28, Yatap-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea  
Contact Person : Jaekyu Choi / CEO  
Telephone No. : +82-2-565-9653  
FCC ID. : 2AKGP-MB100  
Model Name : MB-100  
Brand Name : markB Analyzer  
Serial Number : N/A  
Date : September 24, 2019

|   |                                      |
|---|--------------------------------------|
| EQUIPMENT CLASS   | DTS-Digital Transmission System      |
| E.U.T. DESCRIPTION                                      | Immnuoassay Analyzer                 |
| THIS REPORT CONCERNS                                    | Original Grant                       |
| MEASUREMENT PROCEDURES                                  | ANSI C63.10: 2013                    |
| TYPE OF EQUIPMENT TESTED                                | Pre-Production                       |
| KIND OF EQUIPMENT                                       | Certification                        |
| AUTHORIZATION REQUESTED                                 |                                      |
| EQUIPMENT WILL BE OPERATED<br>UNDER FCC RULES PART(S)   | FCC PART 15 SUBPART C Section 15.247 |
| Modifications on the Equipment to Achieve<br>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) | 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 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea

- Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-14617/ G-10666 / T-1842

IC (Industry Canada) – Registration No. Site# 3736A-3

- Site Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

### 3. GENERAL INFORMATION

#### 3.1 Product Description

The BBB Inc., Model MB-100 (referred to as the EUT in this report) is an Immunoassay Analyzer. Product specification information described herein was obtained from product data sheet or user's manual.

|   |                              |   |  |
|---|------------------------------|---|--|
| Device Type   | Immunoassay Analyzer         |   |  |
| Operating Frequency                                   | Bluetooth LE                 | 2 402 MHz ~ 2 480 MHz                     |  |
|   | WLAN<br>2.4 GHz Band         | 2 412 MHz ~ 2 462 MHz (802.11b/g/n(HT20)) |  |
|   |                              | 2 422 MHz ~ 2 452 MHz (802.11n(HT40))     |  |
|   | NFC                          | 13.56 MHz                                 |  |
| RF Output Power                                       | Bluetooth LE                 | -6.78 dBm                                 |  |
|   | WLAN<br>2.4 GHz Band         | 802.11b (13.13 dBm)                       |  |
|   |                              | 802.11g (10.67 dBm)                       |  |
|   |                              | 802.11n(HT20) (11.01 dBm)                 |  |
|   |                              | 802.11n(HT40) (10.81 dBm)                 |  |
| Number of Channel                                     | Bluetooth LE                 | 40 Channels                               |  |
|   | WLAN<br>2.4 GHz Band         | 11 Channels                               |  |
|   |                              | 1 Channel                                 |  |
| Modulation Type                                       | Bluetooth LE                 | DSSS Modulation(GFSK)                     |  |
|   | WLAN<br>2.4 GHz Band         | DSSS Modulation(DBPSK/DQPSK/CCK)          |  |
|   |                              | OFDM Modulation(BPSK/QPSK/16QAM/64QAM)    |  |
|   | NFC                          | ASK                                       |  |
| Antenna Type  | Bluetooth LE                 | FPC Antenna                               |  |
|   | WLAN<br>2.4 GHz Band         |   |  |
|   | NFC                          | PCB Antenna                               |  |
| Antenna Gain  | Bluetooth LE                 | 1.74 dBi                                  |  |
|   | WLAN                         |   |  |
|   | 2.4 GHz Band                 |   |  |
| List of each Osc. or crystal<br>Freq.(Freq. >= 1 MHz) | 32.768kHz, 13.56 MHz, 32 MHz |   |  |
| Rated Supply Voltage                                  | DC 3.8 V                     |   |  |

### 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   | N/A          | N/A               | -      |
| Sub Board    | N/A          | N/A               | -      |
| NFC Board    | N/A          | N/A               |        |
| Module Board | N/A          | N/A               | -      |
| Display      | N/A          | N/A               |        |
| Main Battery | N/A          | N/A               |        |
| Sub Battery  | N/A          | N/A               | -      |

### 5.2 Peripheral equipment

-None

### 5.3 Configuration of Test System

**Line Conducted Test:** 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.

### 5.4 Antenna Requirement

For intentional device, according to section 15.203 an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

**Antenna Construction:**

The transmitter antenna of the EUT is FPC Antenna, so no consideration of replacement by the user.

## 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) |
|----------------|---|
| Charging 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. MINIMUM 6 dB BANDWIDTH

### 7.1 Operating environment

Temperature : 24 °C

Relative humidity : 47 % 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.          |
|--------------|-----------------|-----------------|---------------|--------------------|
| ■ - FSV30    | Rohde & Schwarz | Signal Analyzer | 101200        | Jul. 24, 2019 (1Y) |

All test equipment used is calibrated on a regular basis.

#### 7.4 Test data for 802.11b WLAN Mode

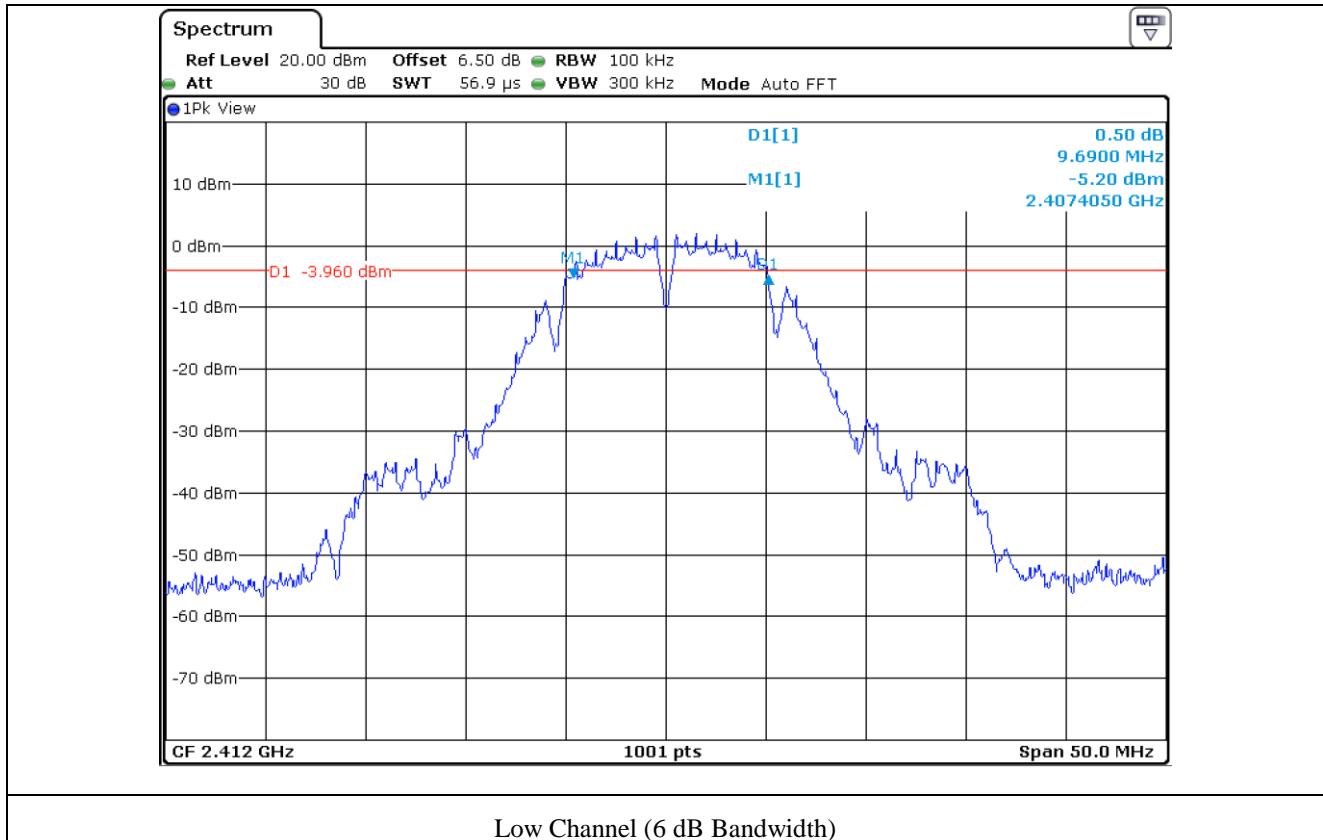
- Test Date : September 11, 2019

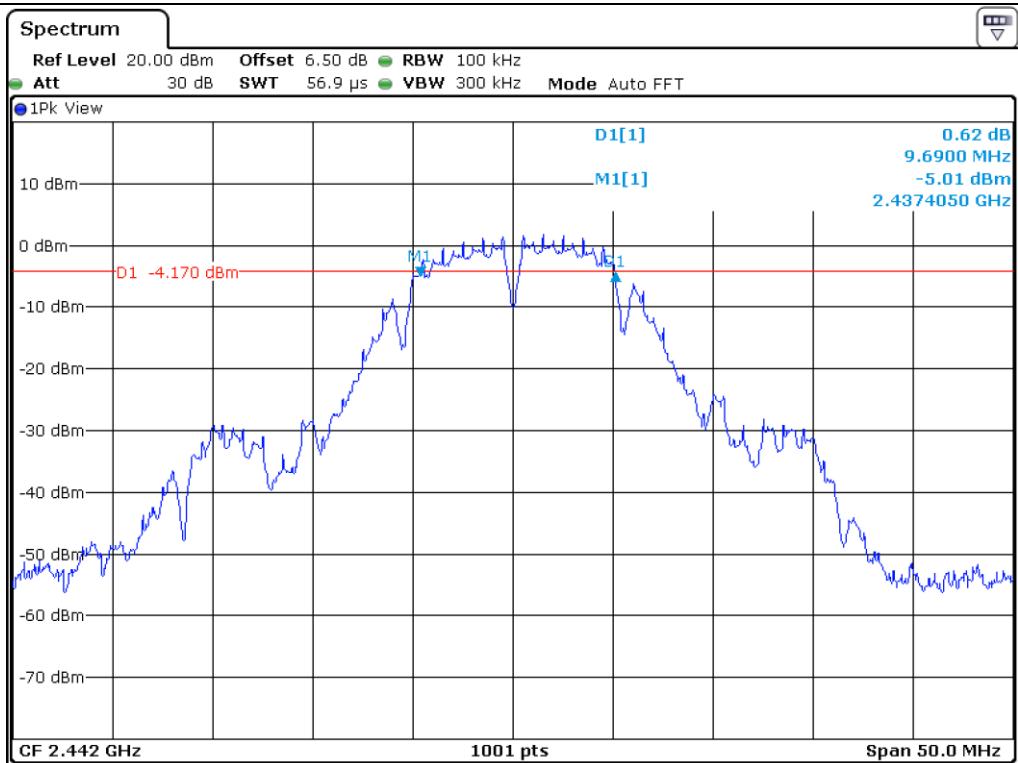
- Test Result : Pass

| CHANNEL | FREQUENCY<br>(MHz) | 6 dB Bandwidth<br>(MHz) | 99 % Occupied<br>Bandwidth (MHz) | LIMIT<br>(kHz) | Bandwidth Margin(MHz) |       |
|---------|--------------------|-------------------------|----------------------------------|----------------|-----------------------|-------|
|         |                    |                         |                                  |                | 6 dB                  | 99 %  |
| Low     | 2 412.00           | 9.69                    | 13.29                            | >500           | 9.19                  | 12.79 |
| Middle  | 2 442.00           | 9.69                    | 13.64                            | >500           | 9.19                  | 13.14 |
| High    | 2 462.00           | 8.69                    | 13.54                            | >500           | 8.19                  | 13.04 |

Remark. Margin = Measured Value - Limit

Tested by: Yu-Seog Sim / Assistant Manager





Middle Channel (6 dB Bandwidth)



High Channel (6 dB Bandwidth)

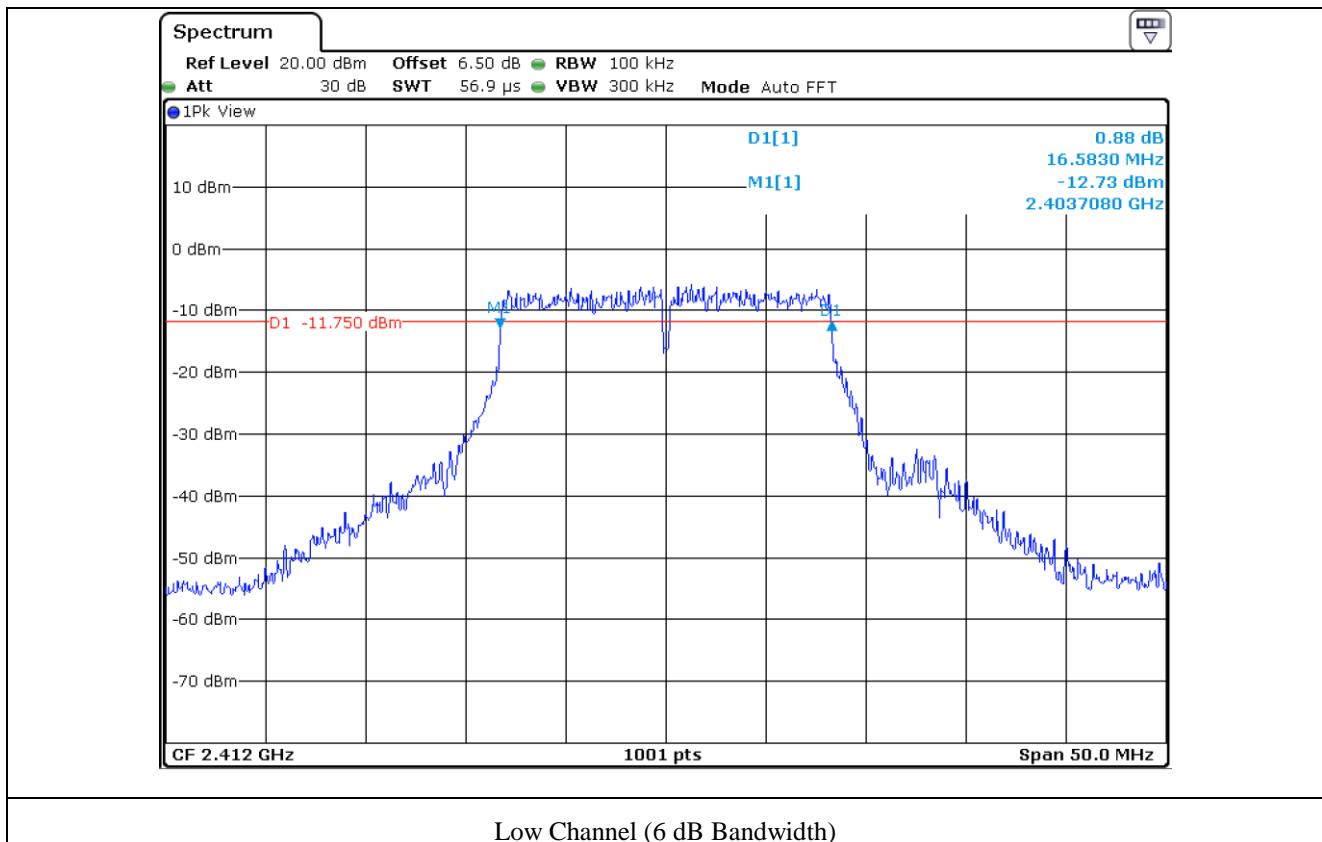
### 7.5 Test data for 802.11g WLAN Mode

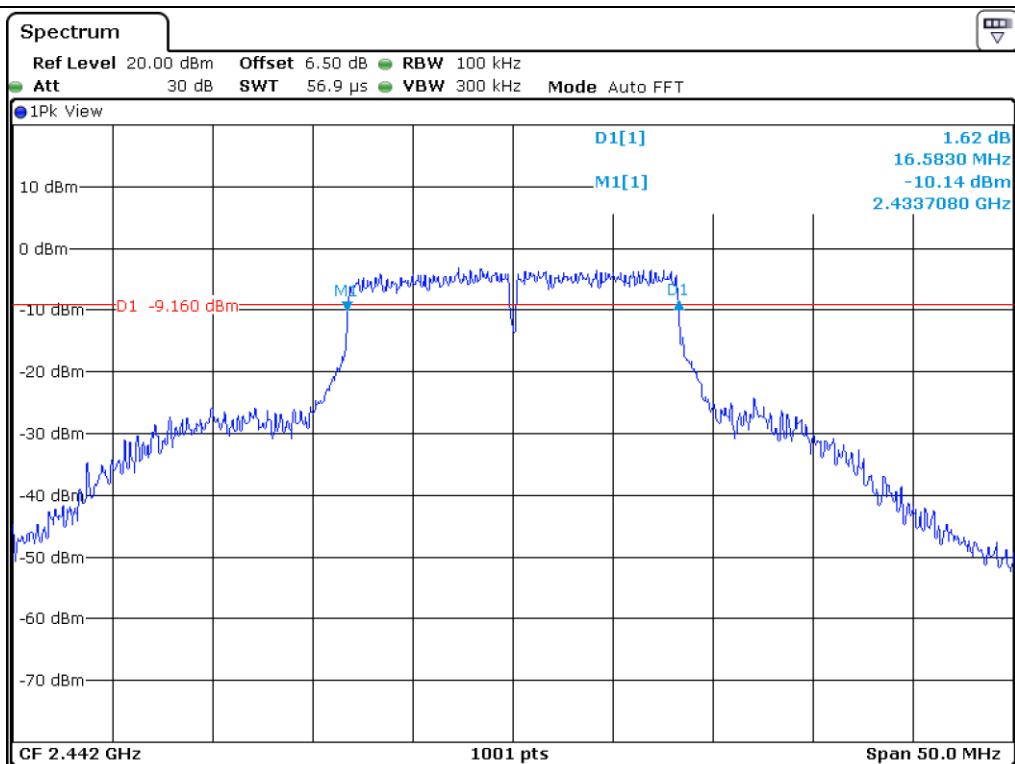
- Test Date : September 11, 2019
- Test Result : Pass

| CHANNEL | FREQUENCY<br>(MHz) | 6 dB Bandwidth<br>(MHz) | 99 % Occupied<br>Bandwidth (MHz) | LIMIT<br>(kHz) | Bandwidth Margin(MHz) |       |
|---------|--------------------|-------------------------|----------------------------------|----------------|-----------------------|-------|
|         |                    |                         |                                  |                | 6 dB                  | 99 %  |
| Low     | 2 412.00           | 16.58                   | 16.68                            | >500           | 16.08                 | 16.18 |
| Middle  | 2 442.00           | 16.58                   | 16.93                            | >500           | 16.08                 | 16.43 |
| High    | 2 462.00           | 9.79                    | 16.68                            | >500           | 9.29                  | 16.18 |

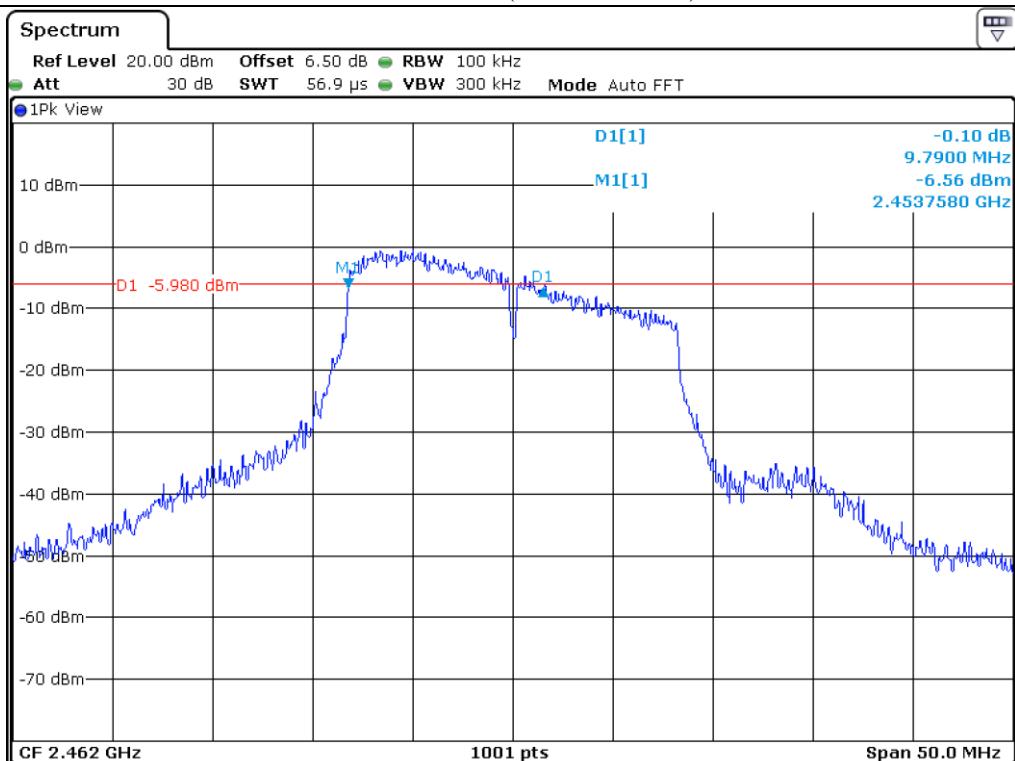
Remark. Margin = Measured Value - Limit

Tested by: Yu-Seog Sim / Assistant Manager





Middle Channel (6 dB Bandwidth)



High Channel (6 dB Bandwidth)

## 7.6 Test data for 802.11n (HT 20) WLAN Mode

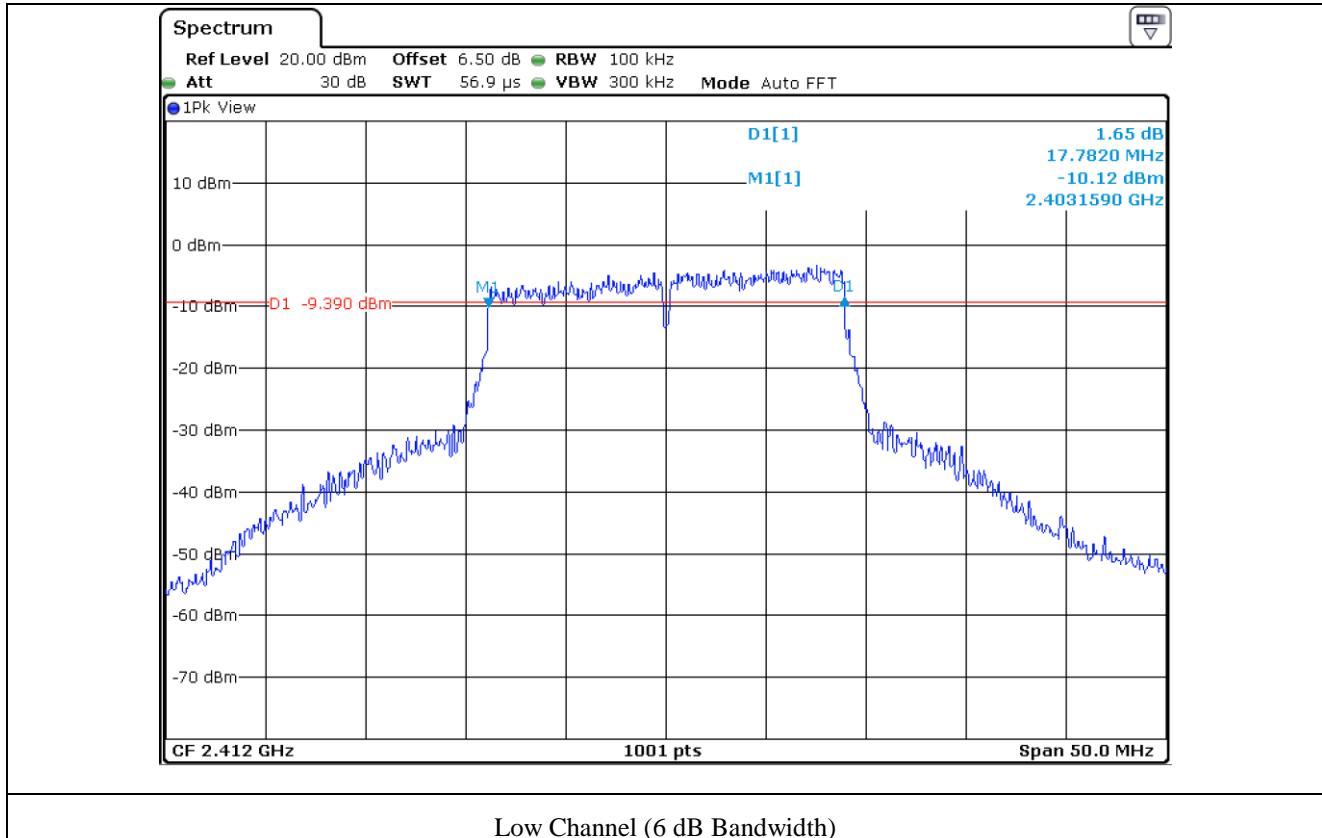
- Test Date : September 11, 2019

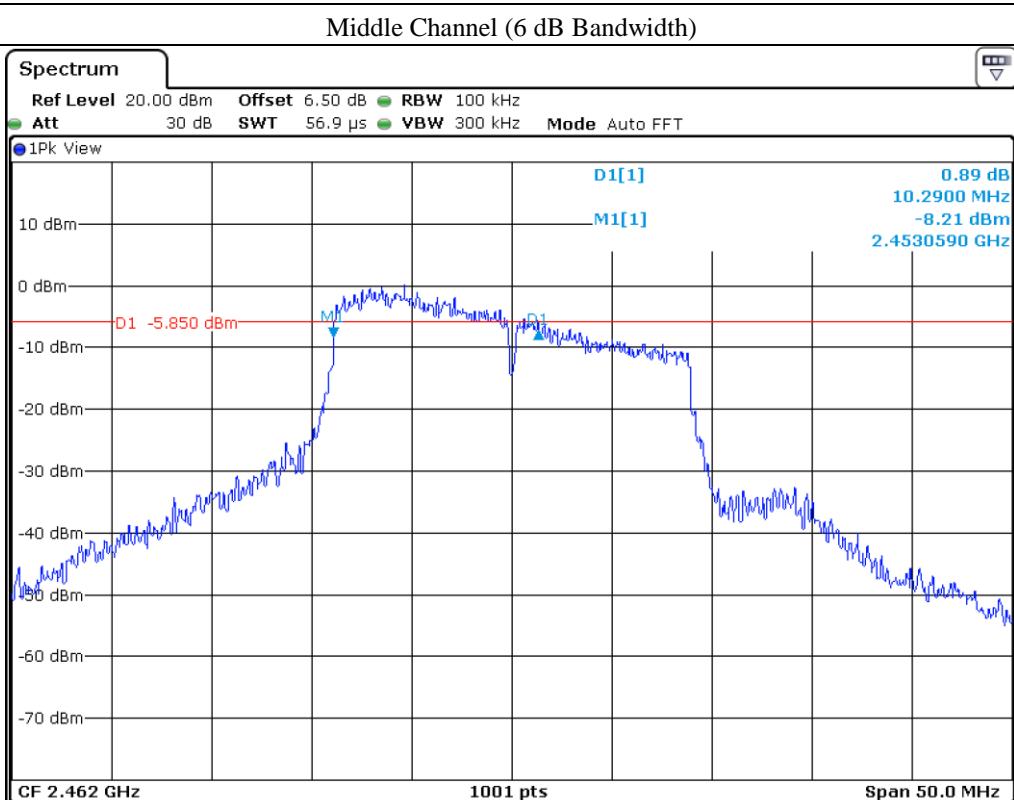
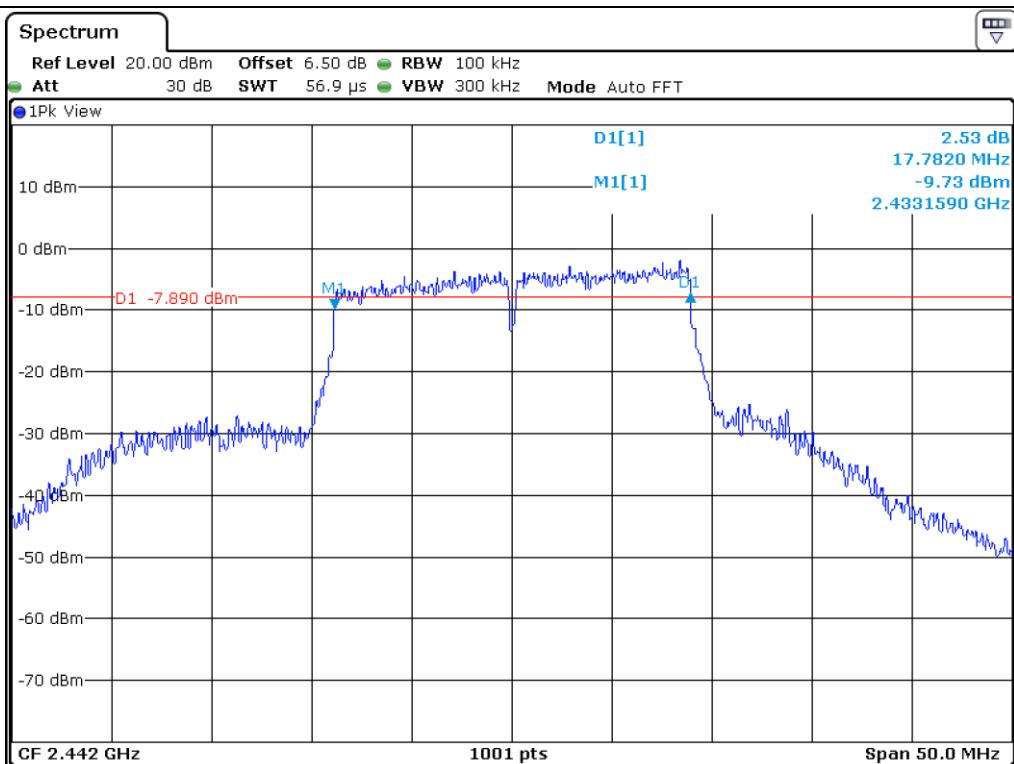
- Test Result : Pass

| CHANNEL | FREQUENCY<br>(MHz) | 6 dB Bandwidth<br>(MHz) | 99 % Occupied<br>Bandwidth (MHz) | LIMIT<br>(kHz) | Bandwidth Margin(MHz) |       |
|---------|--------------------|-------------------------|----------------------------------|----------------|-----------------------|-------|
|         |                    |                         |                                  |                | 6 dB                  | 99 %  |
| Low     | 2 412.00           | 17.78                   | 17.78                            | >500           | 17.28                 | 17.28 |
| Middle  | 2 442.00           | 17.78                   | 17.93                            | >500           | 17.28                 | 17.43 |
| High    | 2 462.00           | 10.29                   | 17.53                            | >500           | 9.79                  | 17.03 |

Remark. Margin = Measured Value - Limit

Tested by: Yu-Seog Sim / Assistant Manager





High Channel (6 dB Bandwidth)

### 7.7 Test data for 802.11n (HT 40) WLAN Mode

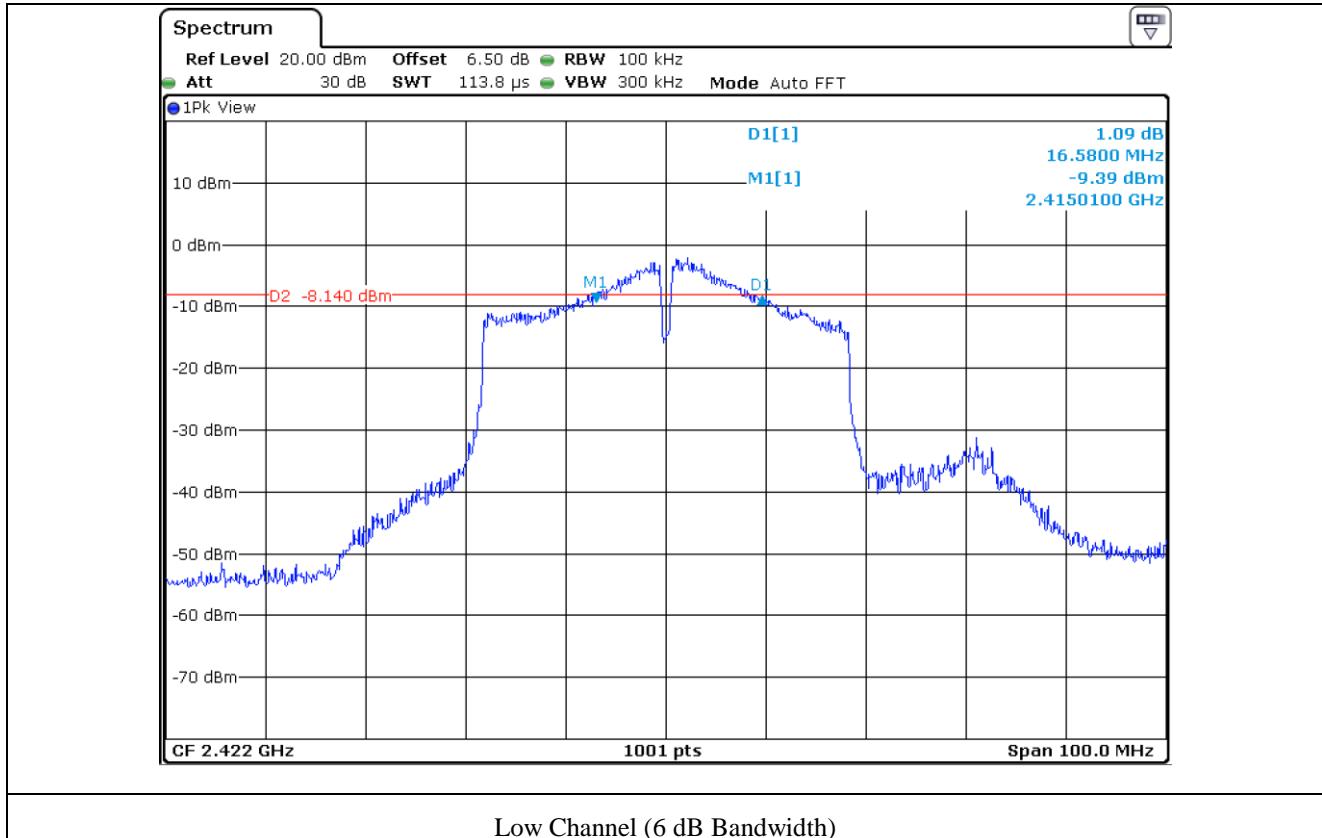
- Test Date : September 11, 2019

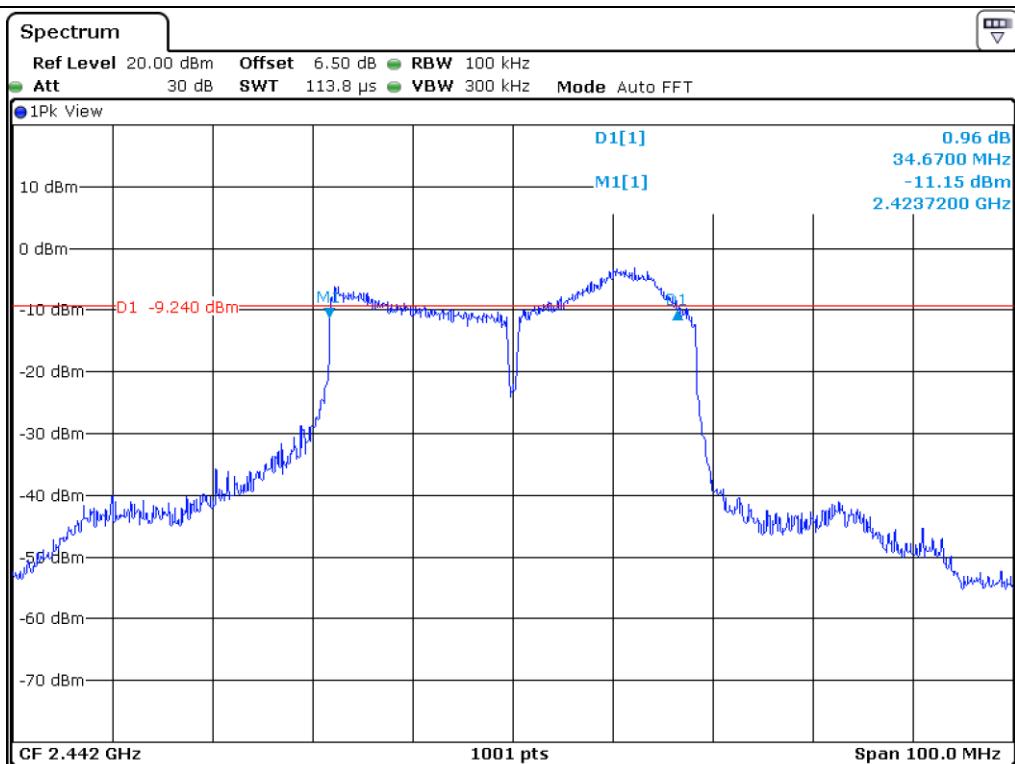
- Test Result : Pass

| CHANNEL | FREQUENCY<br>(MHz) | 6 dB Bandwidth<br>(MHz) | 99 % Occupied<br>Bandwidth (MHz) | LIMIT<br>(kHz) | Bandwidth Margin(MHz) |       |
|---------|--------------------|-------------------------|----------------------------------|----------------|-----------------------|-------|
|         |                    |                         |                                  |                | 6 dB                  | 99 %  |
| Low     | 2 422.00           | 16.58                   | 35.36                            | >500           | 16.08                 | 34.86 |
| Middle  | 2 442.00           | 34.67                   | 36.06                            | >500           | 34.17                 | 35.56 |
| High    | 2 452.00           | 12.39                   | 35.36                            | >500           | 11.89                 | 34.86 |

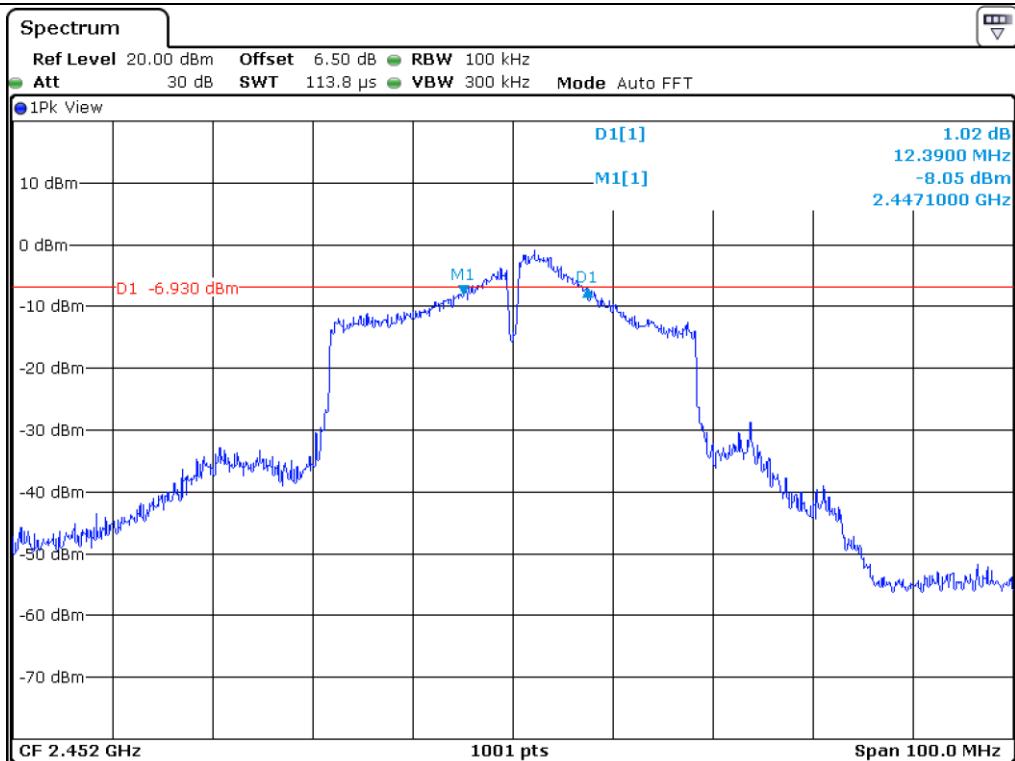
Remark. Margin = Measured Value - Limit

Tested by: Yu-Seog Sim / Assistant Manager





#### Middle Channel (6 dB Bandwidth)



#### High Channel (6 dB Bandwidth)

## 8. MAXIMUM PEAK OUTPUT POWER

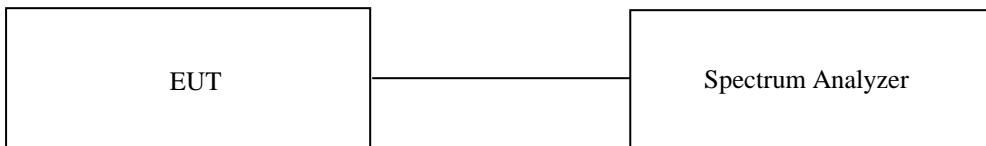
### 8.1 Operating environment

Temperature : 24 °C

Relative humidity : 47 % 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.          |
|--------------|-----------------|-----------------|---------------|--------------------|
| ■ - FSV30    | Rohde & Schwarz | Signal Analyzer | 101200        | Jul. 24, 2019 (1Y) |

All test equipment used is calibrated on a regular basis.

#### 8.4 Test data for 802.11b WLAN Mode

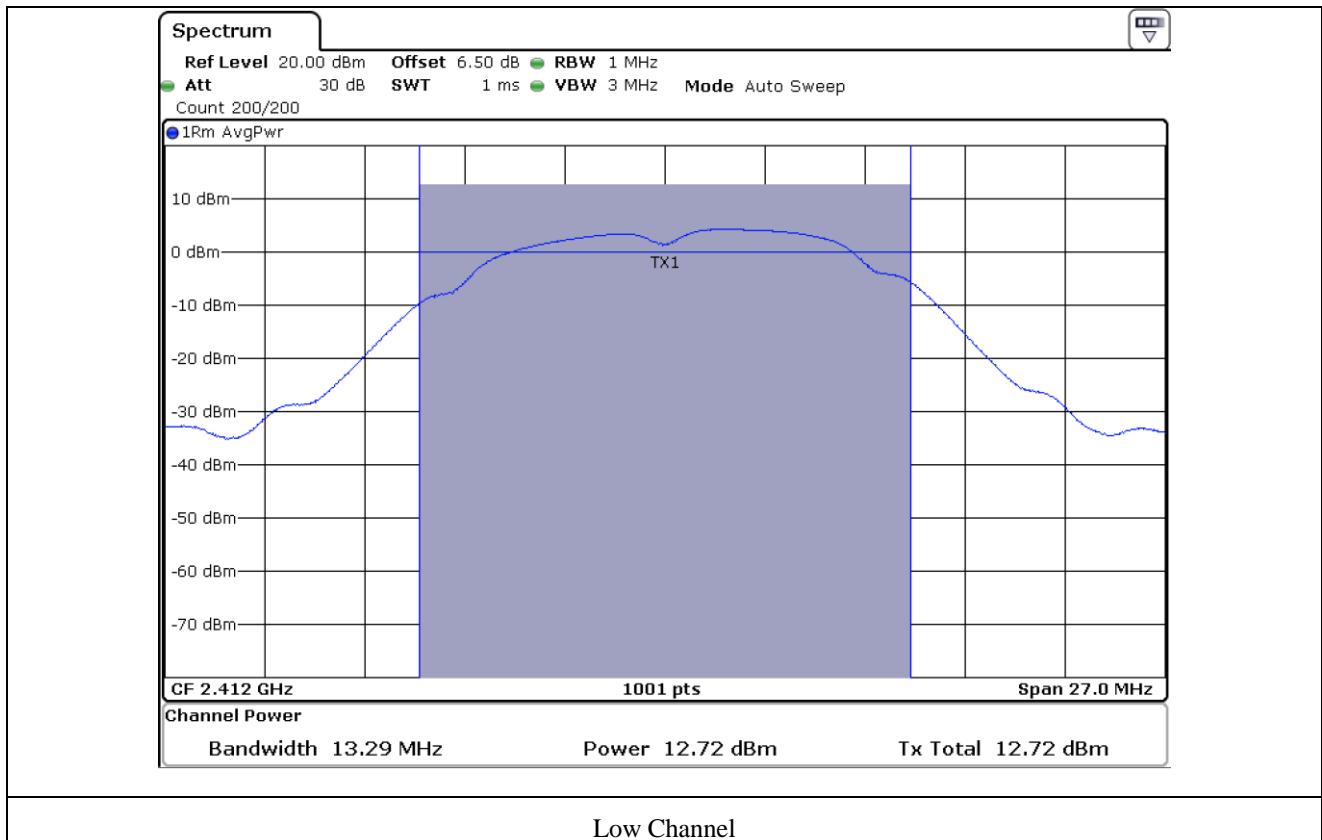
- Test Date : September 11, 2019

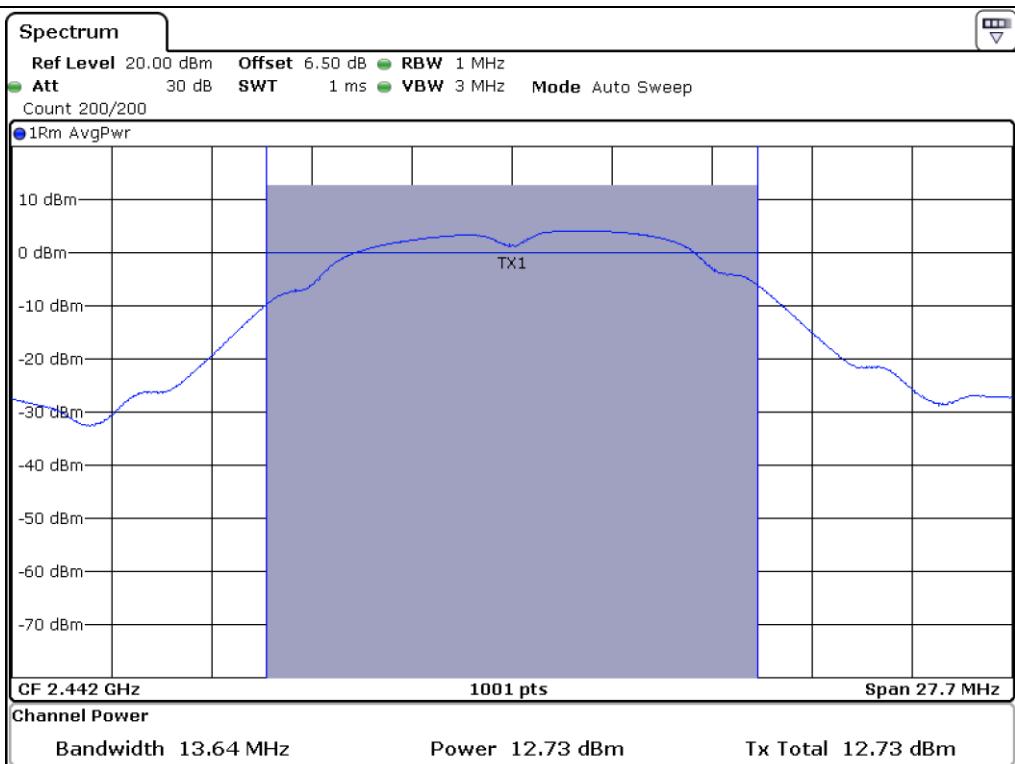
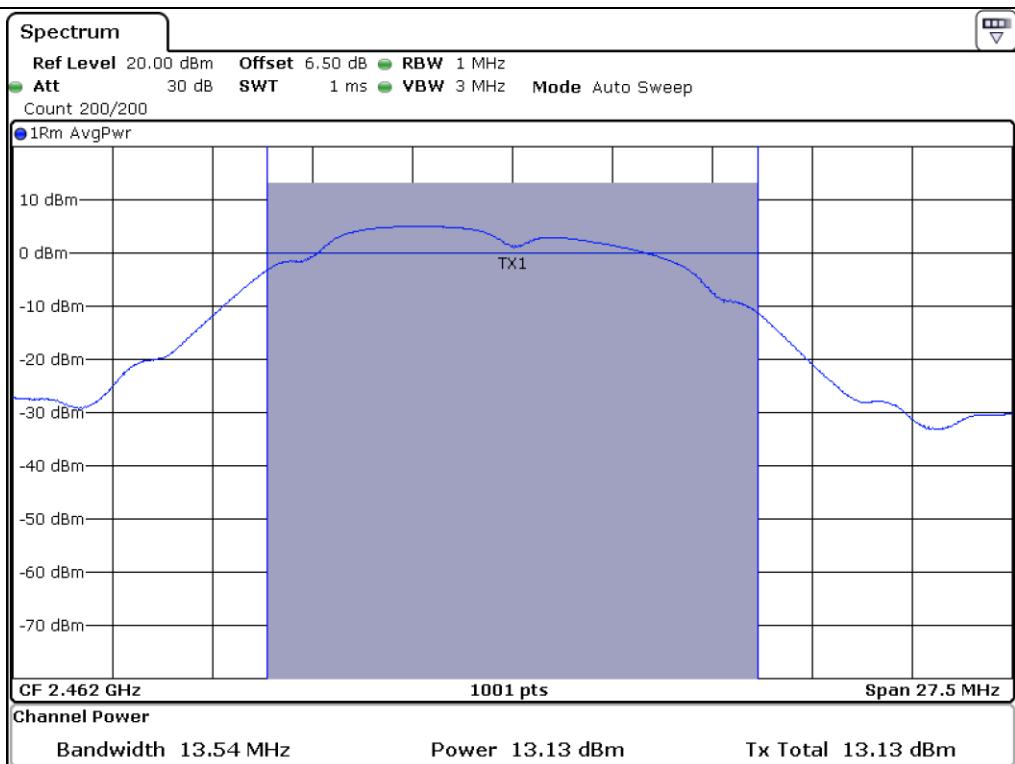
- Test Result : Pass

| CHANNEL | FREQUENCY<br>(MHz) | 99 % Occupied<br>Bandwidth (MHz) | MEASURED VALUE<br>(dBm) | LIMIT<br>(dBm) | MARGIN<br>(dB) |
|---------|--------------------|----------------------------------|-------------------------|----------------|----------------|
| LOW     | 2 412.00           | 13.29                            | 12.72                   | 30.00          | 17.28          |
| MIDDLE  | 2 442.00           | 13.64                            | 12.73                   | 30.00          | 17.27          |
| HIGH    | 2 462.00           | 13.54                            | 13.13                   | 30.00          | 16.87          |

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

Tested by: Yu-Seog Sim / Assistant Manager



**Middle Channel****High Channel**

### 8.5 Test data for 802.11g WLAN Mode

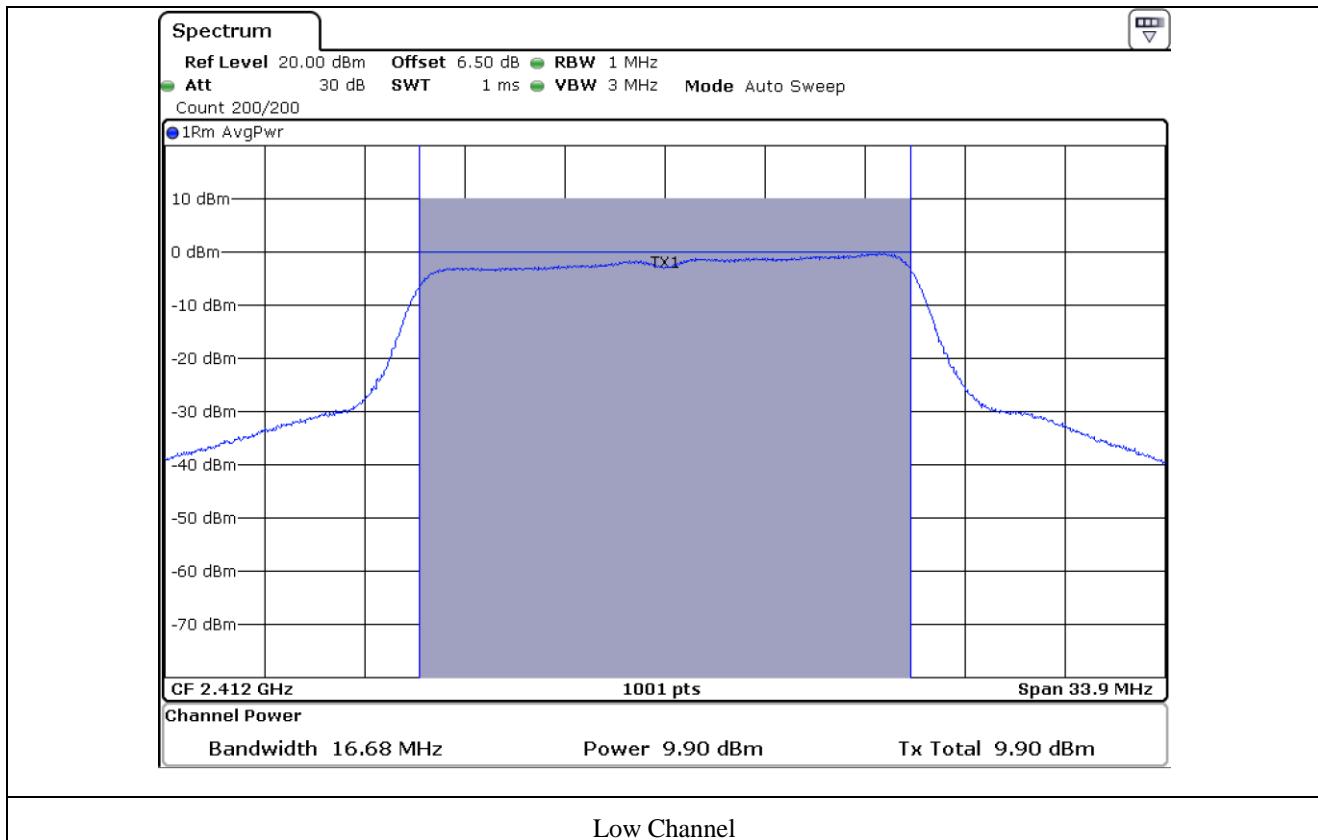
- Test Date : September 11, 2019

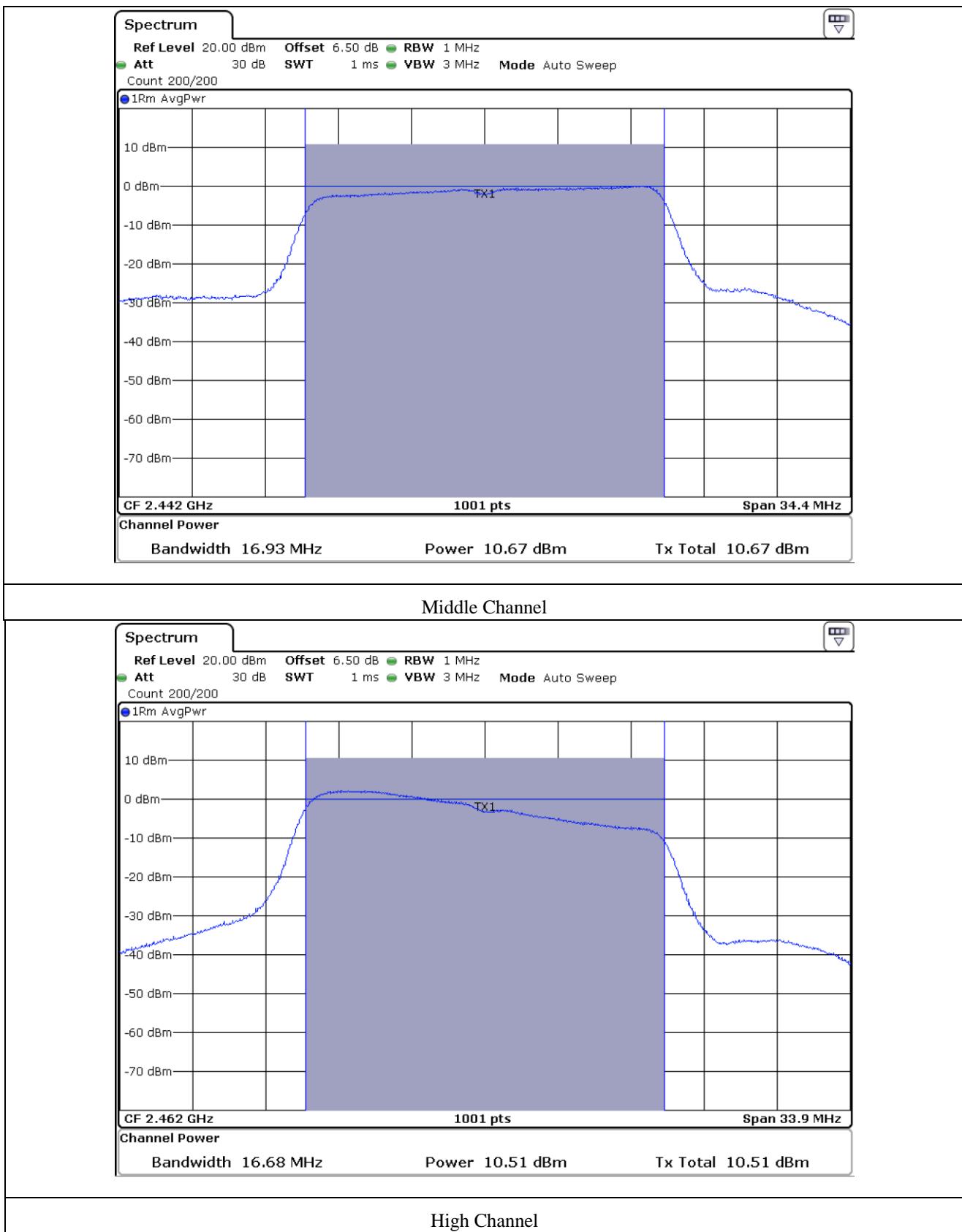
- Test Result : Pass

| CHANNEL | FREQUENCY<br>(MHz) | 99 % Occupied<br>Bandwidth (MHz) | MEASURED VALUE<br>(dBm) | LIMIT<br>(dBm) | MARGIN<br>(dB) |
|---------|--------------------|----------------------------------|-------------------------|----------------|----------------|
| LOW     | 2 412.00           | 16.68                            | 9.90                    | 30.00          | 20.10          |
| MIDDLE  | 2 442.00           | 16.93                            | 10.67                   | 30.00          | 19.33          |
| HIGH    | 2 462.00           | 16.68                            | 10.51                   | 30.00          | 19.49          |

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

Tested by: Yu-Seog Sim / Assistant Manager





### 8.6 Test data for 802.11n(HT20) WLAN Mode

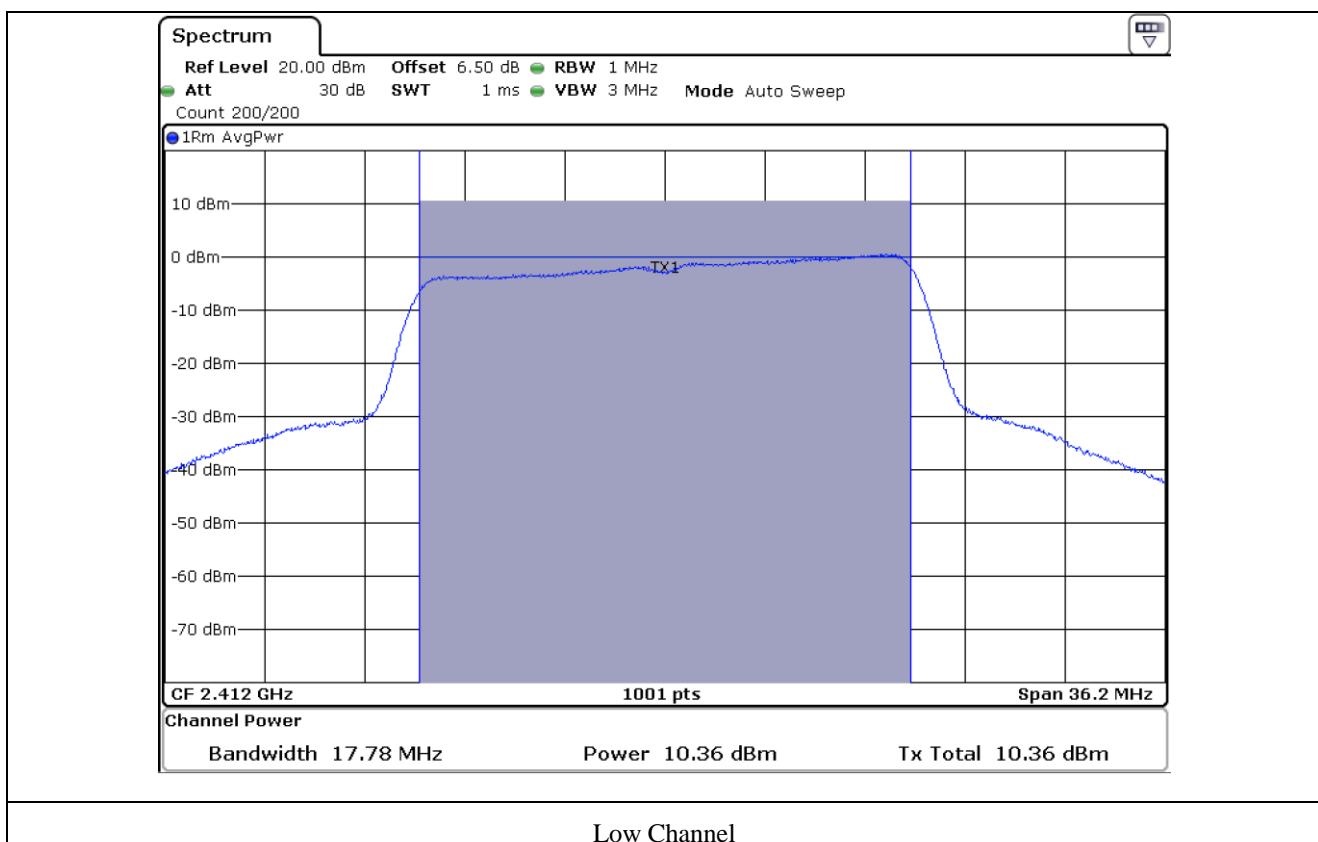
- Test Date : September 11, 2019

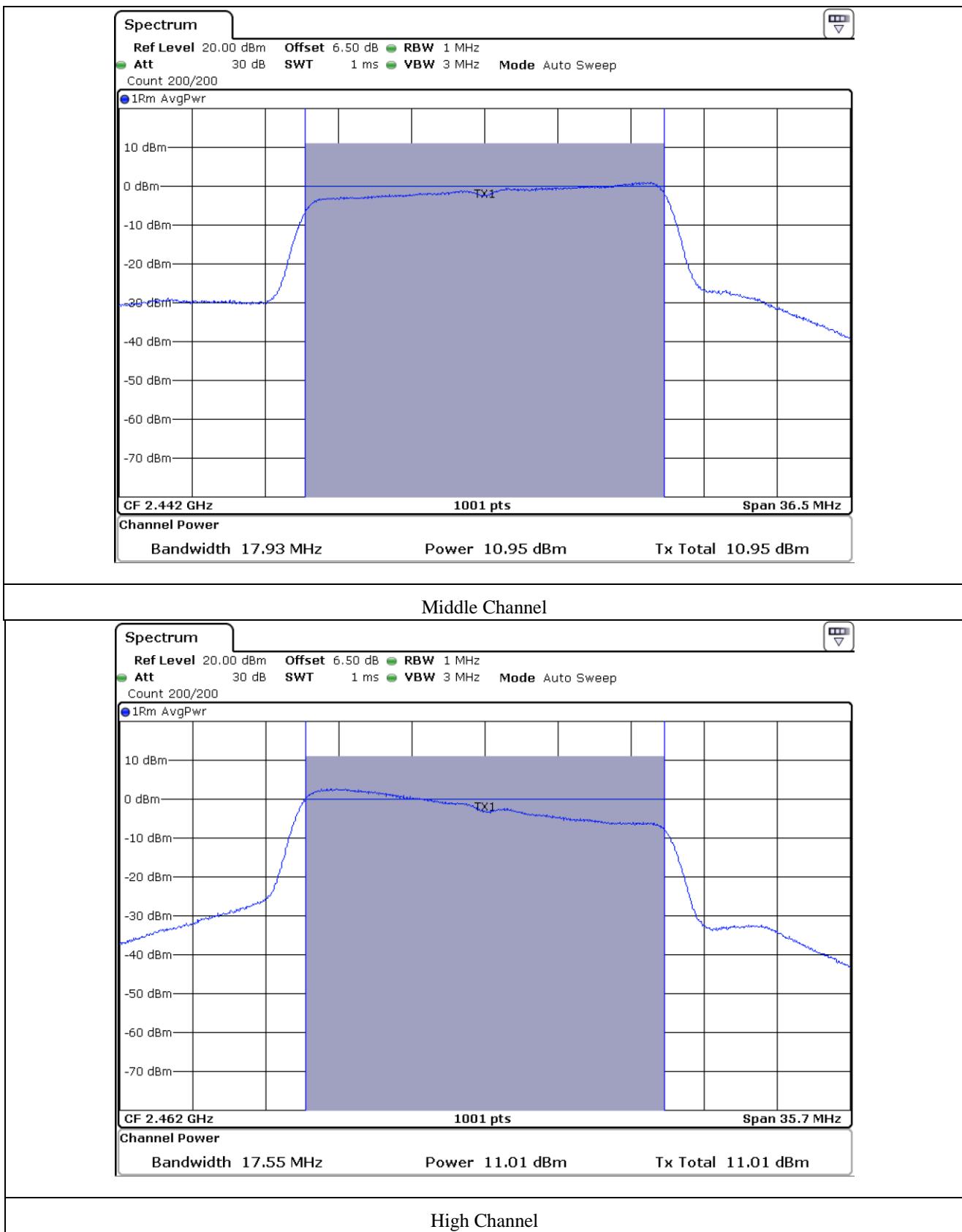
- Test Result : Pass

| CHANNEL | FREQUENCY<br>(MHz) | 99 % Occupied<br>Bandwidth (MHz) | MEASURED VALUE<br>(dBm) | LIMIT<br>(dBm) | MARGIN<br>(dB) |
|---------|--------------------|----------------------------------|-------------------------|----------------|----------------|
| LOW     | 2 412.00           | 17.78                            | 10.36                   | 30.00          | 19.64          |
| MIDDLE  | 2 442.00           | 17.93                            | 10.95                   | 30.00          | 19.05          |
| HIGH    | 2 462.00           | 17.53                            | 11.01                   | 30.00          | 18.99          |

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

Tested by: Yu-Seog Sim / Assistant Manager





### 8.7 Test data for 802.11n(HT40) WLAN Mode

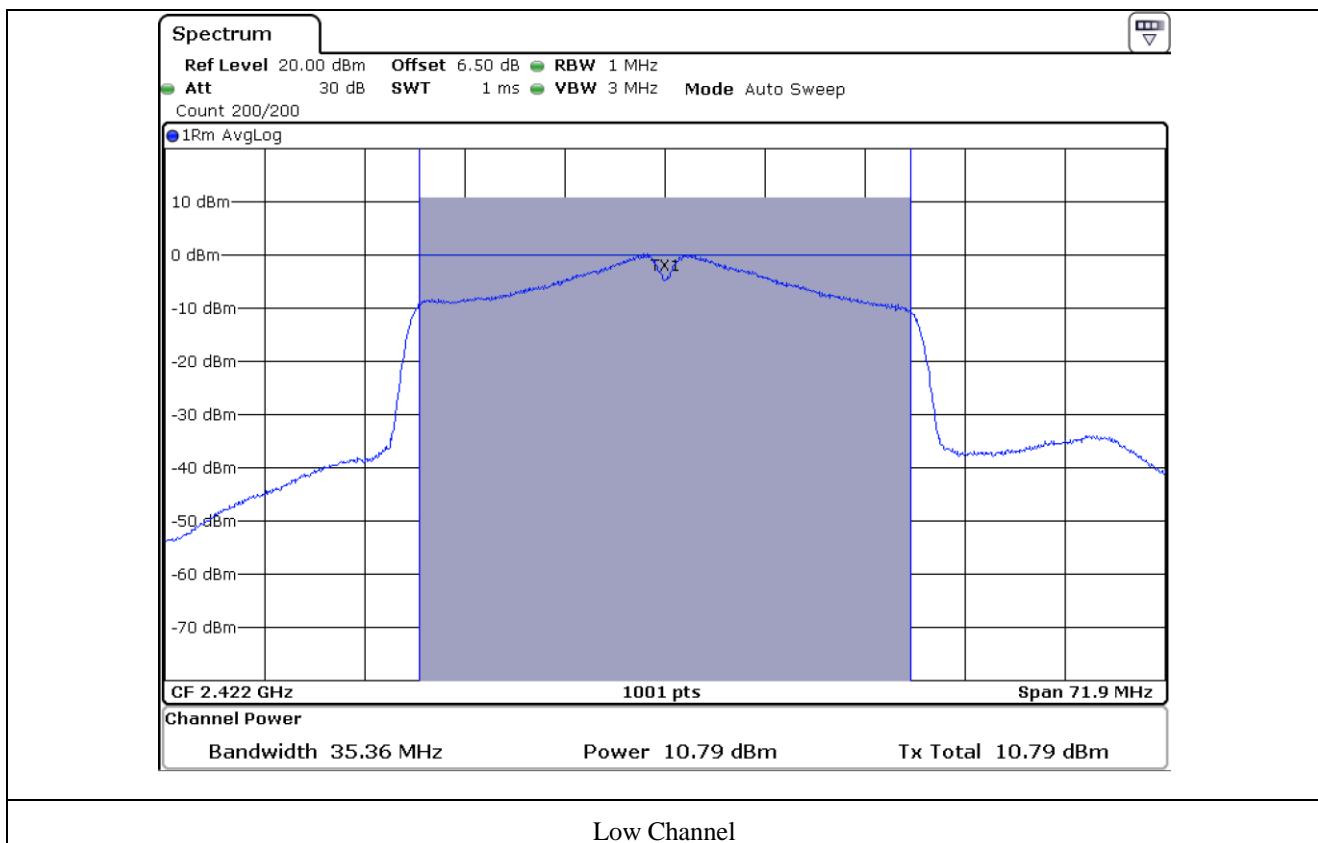
- Test Date : September 11, 2019

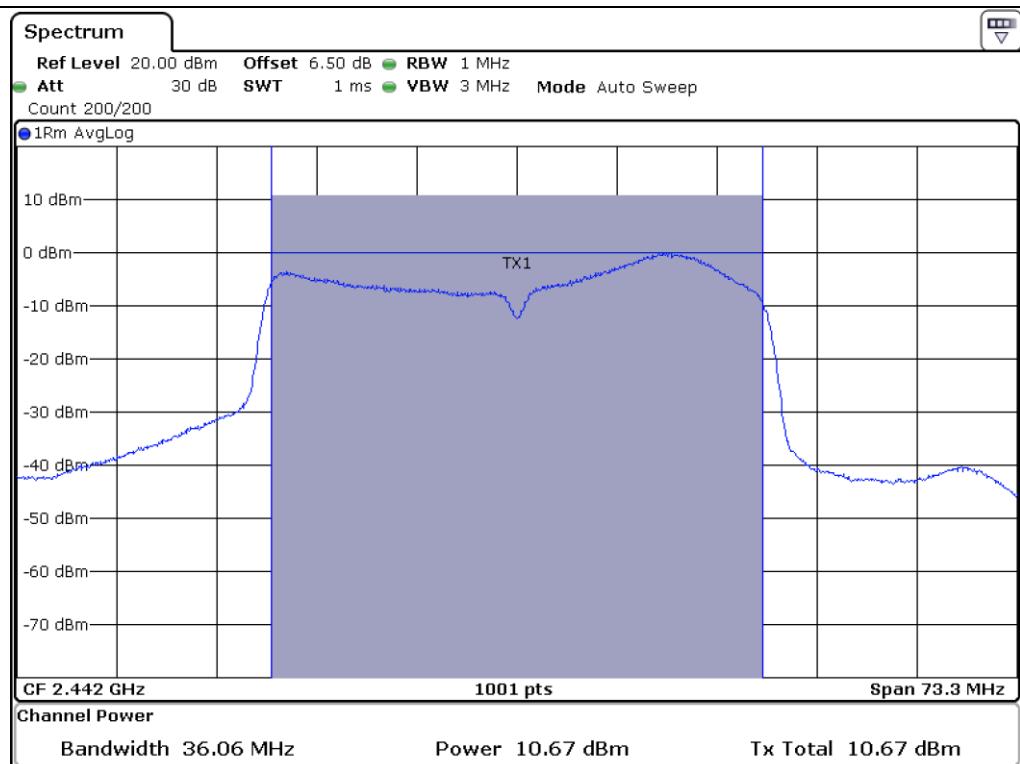
- Test Result : Pass

| CHANNEL | FREQUENCY<br>(MHz) | 99 % Occupied<br>Bandwidth (MHz) | MEASURED VALUE<br>(dBm) | LIMIT<br>(dBm) | MARGIN<br>(dB) |
|---------|--------------------|----------------------------------|-------------------------|----------------|----------------|
| LOW     | 2 422.00           | 35.36                            | 10.79                   | 30.00          | 19.21          |
| MIDDLE  | 2 442.00           | 36.06                            | 10.67                   | 30.00          | 19.33          |
| HIGH    | 2 452.00           | 35.36                            | 10.81                   | 30.00          | 19.19          |

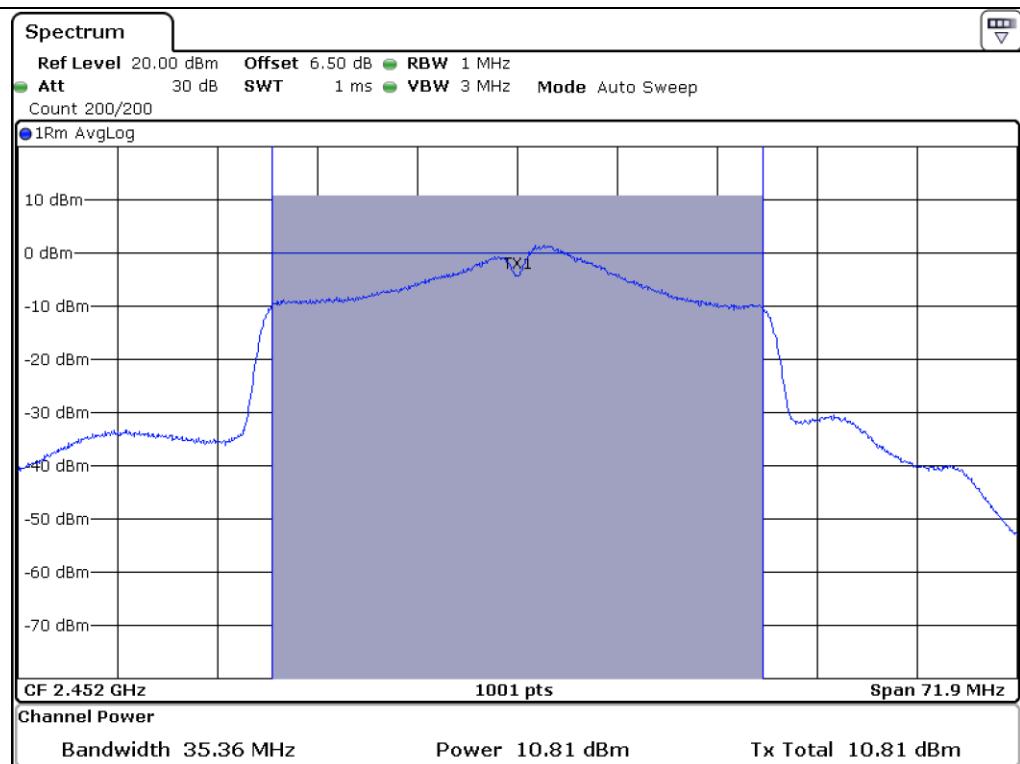
Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

Tested by: Yu-Seog Sim / Assistant Manager





### Middle Channel



### High Channel

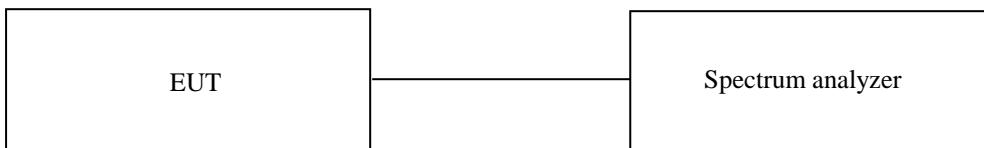
## 9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

### 9.1 Operating environment

Temperature : 24 °C  
 Relative humidity : 47 % R.H.

### 9.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution and video bandwidth is set to 100 kHz, and peak detection was used.



### 9.3 Test set-up for radiated measurement

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

The frequency spectrum from 30 MHz to 40 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

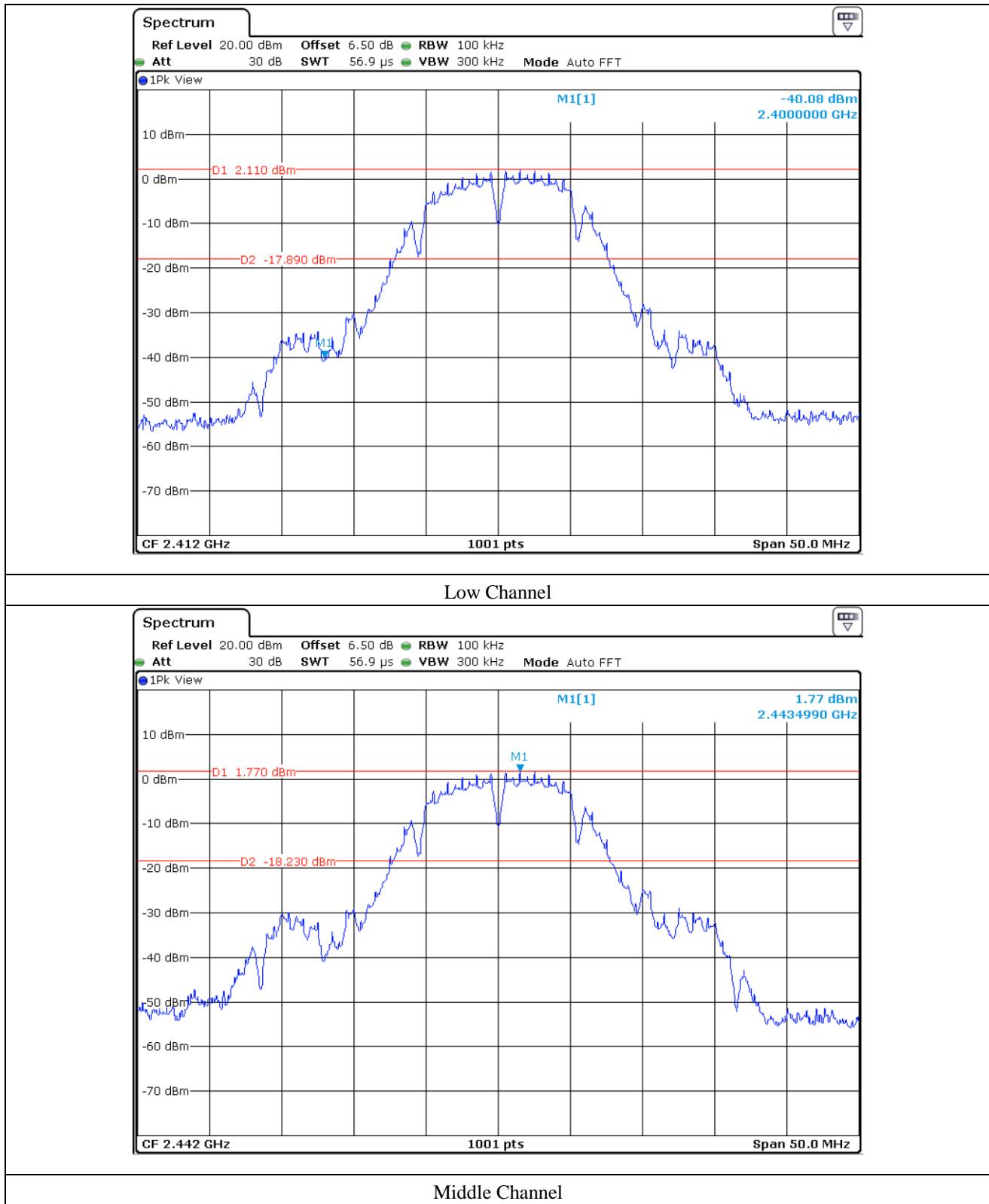
### 9.4 Test equipment used

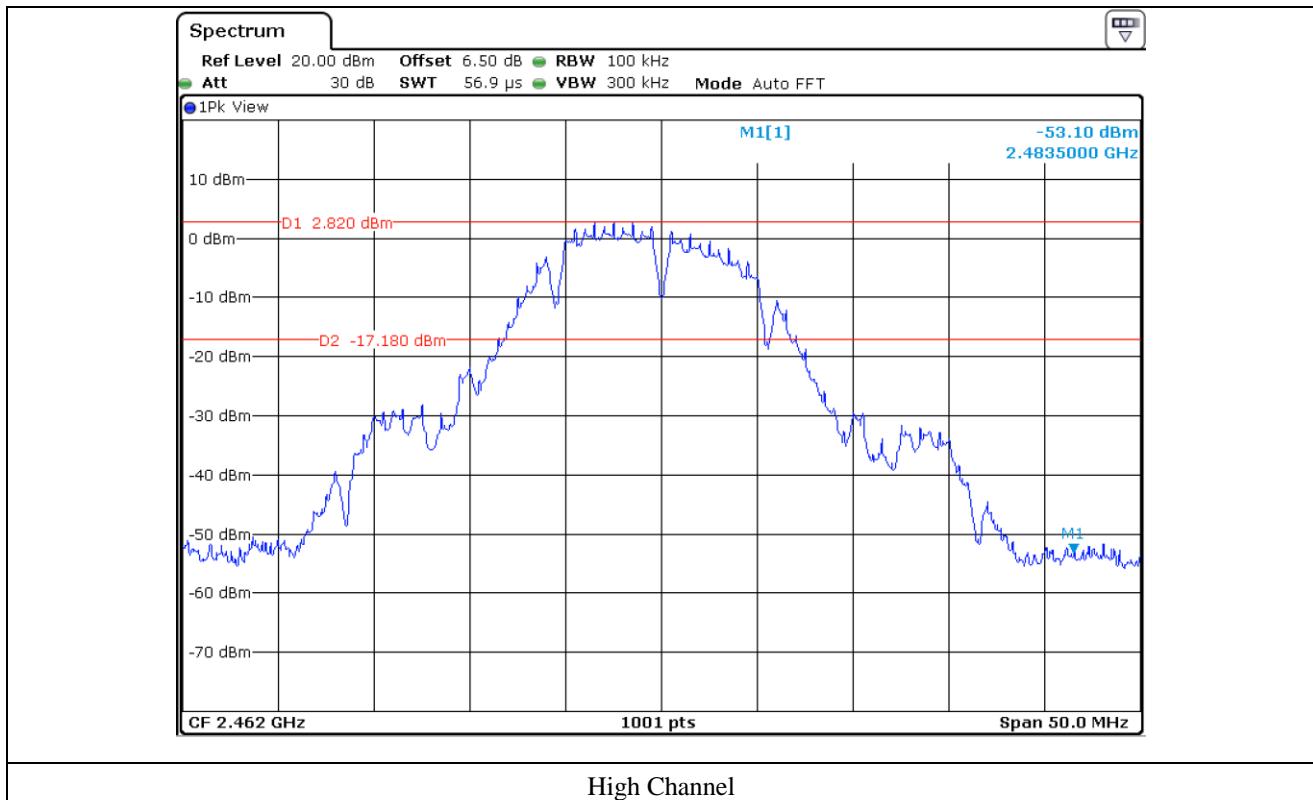
| Model Number    | Manufacturer       | Description              | Serial Number | Last Cal. (Interval) |
|-----------------|--------------------|--------------------------|---------------|----------------------|
| □ - ESCI        | Rohde & Schwarz    | EMI Test Receiver        | 101012        | Oct. 22, 2018 (1Y)   |
| ■ - ESR         | Rohde & Schwarz    | EMI Test Receiver        | 101470        | Oct. 22, 2018 (1Y)   |
| □ - FSP         | Rohde & Schwarz    | Spectrum Analyzer        | 100017        | Jul. 25, 2019 (1Y)   |
| ■ - 310N        | Sonoma Instrument  | AMPLIFIER                | 312544        | Mar. 18, 2019 (1Y)   |
| ■ - FSV30       | Rohde & Schwarz    | Signal Analyzer          | 101200        | Jul. 24, 2019 (1Y)   |
| ■ - SCU-18      | Rohde & Schwarz    | Pre-Amplifier            | 102266        | Jul. 24, 2019 (1Y)   |
| ■ - MA-4000XPET | Innco Systems GmbH | Antenna Master           | MA4000/509    | N/A                  |
| □ - HD100       | HD GmbH            | Position Controller      | N/A           | N/A                  |
| ■ - DT3000-3t   | Innco Systems GmbH | Turn Table               | N/A           | N/A                  |
| □ - FMZB 1513   | Schwarzbeck        | LOOP ANTENNA             | 1513-235      | May. 13, 2018 (2Y)   |
| ■ - VULB9163    | Schwarzbeck        | TRILOG Broadband Antenna | 9163-419      | Aug. 09, 2018 (2Y)   |
| ■ - BBHA9120D   | Schwarzbeck        | Horn Antenna             | BBHA9120D295  | Jul. 16, 2019 (1Y)   |
| ■ - BBHA9170    | Schwarzbeck        | Horn Antenna             | BBHA91700179  | Jan. 16, 2019 (1Y)   |
| ■ - BBV 9718 B  | Schwarzbeck        | Broadband Preamplifier   | 009           | Mar. 11, 2019(1Y)    |

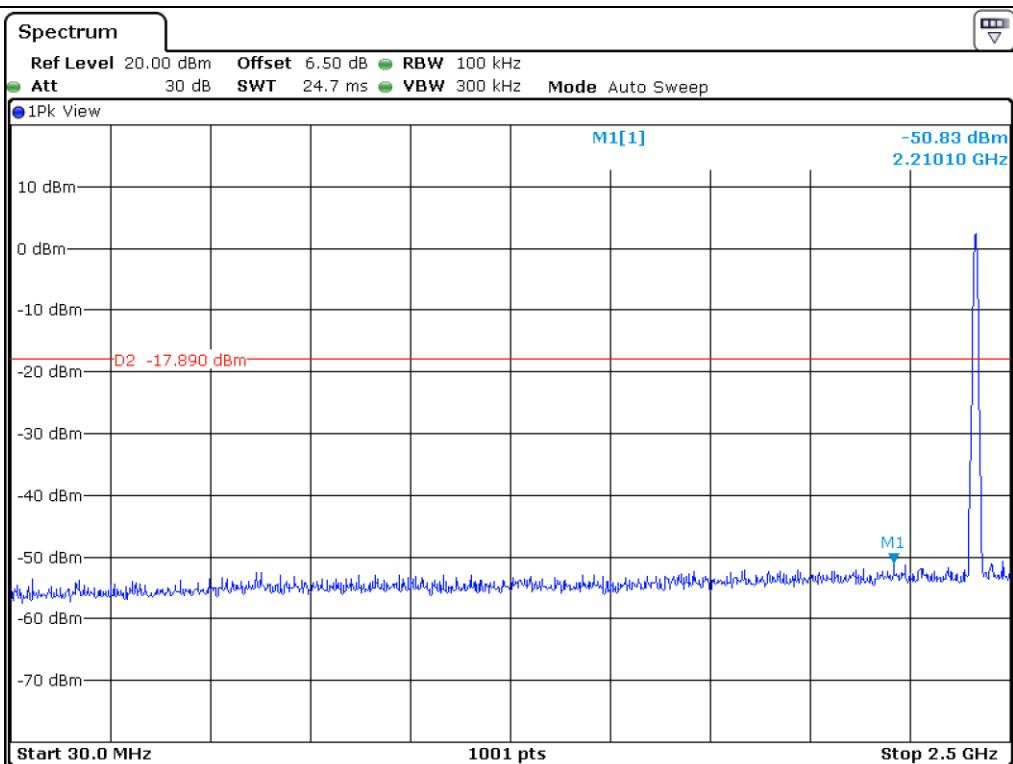
All test equipment used is calibrated on a regular basis.

## 9.5 Test data for conducted emission

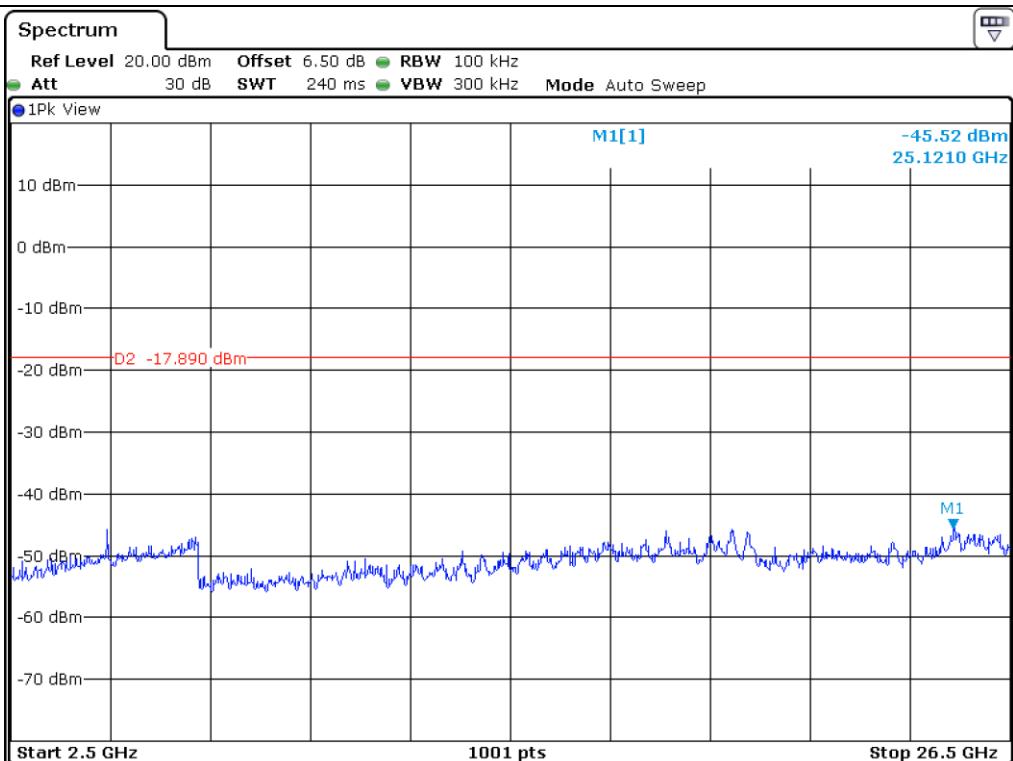
### 9.5.1 Test data for 802.11b WLAN Mode



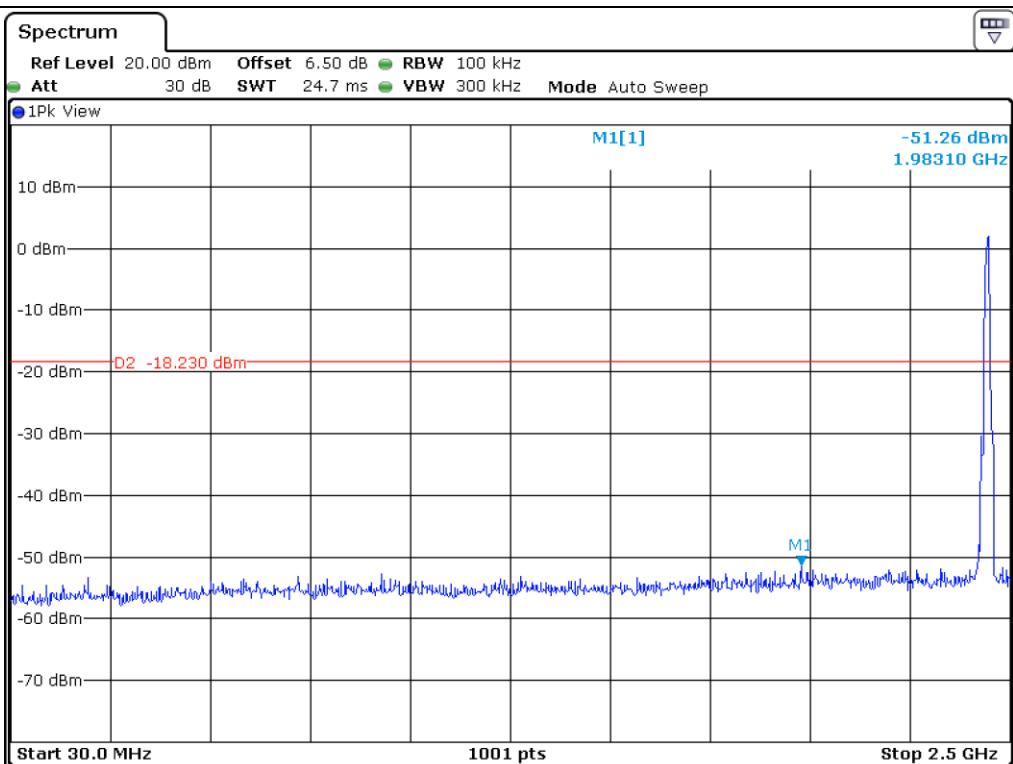




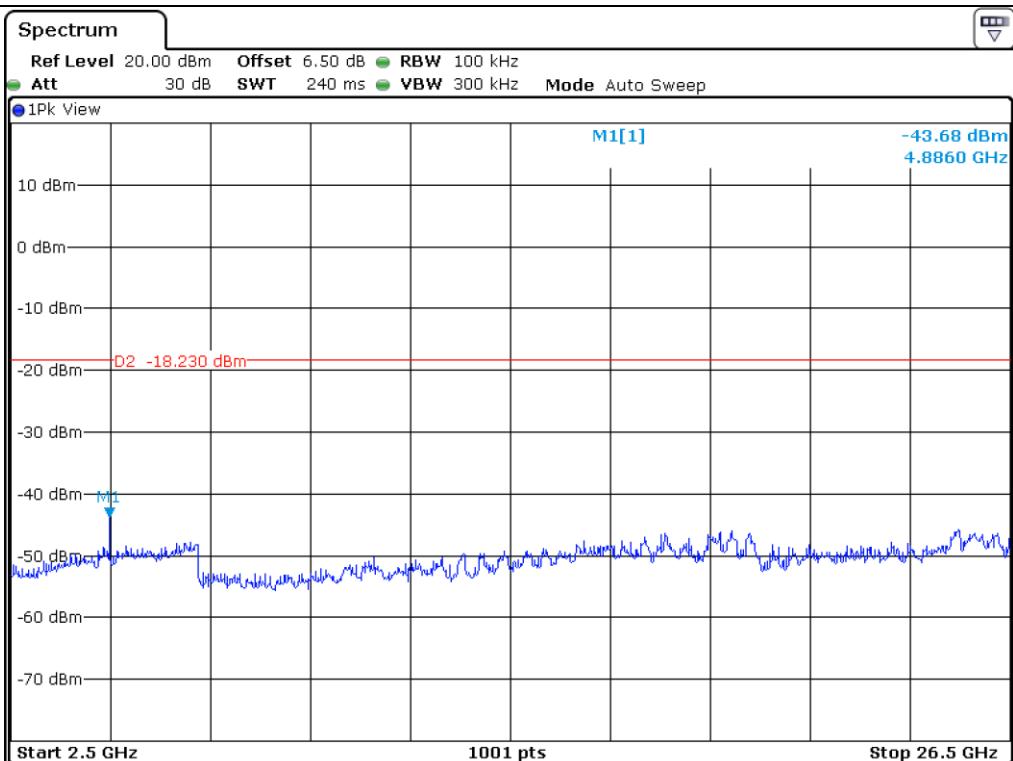
## Low Channel



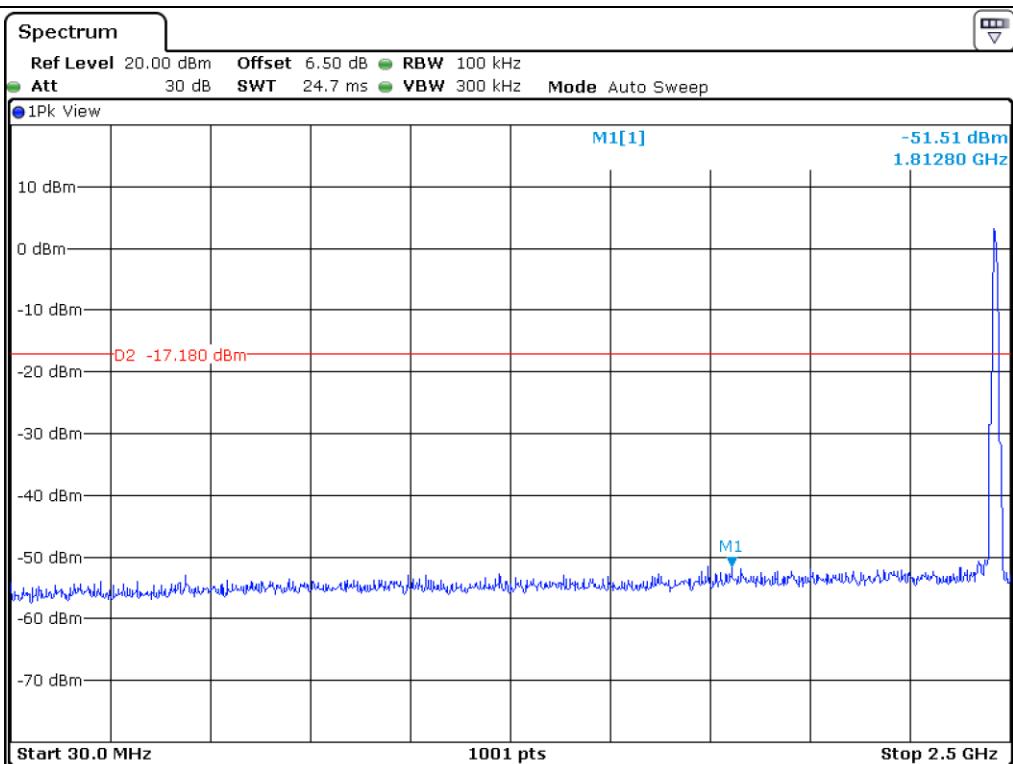
## Low Channel



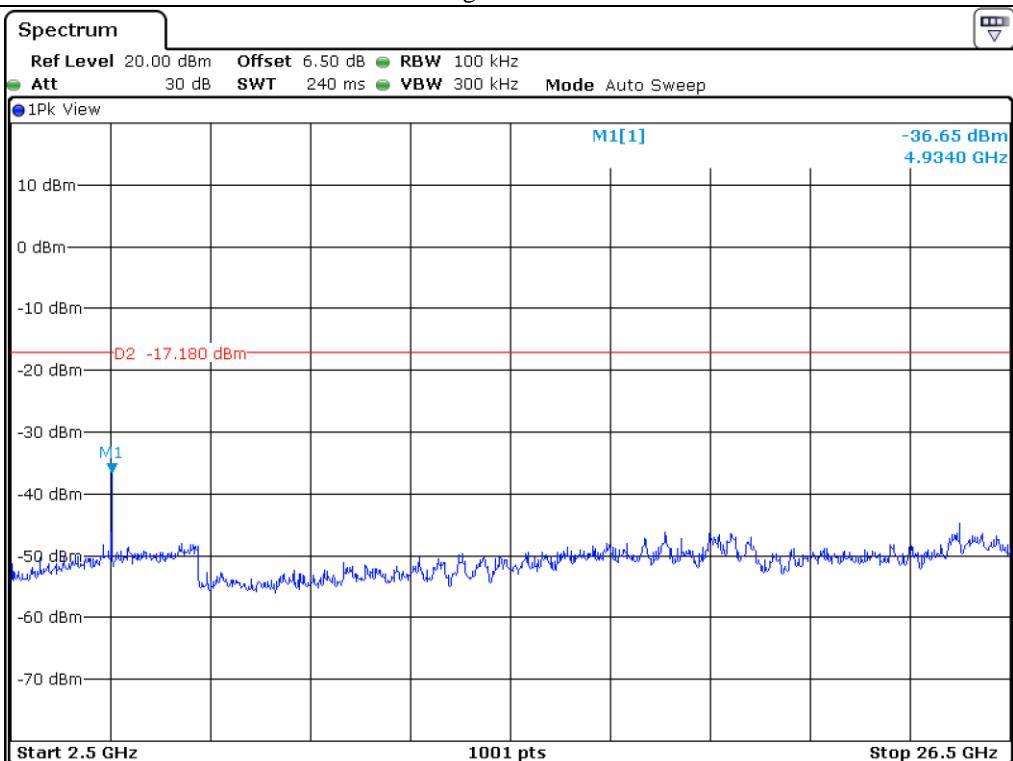
Middle Channel



Middle Channel

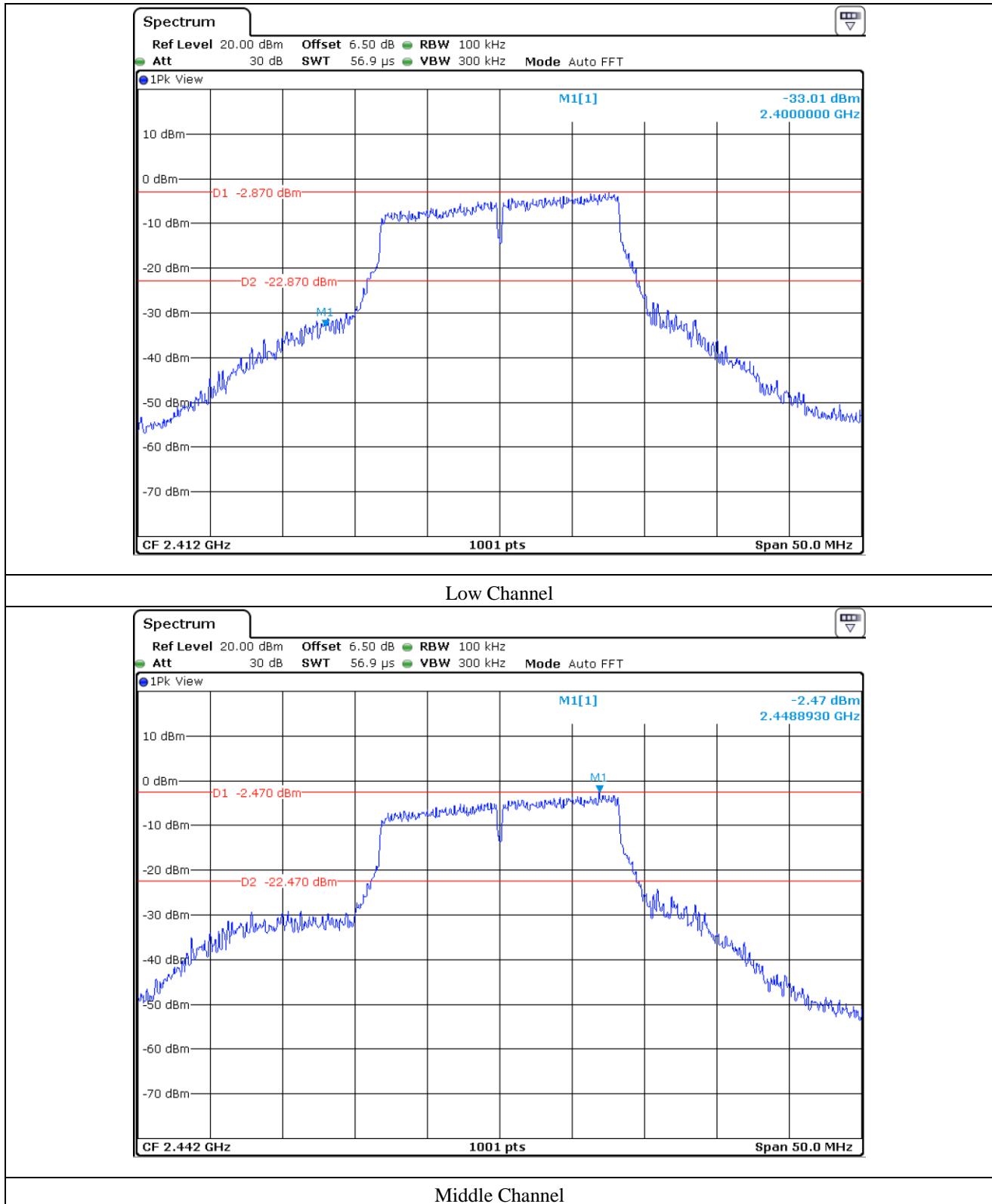


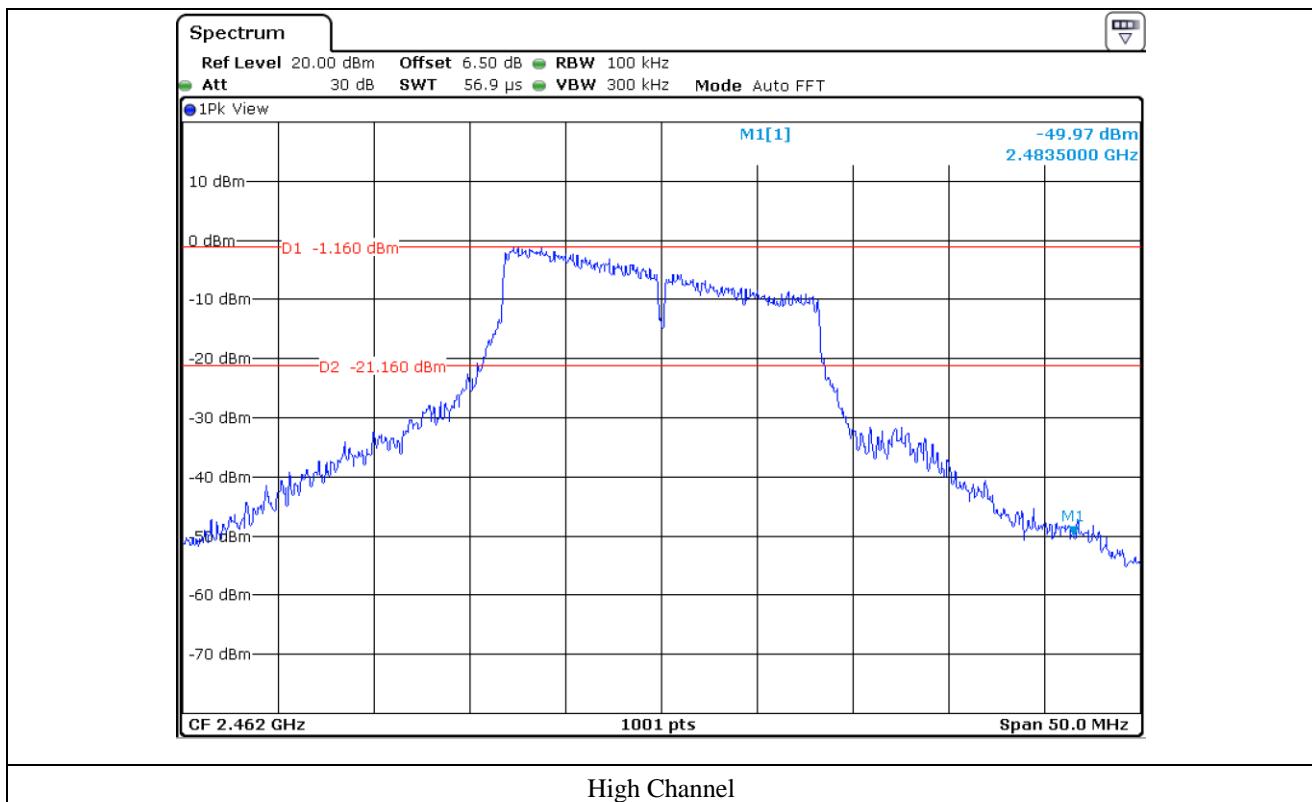
### High Channel

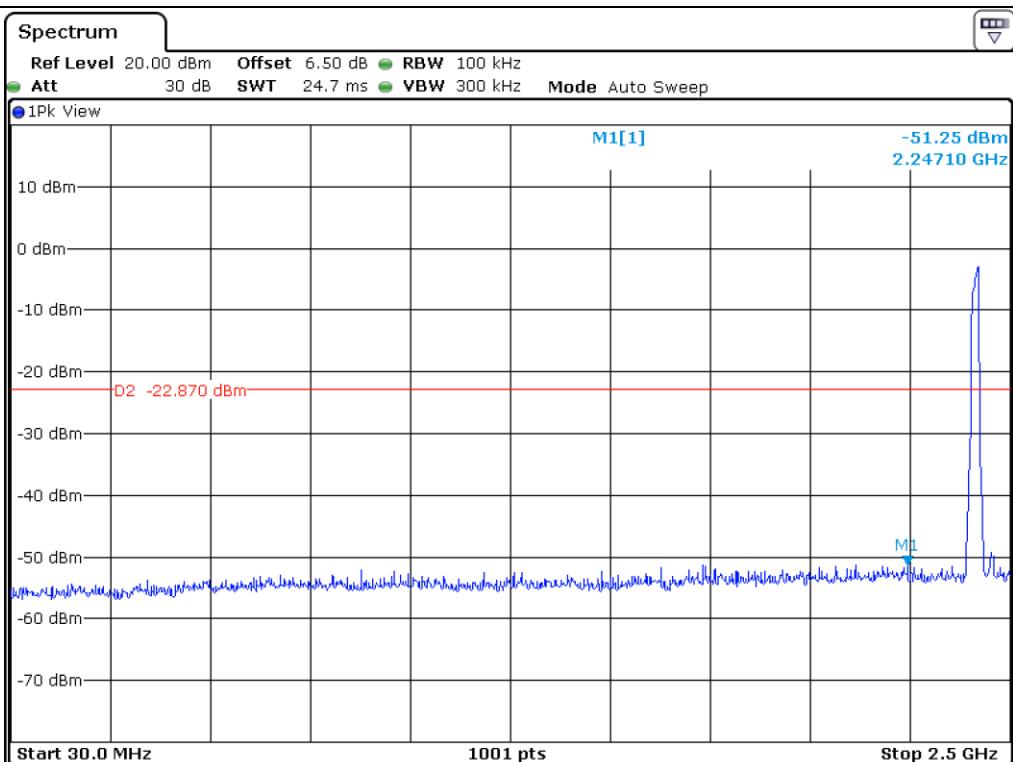


### High Channel

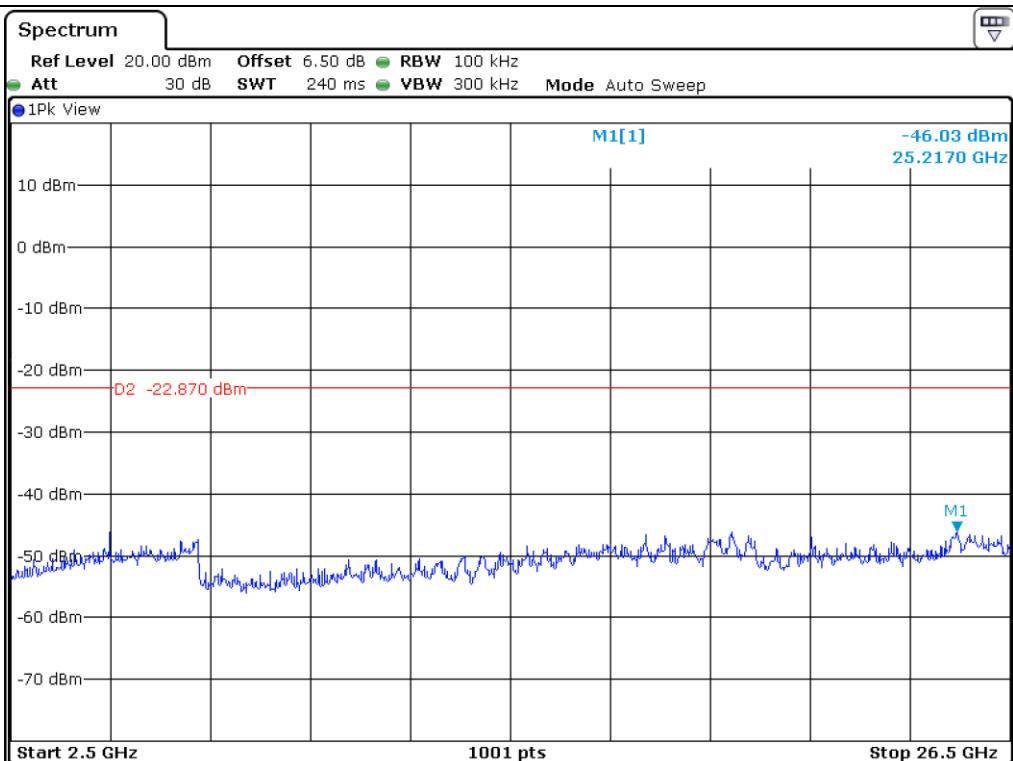
### 9.5.2 Test data for 802.11g WLAN Mode



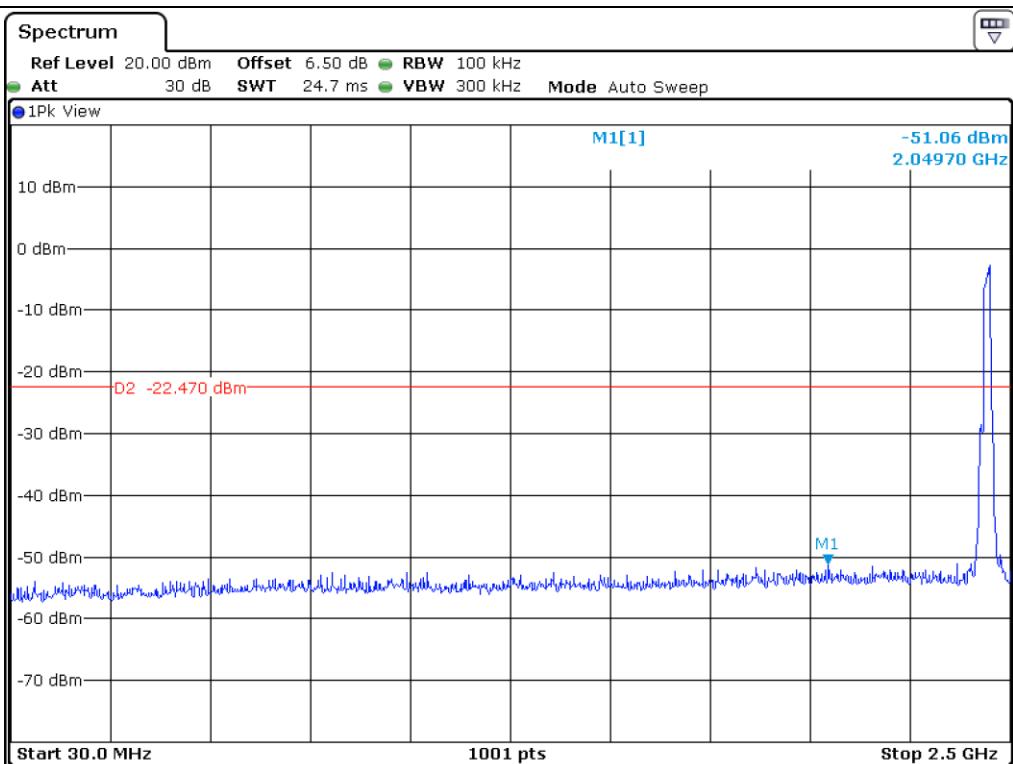




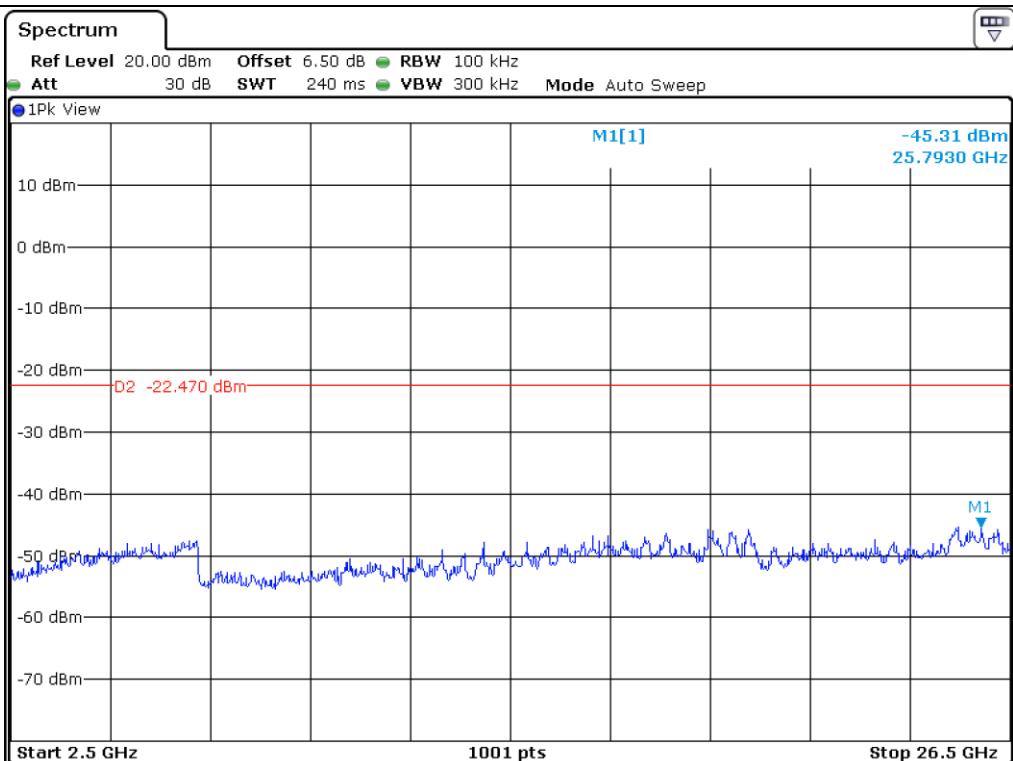
### Low Channel



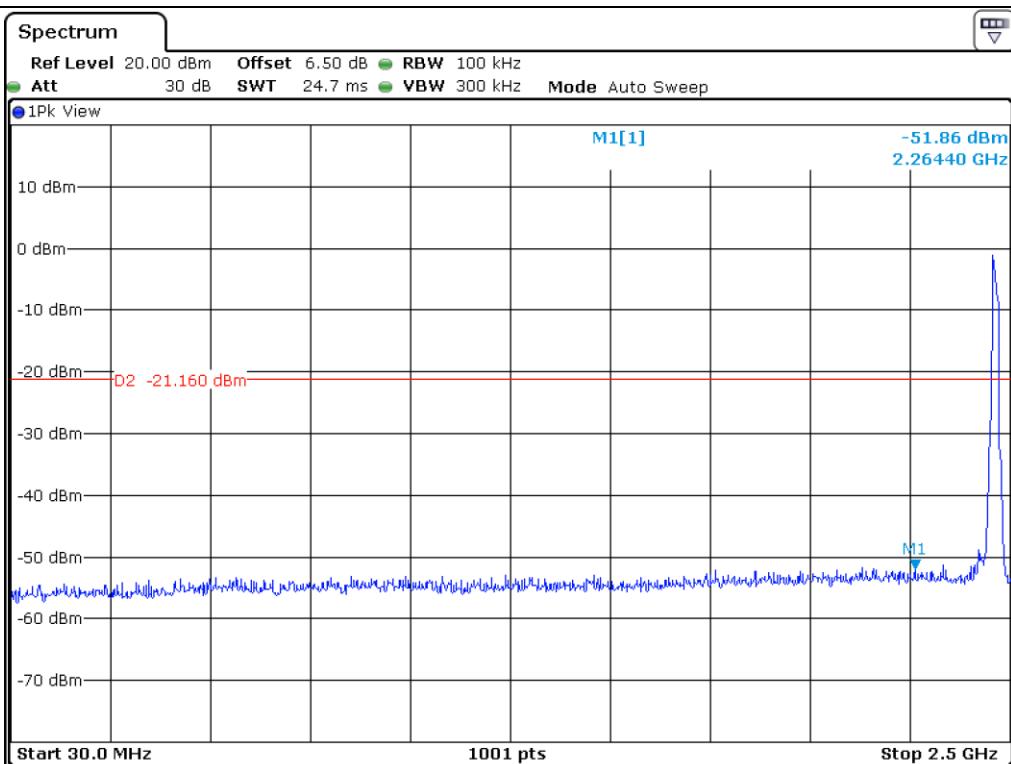
### Low Channel



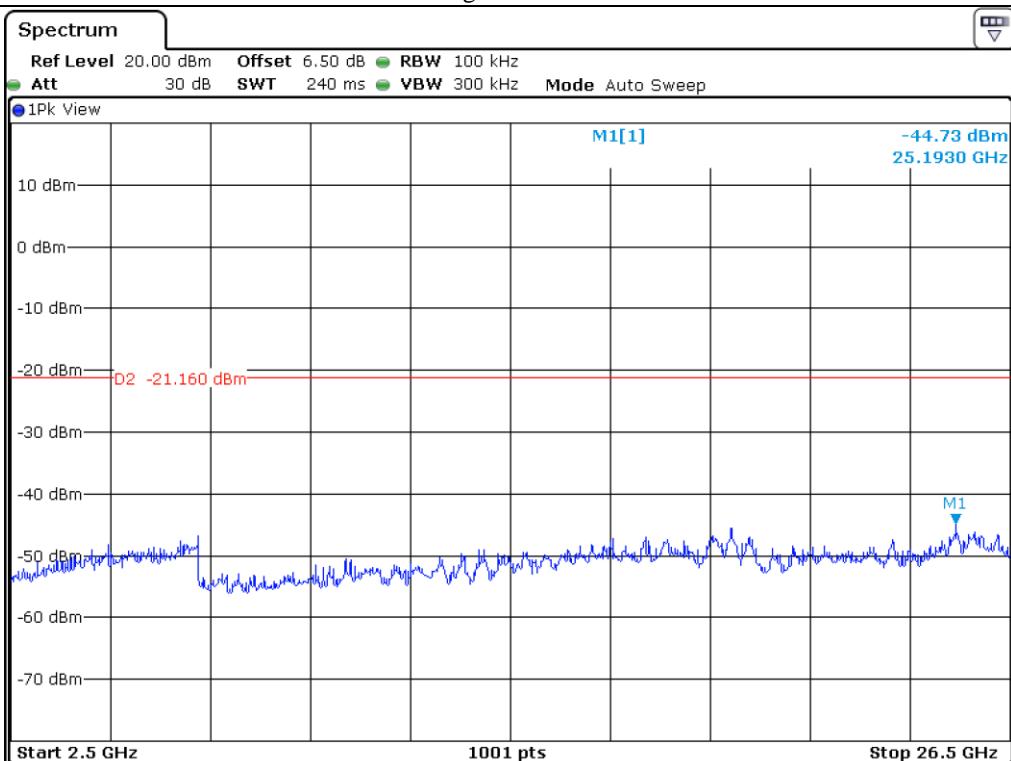
### Middle Channel



### Middle Channel

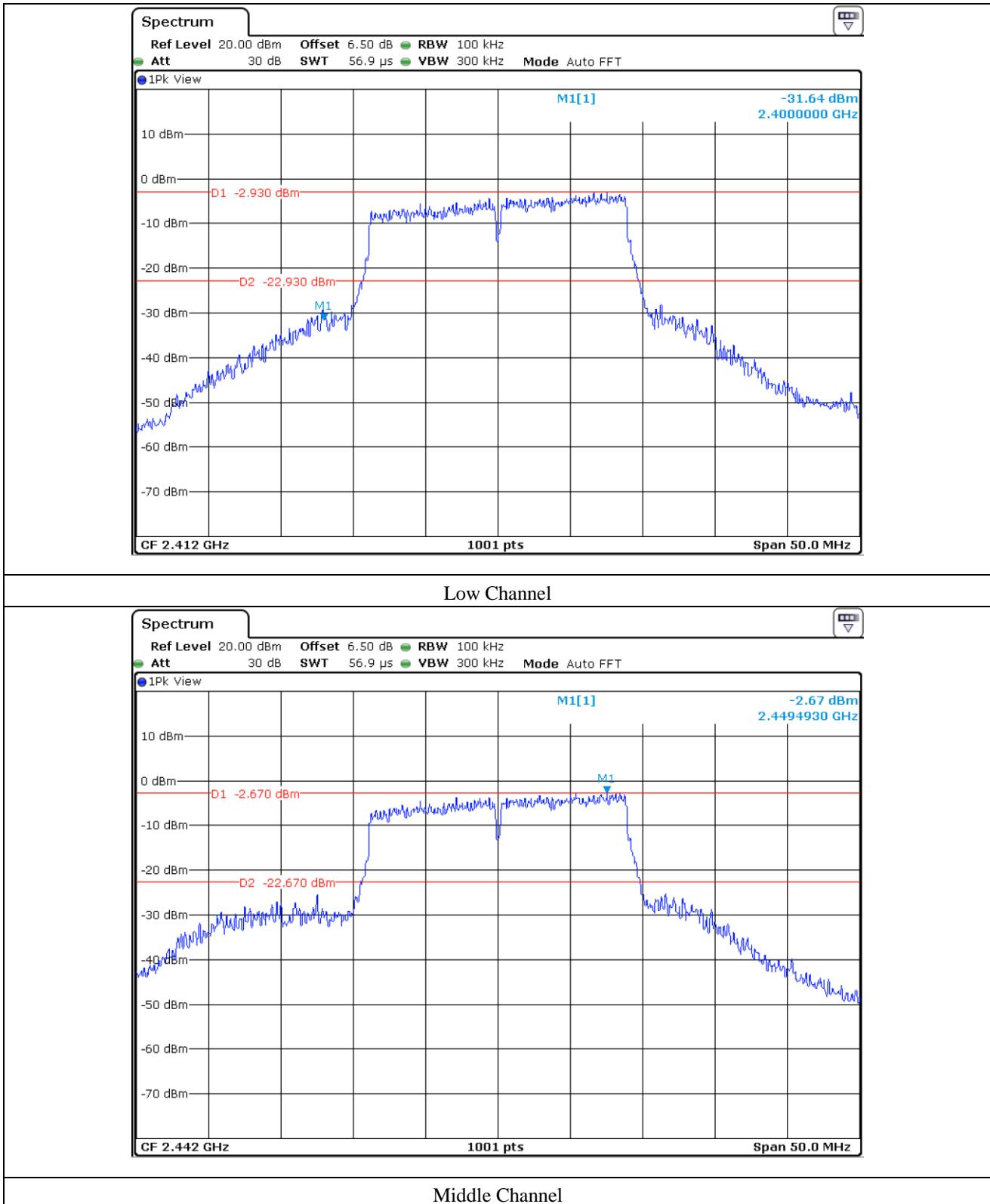


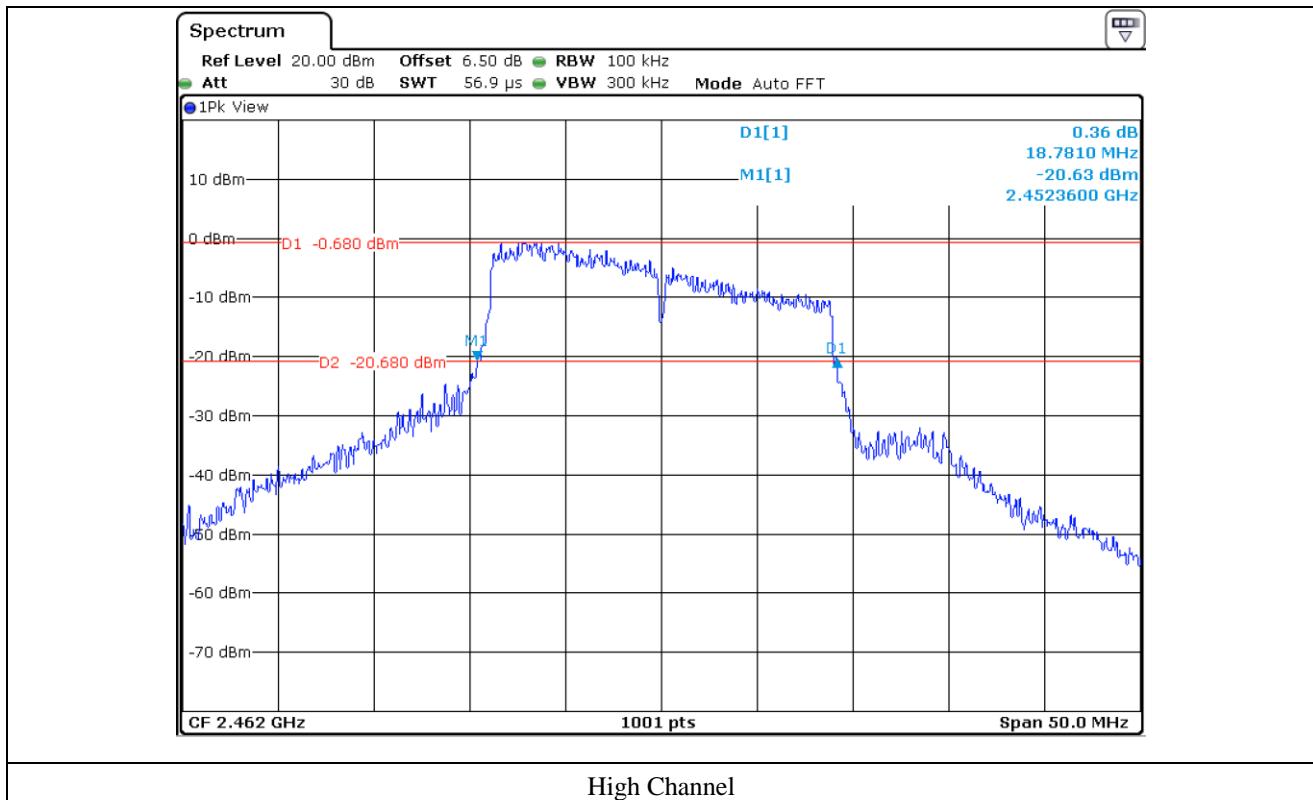
### High Channel

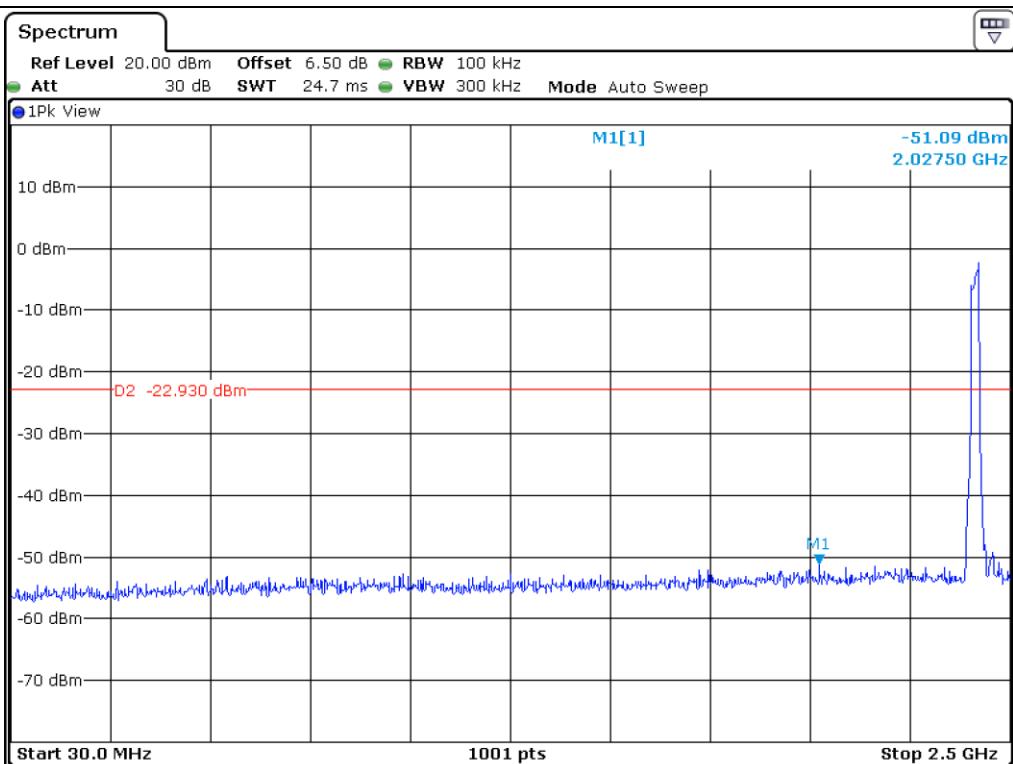


### High Channel

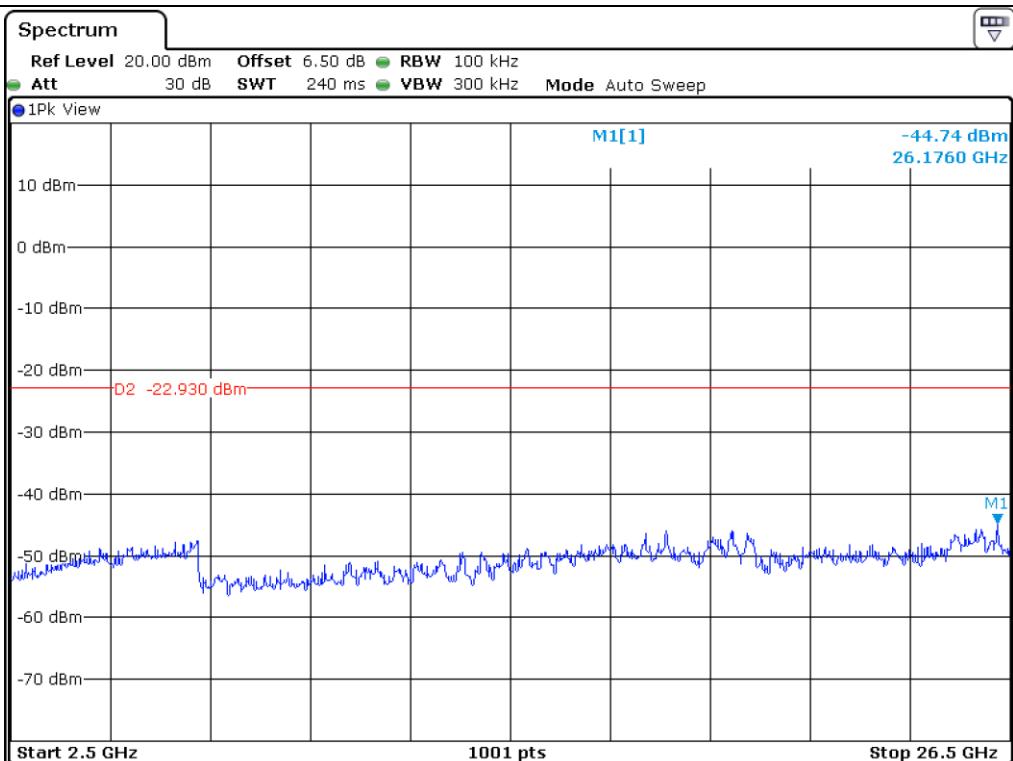
### 9.5.3 Test data for 802.11n (HT20) WLAN Mode



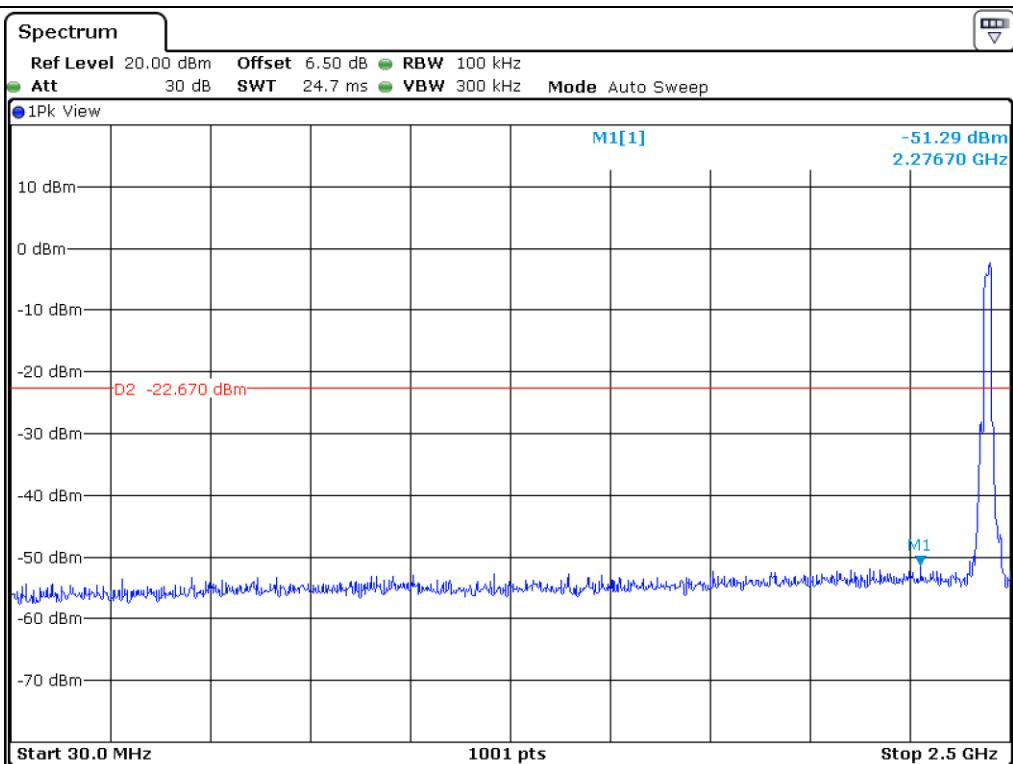




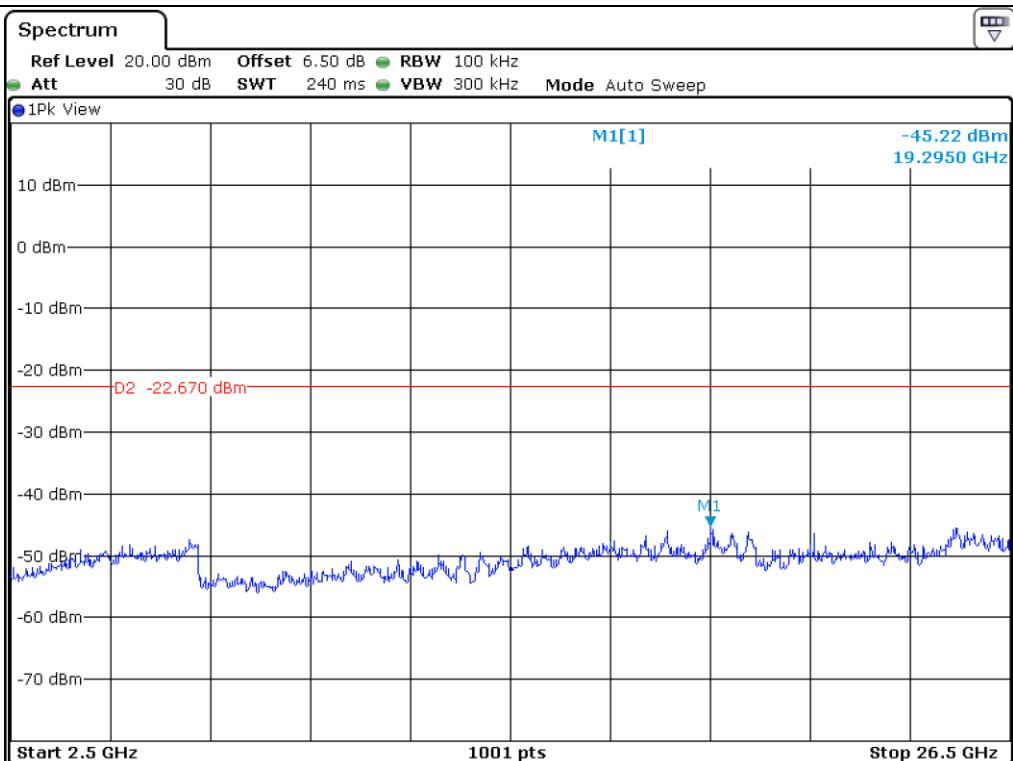
### Low Channel



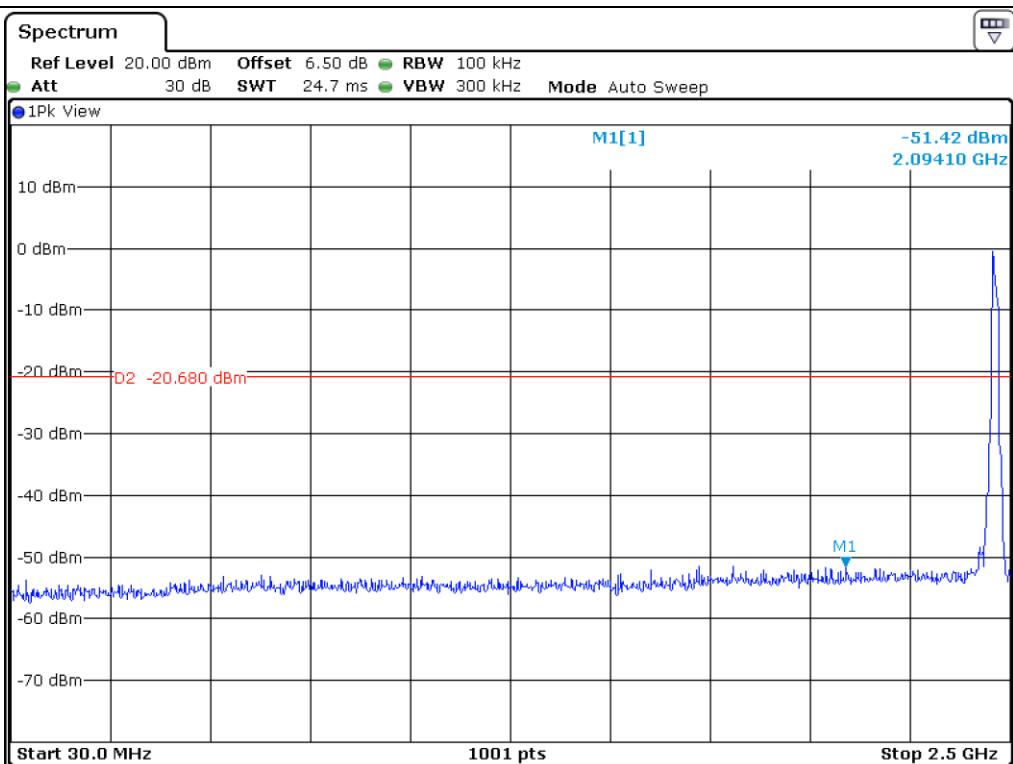
### Low Channel



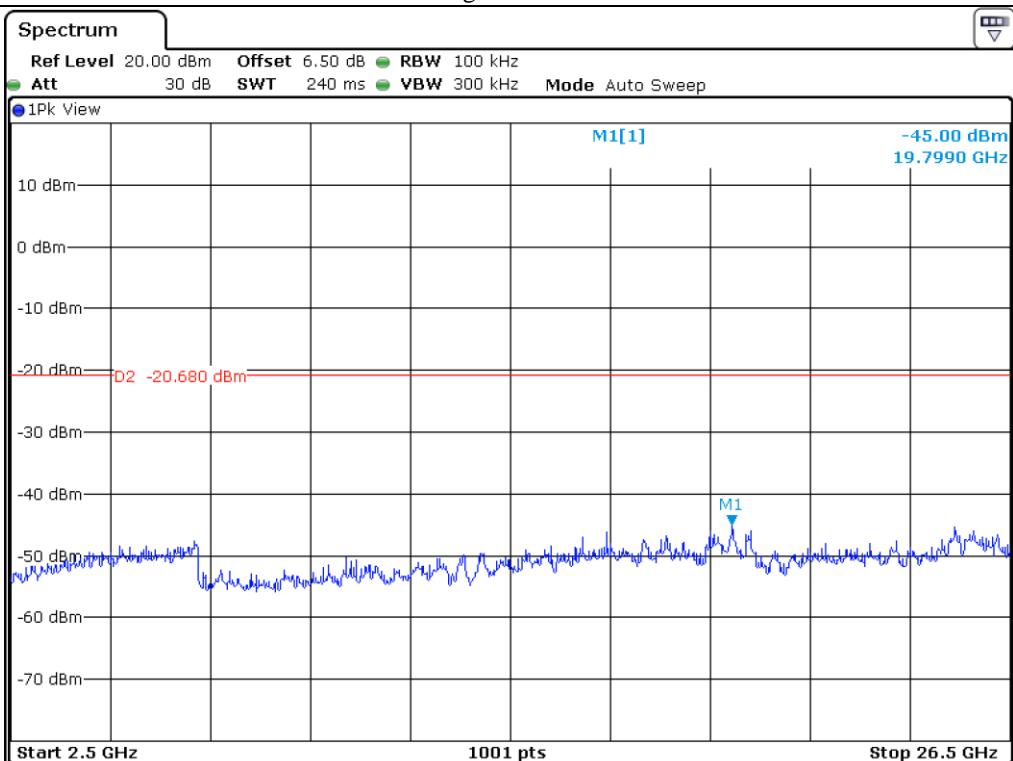
### Middle Channel



### Middle Channel

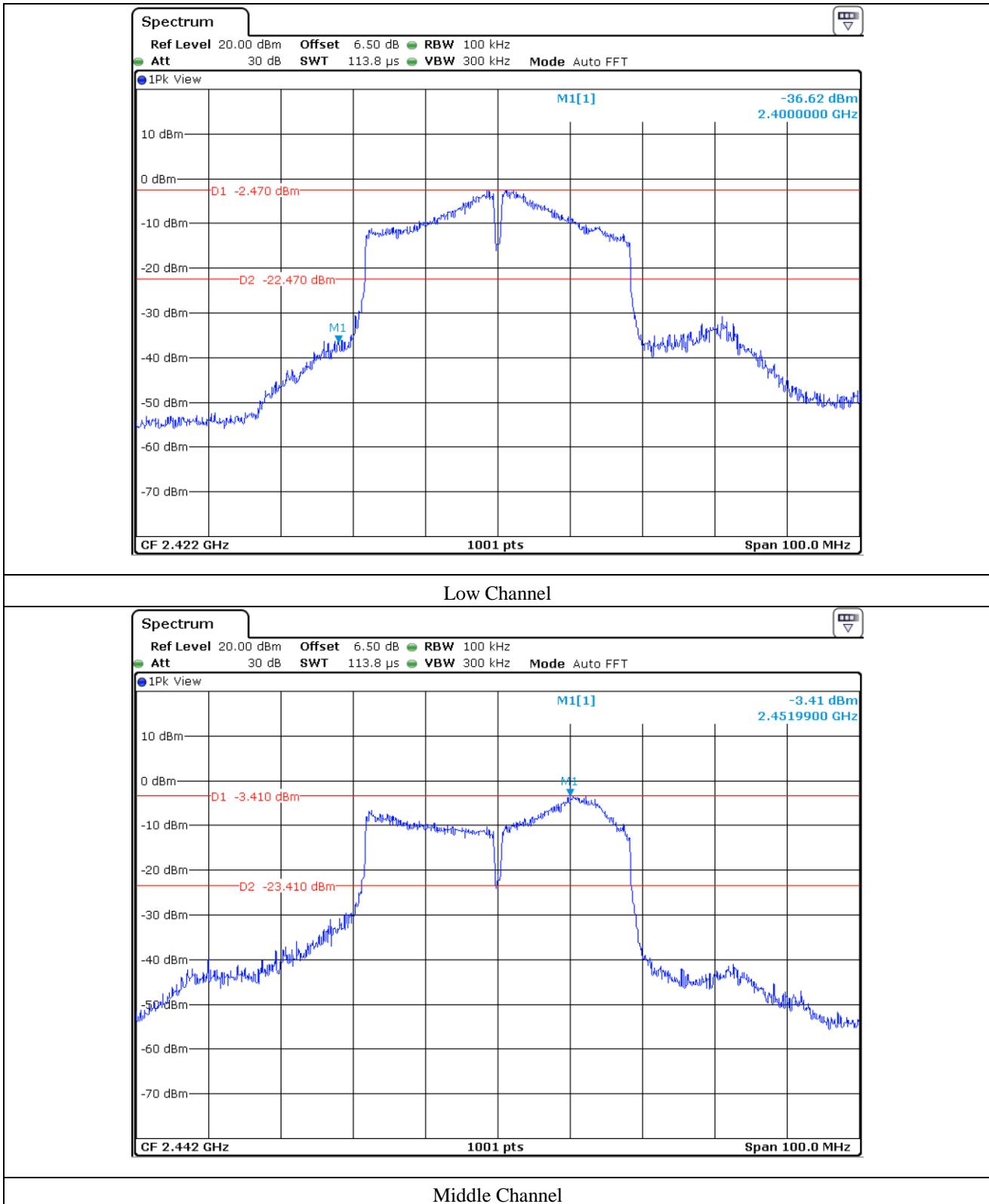


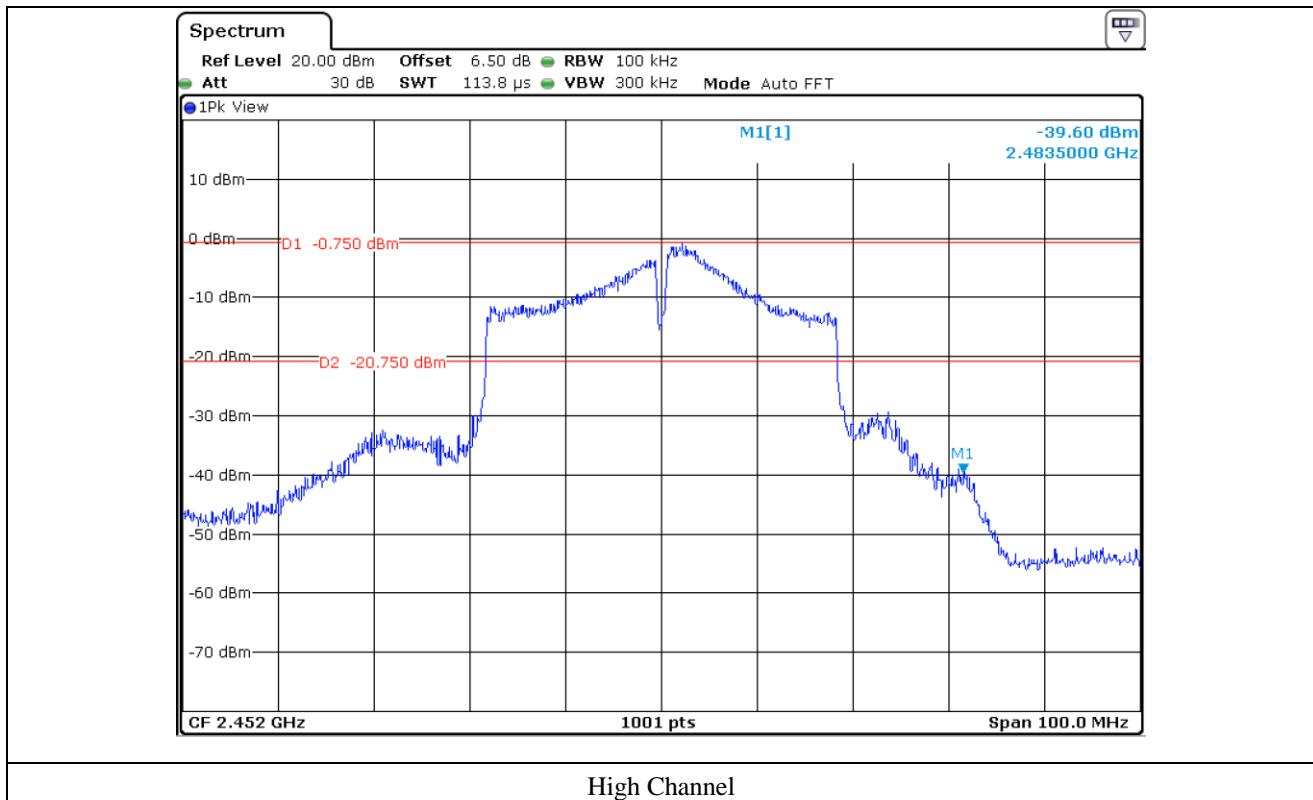
### High Channel

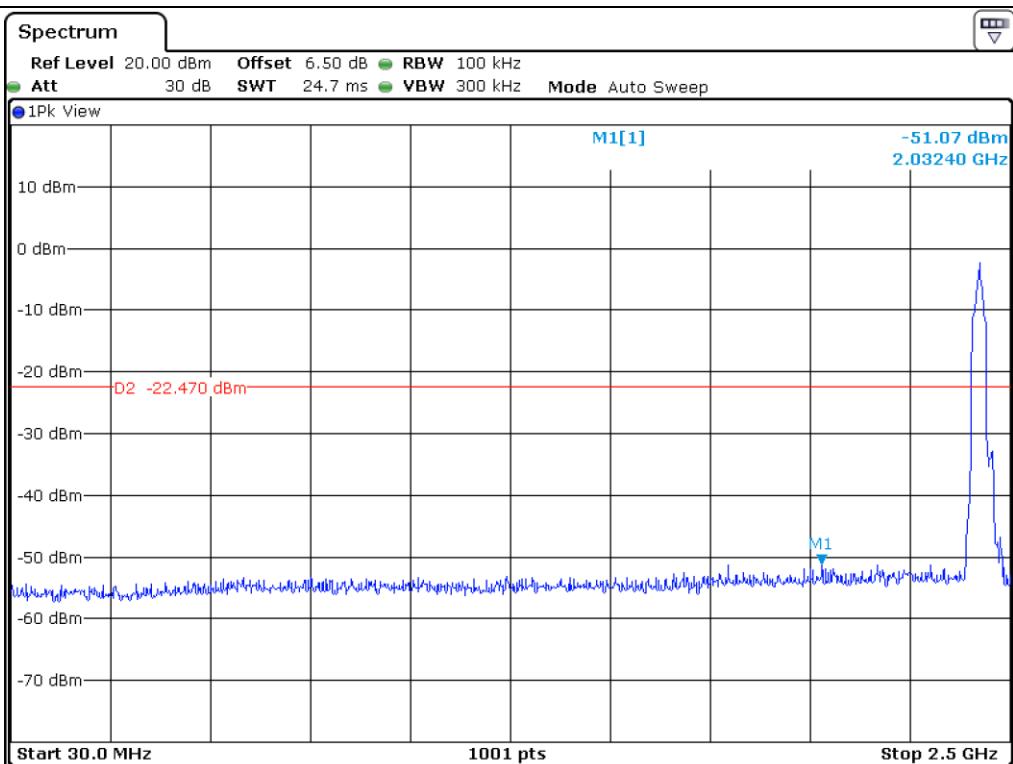


### High Channel

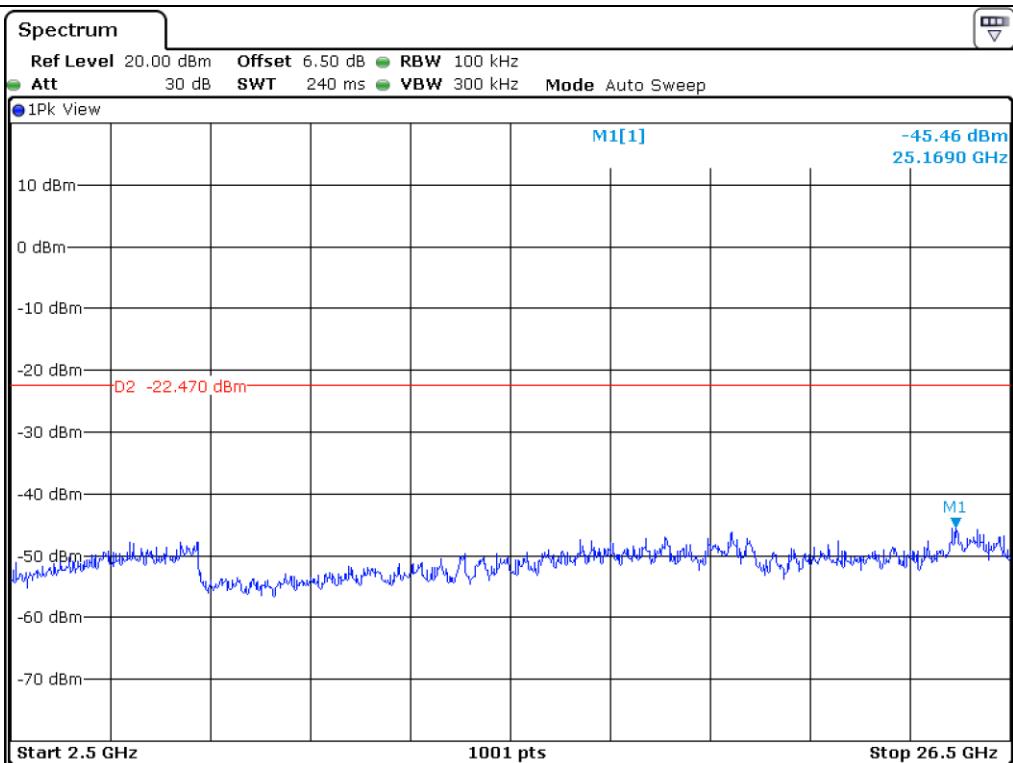
### 9.5.4 Test data for 802.11n (HT40) WLAN Mode



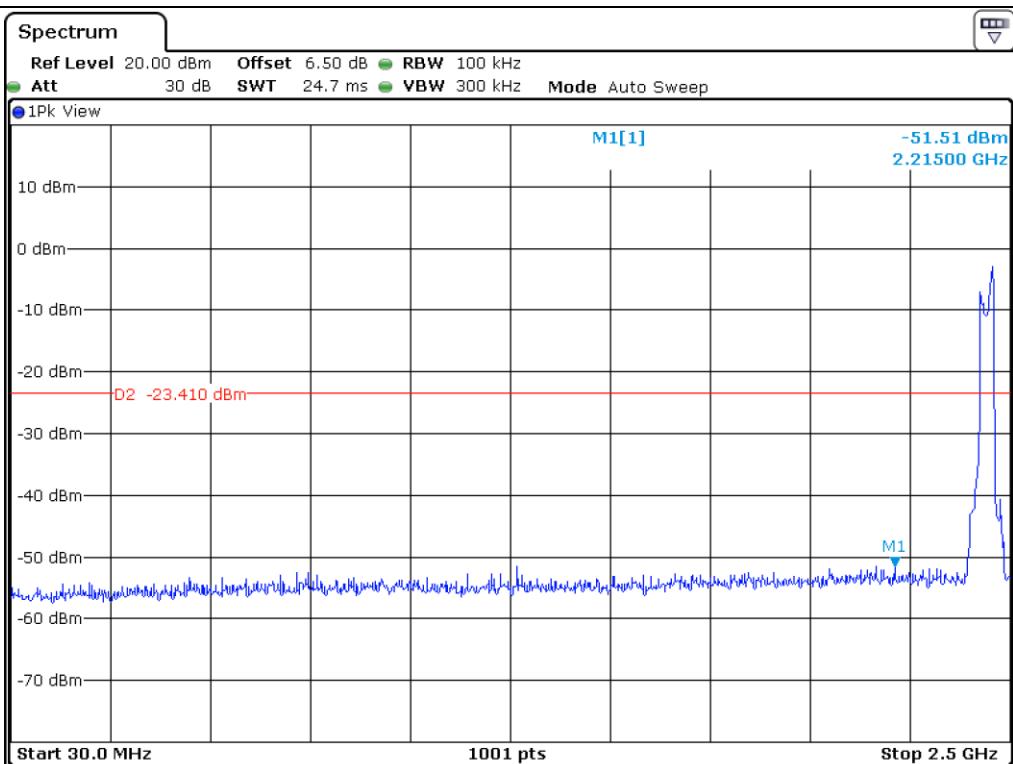




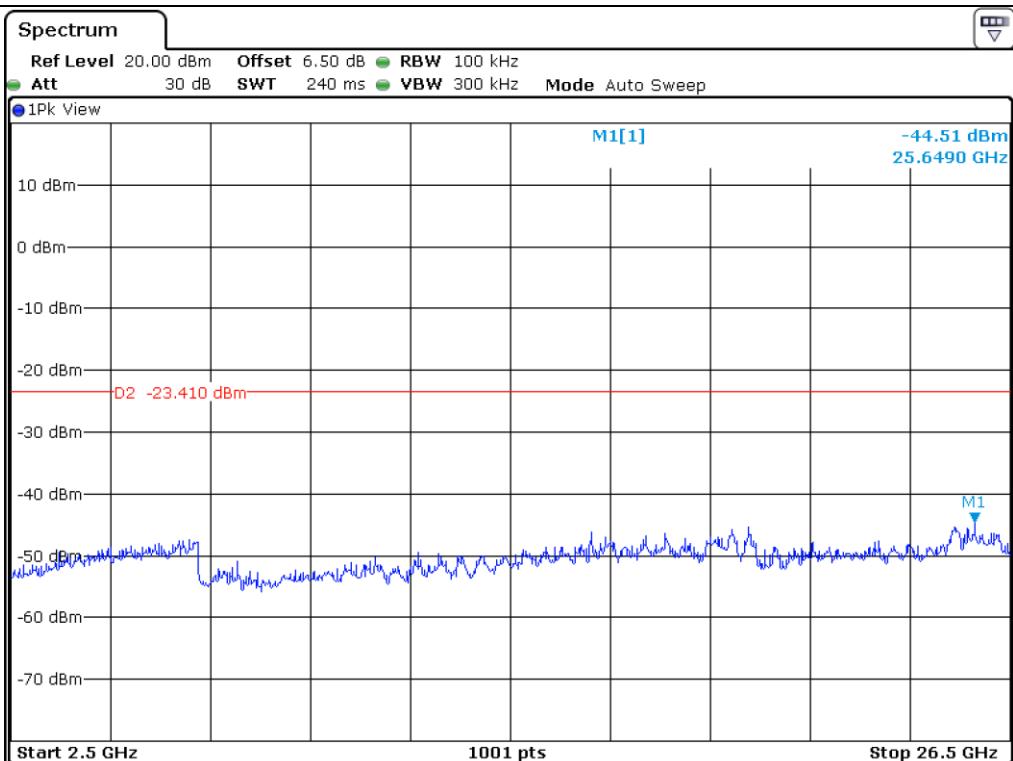
### Low Channel



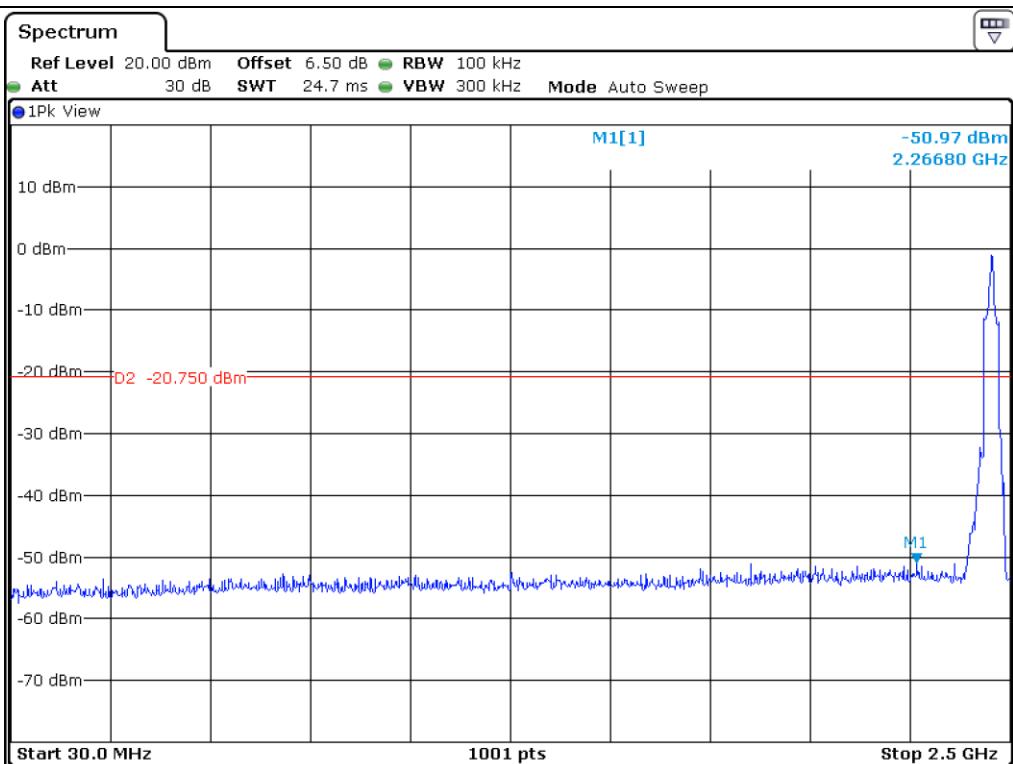
### Low Channel



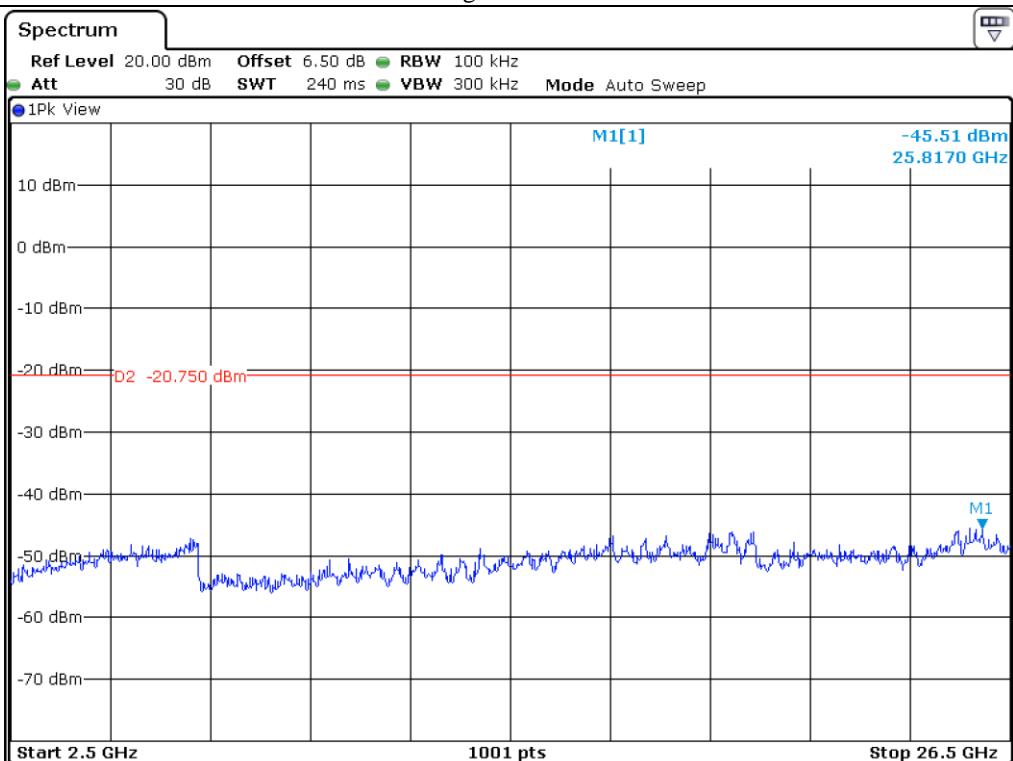
### Middle Channel



### 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 WLAN Mode

- Test Date : September 11, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Detector : Peak Mode(Peak), Average Mode(RMS)
- Frequency range : 30 MHz ~ 26.5 GHz
- Measurement distance : 3 m
- Result : PASSED

| Frequency<br>(MHz)                | Reading<br>(dB $\mu$ V) | Detector<br>Mode | Ant. Pol.<br>(H/V) | Ant.<br>Factor | Cable<br>Loss | Amp<br>Gain | Total<br>(dB $\mu$ V/m) | Limits<br>(dB $\mu$ V/m) | Margin<br>(dB) |
|-----------------------------------|-------------------------|------------------|--------------------|----------------|---------------|-------------|-------------------------|--------------------------|----------------|
| <b>Test Data for Low Channel</b>  |                         |                  |                    |                |               |             |                         |                          |                |
| 2 338.19                          | 38.28                   | Peak             | H                  | 27.60          | 8.80          | 34.31       | 40.37                   | 74.00                    | 33.63          |
| 2 334.83                          | 26.90                   | Average          | H                  |                |               |             | 28.99                   | 54.00                    | 25.01          |
| 2 376.63                          | 37.89                   | Peak             | V                  |                |               |             | 39.98                   | 74.00                    | 34.02          |
| 2 326.50                          | 25.40                   | Average          | V                  |                |               |             | 27.49                   | 54.00                    | 26.51          |
| <b>Test Data for High Channel</b> |                         |                  |                    |                |               |             |                         |                          |                |
| 2 484.23                          | 38.39                   | Peak             | H                  | 27.80          | 8.80          | 34.40       | 40.59                   | 74.00                    | 33.41          |
| 2 484.56                          | 26.31                   | Average          | H                  |                |               |             | 28.51                   | 54.00                    | 25.49          |
| 2 485.42                          | 38.28                   | Peak             | V                  |                |               |             | 40.48                   | 74.00                    | 33.52          |
| 2 483.97                          | 26.07                   | Average          | V                  |                |               |             | 28.27                   | 54.00                    | 25.73          |

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: Yu-Seog Sim / Assistant Manager

### 9.6.1.2 Test data for 802.11g WLAN Mode

- Test Date : September 11, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Detector : Peak Mode(Peak), Average Mode(RMS)
- Frequency range : 30 MHz ~ 26.5 GHz
- Measurement distance : 3 m
- Result : PASSED

| Frequency<br>(MHz)                | Reading<br>(dB $\mu$ V) | Detector<br>Mode | Ant. Pol.<br>(H/V) | Ant.<br>Factor | Cable<br>Loss | Amp<br>Gain | Total<br>(dB $\mu$ V/m) | Limits<br>(dB $\mu$ V/m) | Margin<br>(dB) |
|-----------------------------------|-------------------------|------------------|--------------------|----------------|---------------|-------------|-------------------------|--------------------------|----------------|
| <b>Test Data for Low Channel</b>  |                         |                  |                    |                |               |             |                         |                          |                |
| 2 389.94                          | 46.14                   | Peak             | H                  | 27.60          | 8.80          | 34.31       | 48.23                   | 74.00                    | 25.77          |
| 2 389.94                          | 29.93                   | Average          | H                  |                |               |             | 32.02                   | 54.00                    | 21.98          |
| 2 389.94                          | 43.03                   | Peak             | V                  |                |               |             | 45.12                   | 74.00                    | 28.88          |
| 2 389.83                          | 28.21                   | Average          | V                  |                |               |             | 30.30                   | 54.00                    | 23.70          |
| <b>Test Data for High Channel</b> |                         |                  |                    |                |               |             |                         |                          |                |
| 2 484.13                          | 48.69                   | Peak             | H                  | 27.80          | 8.80          | 34.40       | 50.89                   | 74.00                    | 23.11          |
| 2 483.56                          | 33.26                   | Average          | H                  |                |               |             | 35.46                   | 54.00                    | 18.54          |
| 2 483.51                          | 46.46                   | Peak             | V                  |                |               |             | 48.66                   | 74.00                    | 25.34          |
| 2 483.51                          | 33.17                   | Average          | V                  |                |               |             | 35.37                   | 54.00                    | 18.63          |

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: Yu-Seog Sim / Assistant Manager

### 9.6.1.3 Test data for 802.11n (HT 20) WLAN Mode

- Test Date : September 11, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Detector : Peak Mode(Peak), Average Mode(RMS)
- Frequency range : 30 MHz ~ 26.5 GHz
- Measurement distance : 3 m
- Result : PASSED

| Frequency<br>(MHz)                | Reading<br>(dB $\mu$ V) | Detector<br>Mode | Ant. Pol.<br>(H/V) | Ant.<br>Factor | Cable<br>Loss | Amp<br>Gain | Total<br>(dB $\mu$ V/m) | Limits<br>(dB $\mu$ V/m) | Margin<br>(dB) |
|-----------------------------------|-------------------------|------------------|--------------------|----------------|---------------|-------------|-------------------------|--------------------------|----------------|
| <b>Test Data for Low Channel</b>  |                         |                  |                    |                |               |             |                         |                          |                |
| 2 389.94                          | 47.59                   | Peak             | H                  | 27.60          | 8.80          | 34.31       | 49.68                   | 74.00                    | 24.32          |
| 2 389.94                          | 29.45                   | Average          | H                  |                |               |             | 31.54                   | 54.00                    | 22.46          |
| 2 389.94                          | 44.57                   | Peak             | V                  |                |               |             | 46.66                   | 74.00                    | 27.34          |
| 2 389.94                          | 28.58                   | Average          | V                  |                |               |             | 30.67                   | 54.00                    | 23.33          |
| <b>Test Data for High Channel</b> |                         |                  |                    |                |               |             |                         |                          |                |
| 2 483.51                          | 47.67                   | Peak             | H                  | 27.80          | 8.80          | 34.40       | 49.87                   | 74.00                    | 24.13          |
| 2 483.51                          | 32.83                   | Average          | H                  |                |               |             | 35.03                   | 54.00                    | 18.97          |
| 2 484.09                          | 47.89                   | Peak             | V                  |                |               |             | 50.09                   | 74.00                    | 23.91          |
| 2 483.54                          | 32.83                   | Average          | V                  |                |               |             | 35.03                   | 54.00                    | 18.97          |

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: Yu-Seog Sim / Assistant Manager

#### 9.6.1.4 Test data for 802.11n (HT 40) WLAN Mode

- Test Date : September 11, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Detector : Peak Mode(Peak), Average Mode(RMS)
- Frequency range : 30 MHz ~ 26.5 GHz
- Measurement distance : 3 m
- Result : PASSED

| Frequency<br>(MHz)                | Reading<br>(dB $\mu$ V) | Detector<br>Mode | Ant. Pol.<br>(H/V) | Ant.<br>Factor | Cable<br>Loss | Amp<br>Gain | Total<br>(dB $\mu$ V/m) | Limits<br>(dB $\mu$ V/m) | Margin<br>(dB) |
|-----------------------------------|-------------------------|------------------|--------------------|----------------|---------------|-------------|-------------------------|--------------------------|----------------|
| <b>Test Data for Low Channel</b>  |                         |                  |                    |                |               |             |                         |                          |                |
| 2 389.94                          | 43.47                   | Peak             | H                  | 27.60          | 11.40         | 33.60       | 48.87                   | 74.00                    | 25.13          |
| 2 389.94                          | 28.38                   | Average          | H                  |                |               |             | 33.78                   | 54.00                    | 20.22          |
| 2 389.94                          | 42.25                   | Peak             | V                  |                |               |             | 47.65                   | 74.00                    | 26.35          |
| 2 389.94                          | 27.76                   | Average          | V                  |                |               |             | 33.16                   | 54.00                    | 20.84          |
| <b>Test Data for High Channel</b> |                         |                  |                    |                |               |             |                         |                          |                |
| 2 483.51                          | 52.96                   | Peak             | H                  | 27.80          | 11.40         | 33.60       | 58.56                   | 74.00                    | 15.44          |
| 2 483.51                          | 40.93                   | Average          | H                  |                |               |             | 46.53                   | 54.00                    | 7.47           |
| 2 483.51                          | 53.06                   | Peak             | V                  |                |               |             | 58.66                   | 74.00                    | 15.34          |
| 2 483.51                          | 40.18                   | Average          | V                  |                |               |             | 45.78                   | 54.00                    | 8.22           |

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: Yu-Seog Sim / Assistant Manager

## 9.6.2 Spurious & Harmonic Radiated Emission

### 9.6.2.1 Test data for 802.11b WLAN Mode

- Test Date : September 11, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Detector : Peak Mode(Peak), Average Mode(RMS)
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Result : PASSED

| Frequency<br>(GHz)                  | Reading<br>(dB $\mu$ V) | Detector<br>Mode | Ant. Pol.<br>(H/V) | Ant.<br>Factor | Cable<br>Loss | Amp<br>Gain | Total<br>(dB $\mu$ V/m) | Limits<br>(dB $\mu$ V/m) | Margin<br>(dB) |
|-------------------------------------|-------------------------|------------------|--------------------|----------------|---------------|-------------|-------------------------|--------------------------|----------------|
| <b>Test Data for Low Channel</b>    |                         |                  |                    |                |               |             |                         |                          |                |
| 4 824.00                            | 37.96                   | Peak             | H                  | 31.30          | 13.30         | 35.24       | 47.32                   | 74.00                    | 26.68          |
|                                     | 25.73                   | Average          | H                  |                |               |             | 35.09                   | 54.00                    | 18.91          |
|                                     | 37.45                   | Peak             | V                  |                |               |             | 46.81                   | 74.00                    | 27.19          |
|                                     | 25.34                   | Average          | V                  |                |               |             | 34.70                   | 54.00                    | 19.30          |
|                                     |                         |                  |                    |                |               |             |                         |                          |                |
| <b>Test Data for Middle Channel</b> |                         |                  |                    |                |               |             |                         |                          |                |
| 4 884.00                            | 37.65                   | Peak             | H                  | 31.30          | 13.50         | 35.27       | 47.18                   | 74.00                    | 26.82          |
|                                     | 25.85                   | Average          | H                  |                |               |             | 35.38                   | 54.00                    | 18.62          |
|                                     | 36.94                   | Peak             | V                  |                |               |             | 46.47                   | 74.00                    | 27.53          |
|                                     | 24.63                   | Average          | V                  |                |               |             | 34.16                   | 54.00                    | 19.84          |
|                                     |                         |                  |                    |                |               |             |                         |                          |                |
| <b>Test Data for High Channel</b>   |                         |                  |                    |                |               |             |                         |                          |                |
| 4 924.00                            | 34.38                   | Peak             | H                  | 31.10          | 13.70         | 35.29       | 43.89                   | 74.00                    | 30.11          |
|                                     | 30.63                   | Average          | H                  |                |               |             | 40.14                   | 54.00                    | 13.86          |
|                                     | 34.26                   | Peak             | V                  |                |               |             | 43.77                   | 74.00                    | 30.23          |
|                                     | 29.85                   | Average          | V                  |                |               |             | 39.36                   | 54.00                    | 14.64          |
|                                     |                         |                  |                    |                |               |             |                         |                          |                |

Tabulated test data for Spurious & Harmonic

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

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

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

Tested by: Yu-Seog Sim / Assistant Manager

### 9.6.2.2 Test data for 802.11g WLAN Mode

- Test Date : September 11, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Detector : Peak Mode(Peak), Average Mode(RMS)
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Result : PASSED

| Frequency<br>(GHz)                  | Reading<br>(dB $\mu$ V) | Detector<br>Mode | Ant. Pol.<br>(H/V) | Ant.<br>Factor | Cable<br>Loss | Amp<br>Gain | Total<br>(dB $\mu$ V/m) | Limits<br>(dB $\mu$ V/m) | Margin<br>(dB) |
|-------------------------------------|-------------------------|------------------|--------------------|----------------|---------------|-------------|-------------------------|--------------------------|----------------|
| <b>Test Data for Low Channel</b>    |                         |                  |                    |                |               |             |                         |                          |                |
| 4 824.00                            | 38.60                   | Peak             | H                  | 31.30          | 13.30         | 35.24       | 47.96                   | 74.00                    | 26.04          |
|                                     | 25.79                   | Average          | H                  |                |               |             | 35.15                   | 54.00                    | 18.85          |
|                                     | 36.80                   | Peak             | V                  |                |               |             | 46.16                   | 74.00                    | 27.84          |
|                                     | 24.93                   | Average          | V                  |                |               |             | 34.29                   | 54.00                    | 19.71          |
|                                     |                         |                  |                    |                |               |             |                         |                          |                |
| <b>Test Data for Middle Channel</b> |                         |                  |                    |                |               |             |                         |                          |                |
| 4 884.00                            | 35.28                   | Peak             | H                  | 31.30          | 13.50         | 35.27       | 44.81                   | 74.00                    | 29.19          |
|                                     | 22.55                   | Average          | H                  |                |               |             | 32.08                   | 54.00                    | 21.92          |
|                                     | 35.26                   | Peak             | V                  |                |               |             | 44.79                   | 74.00                    | 29.21          |
|                                     | 22.01                   | Average          | V                  |                |               |             | 31.54                   | 54.00                    | 22.46          |
|                                     |                         |                  |                    |                |               |             |                         |                          |                |
| <b>Test Data for High Channel</b>   |                         |                  |                    |                |               |             |                         |                          |                |
| 4 924.00                            | 37.89                   | Peak             | H                  | 31.10          | 13.70         | 35.29       | 47.40                   | 74.00                    | 26.60          |
|                                     | 30.74                   | Average          | H                  |                |               |             | 40.25                   | 54.00                    | 13.75          |
|                                     | 33.91                   | Peak             | V                  |                |               |             | 43.42                   | 74.00                    | 30.58          |
|                                     | 29.72                   | Average          | V                  |                |               |             | 39.23                   | 54.00                    | 14.77          |
|                                     |                         |                  |                    |                |               |             |                         |                          |                |

Tabulated test data for Spurious & Harmonic

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: Yu-Seog Sim / Assistant Manager

### 9.6.2.3 Test data for 802.11n (HT 20) WLAN Mode

- Test Date : September 11, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Detector : Peak Mode(Peak), Average Mode(RMS)
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Result : PASSED

| Frequency<br>(GHz)                  | Reading<br>(dB $\mu$ V) | Detector<br>Mode | Ant. Pol.<br>(H/V) | Ant.<br>Factor | Cable<br>Loss | Amp<br>Gain | Total<br>(dB $\mu$ V/m) | Limits<br>(dB $\mu$ V/m) | Margin<br>(dB) |
|-------------------------------------|-------------------------|------------------|--------------------|----------------|---------------|-------------|-------------------------|--------------------------|----------------|
| <b>Test Data for Low Channel</b>    |                         |                  |                    |                |               |             |                         |                          |                |
| 4 824.00                            | 38.47                   | Peak             | H                  | 31.30          | 13.30         | 35.24       | 47.83                   | 74.00                    | 26.17          |
|                                     | 26.04                   | Average          | H                  |                |               |             | 35.40                   | 54.00                    | 18.60          |
|                                     | 37.55                   | Peak             | V                  |                |               |             | 46.91                   | 74.00                    | 27.09          |
|                                     | 25.65                   | Average          | V                  |                |               |             | 35.01                   | 54.00                    | 18.99          |
|                                     |                         |                  |                    |                |               |             |                         |                          |                |
| <b>Test Data for Middle Channel</b> |                         |                  |                    |                |               |             |                         |                          |                |
| 4 884.00                            | 34.67                   | Peak             | H                  | 31.30          | 13.50         | 35.27       | 44.20                   | 74.00                    | 29.80          |
|                                     | 22.18                   | Average          | H                  |                |               |             | 31.71                   | 54.00                    | 22.29          |
|                                     | 34.94                   | Peak             | V                  |                |               |             | 44.47                   | 74.00                    | 29.53          |
|                                     | 22.57                   | Average          | V                  |                |               |             | 32.10                   | 54.00                    | 21.90          |
|                                     |                         |                  |                    |                |               |             |                         |                          |                |
| <b>Test Data for High Channel</b>   |                         |                  |                    |                |               |             |                         |                          |                |
| 4 924.00                            | 37.91                   | Peak             | H                  | 31.10          | 13.70         | 35.29       | 47.42                   | 74.00                    | 26.58          |
|                                     | 30.77                   | Average          | H                  |                |               |             | 40.28                   | 54.00                    | 13.72          |
|                                     | 34.26                   | Peak             | V                  |                |               |             | 43.77                   | 74.00                    | 30.23          |
|                                     | 29.60                   | Average          | V                  |                |               |             | 39.11                   | 54.00                    | 14.89          |
|                                     |                         |                  |                    |                |               |             |                         |                          |                |

Tabulated test data for Spurious & Harmonic

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: Yu-Seog Sim / Assistant Manager

#### 9.6.2.4 Test data for 802.11n (HT 40) WLAN Mode

- Test Date : September 11, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Detector : Peak Mode(Peak), Average Mode(RMS)
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Result : PASSED

| Frequency<br>(GHz)                  | Reading<br>(dB $\mu$ V) | Detector<br>Mode | Ant. Pol.<br>(H/V) | Ant.<br>Factor | Cable<br>Loss | Amp<br>Gain | Total<br>(dB $\mu$ V/m) | Limits<br>(dB $\mu$ V/m) | Margin<br>(dB) |
|-------------------------------------|-------------------------|------------------|--------------------|----------------|---------------|-------------|-------------------------|--------------------------|----------------|
| <b>Test Data for Low Channel</b>    |                         |                  |                    |                |               |             |                         |                          |                |
| 4 844.00                            | 38.02                   | Peak             | H                  | 31.00          | 16.10         | 32.90       | 52.22                   | 74.00                    | 21.78          |
|                                     | 25.20                   | Average          | H                  |                |               |             | 39.40                   | 54.00                    | 14.60          |
|                                     | 37.78                   | Peak             | V                  |                |               |             | 51.98                   | 74.00                    | 22.02          |
|                                     | 25.19                   | Average          | V                  |                |               |             | 39.39                   | 54.00                    | 14.61          |
|                                     |                         |                  |                    |                |               |             |                         |                          |                |
| <b>Test Data for Middle Channel</b> |                         |                  |                    |                |               |             |                         |                          |                |
| 4 884.00                            | 34.54                   | Peak             | H                  | 31.10          | 16.10         | 33.00       | 48.74                   | 74.00                    | 25.26          |
|                                     | 22.33                   | Average          | H                  |                |               |             | 36.53                   | 54.00                    | 17.47          |
|                                     | 34.56                   | Peak             | V                  |                |               |             | 48.76                   | 74.00                    | 25.24          |
|                                     | 22.51                   | Average          | V                  |                |               |             | 36.71                   | 54.00                    | 17.29          |
|                                     |                         |                  |                    |                |               |             |                         |                          |                |
| <b>Test Data for High Channel</b>   |                         |                  |                    |                |               |             |                         |                          |                |
| 4 904.00                            | 36.20                   | Peak             | H                  | 31.20          | 16.10         | 33.10       | 50.40                   | 74.00                    | 23.60          |
|                                     | 23.33                   | Average          | H                  |                |               |             | 37.53                   | 54.00                    | 16.47          |
|                                     | 35.10                   | Peak             | V                  |                |               |             | 49.30                   | 74.00                    | 24.70          |
|                                     | 23.35                   | Average          | V                  |                |               |             | 37.55                   | 54.00                    | 16.45          |
|                                     |                         |                  |                    |                |               |             |                         |                          |                |

Tabulated test data for Spurious & Harmonic

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: Yu-Seog Sim / Assistant Manager

## 10. PEAK POWER SPECTRAL DENSITY

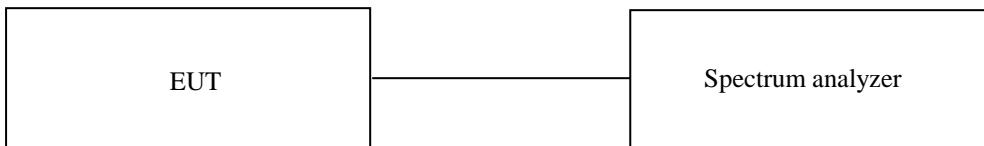
### 10.1 Operating environment

Temperature : 24 °C

Relative humidity : 47 % 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.          |
|--------------|-----------------|-----------------|---------------|--------------------|
| ■ - FSV30    | Rohde & Schwarz | Signal Analyzer | 101200        | Jul. 24, 2019 (1Y) |

All test equipment used is calibrated on a regular basis.

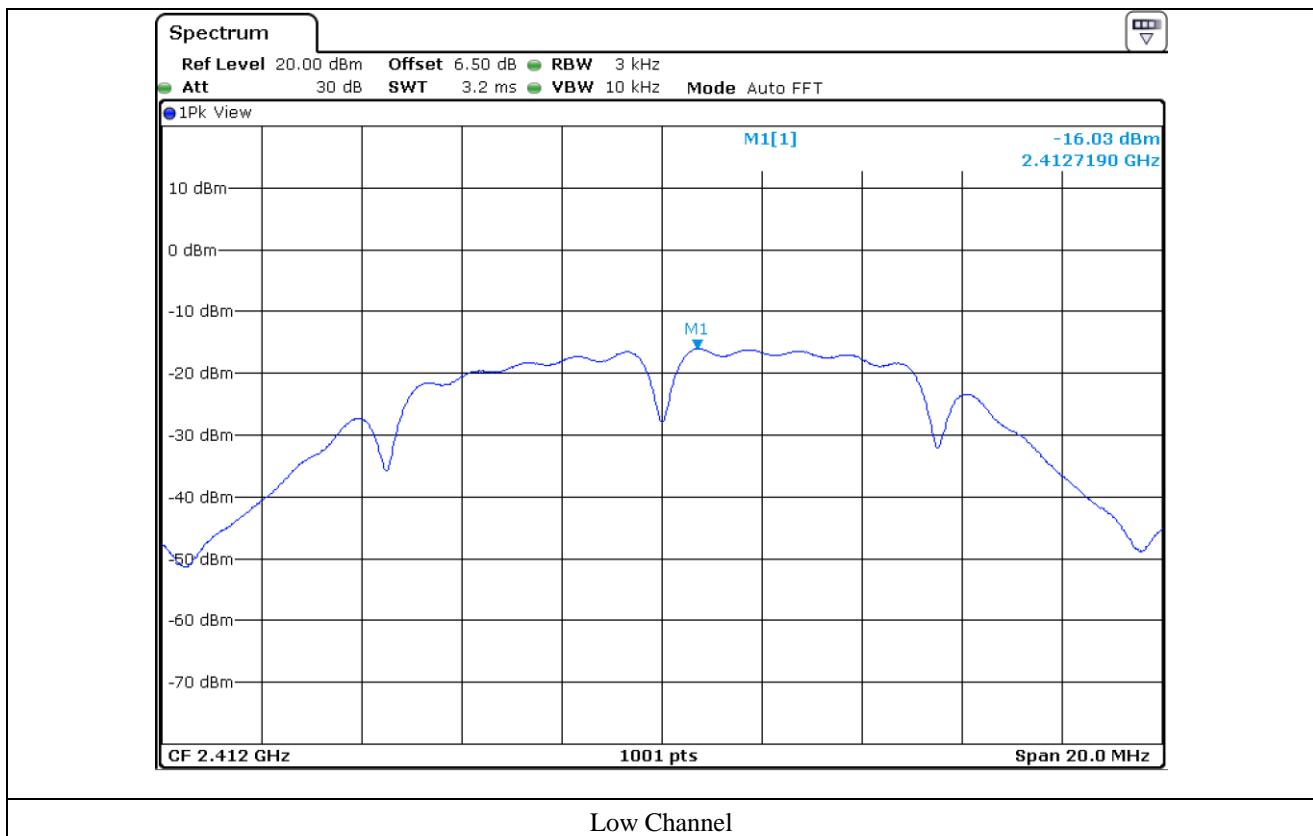
#### 10.4 Test data for 802.11b WLAN Mode

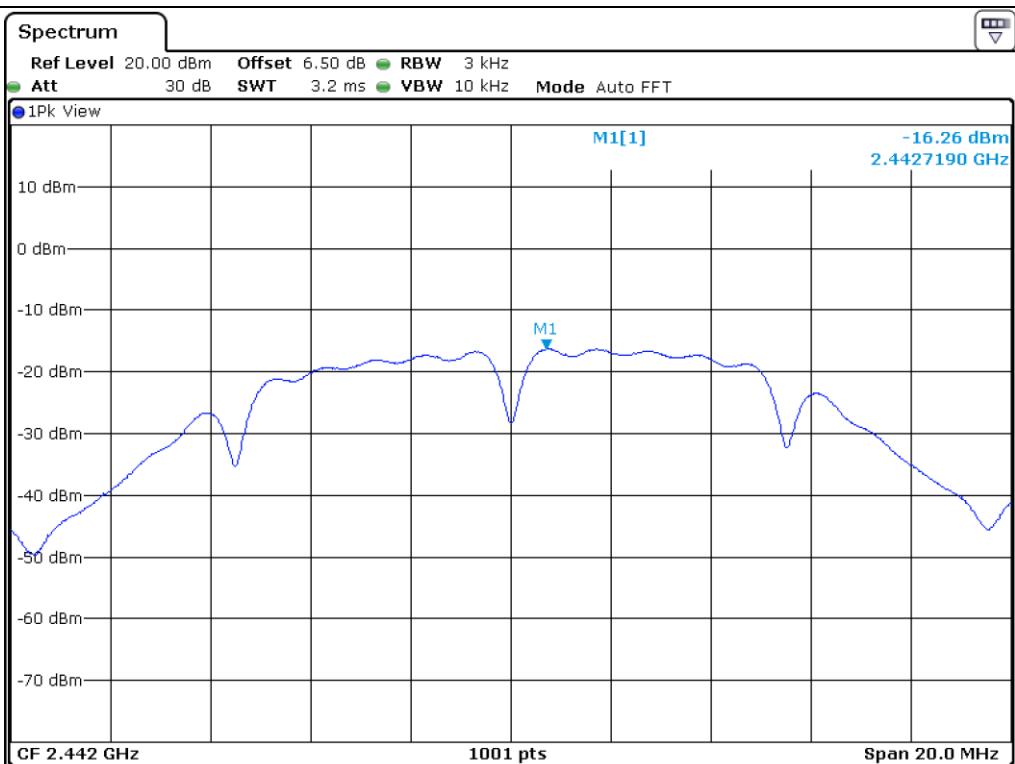
- Test Date : September 11, 2019
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

| CHANNEL | FREQUENCY(MHz) | MEASURED VALUE (dBm) | LIMIT (dBm) | MARGIN (dB) |
|---------|----------------|----------------------|-------------|-------------|
| Low     | 2 412.00       | -16.03               | 8.00        | 24.03       |
| Middle  | 2 442.00       | -16.26               | 8.00        | 24.26       |
| High    | 2 462.00       | -15.44               | 8.00        | 23.44       |

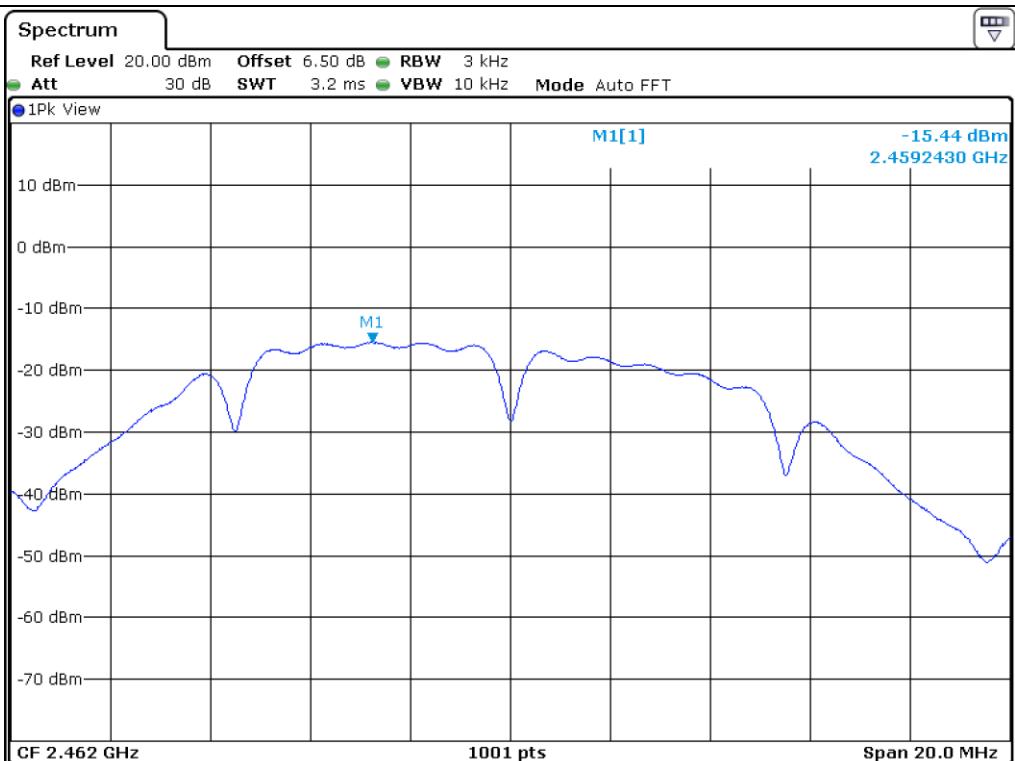
Remark. Margin = Limit – Measured value

Tested by: Yu-Seog Sim / Assistant Manager





### Middle Channel



### High Channel

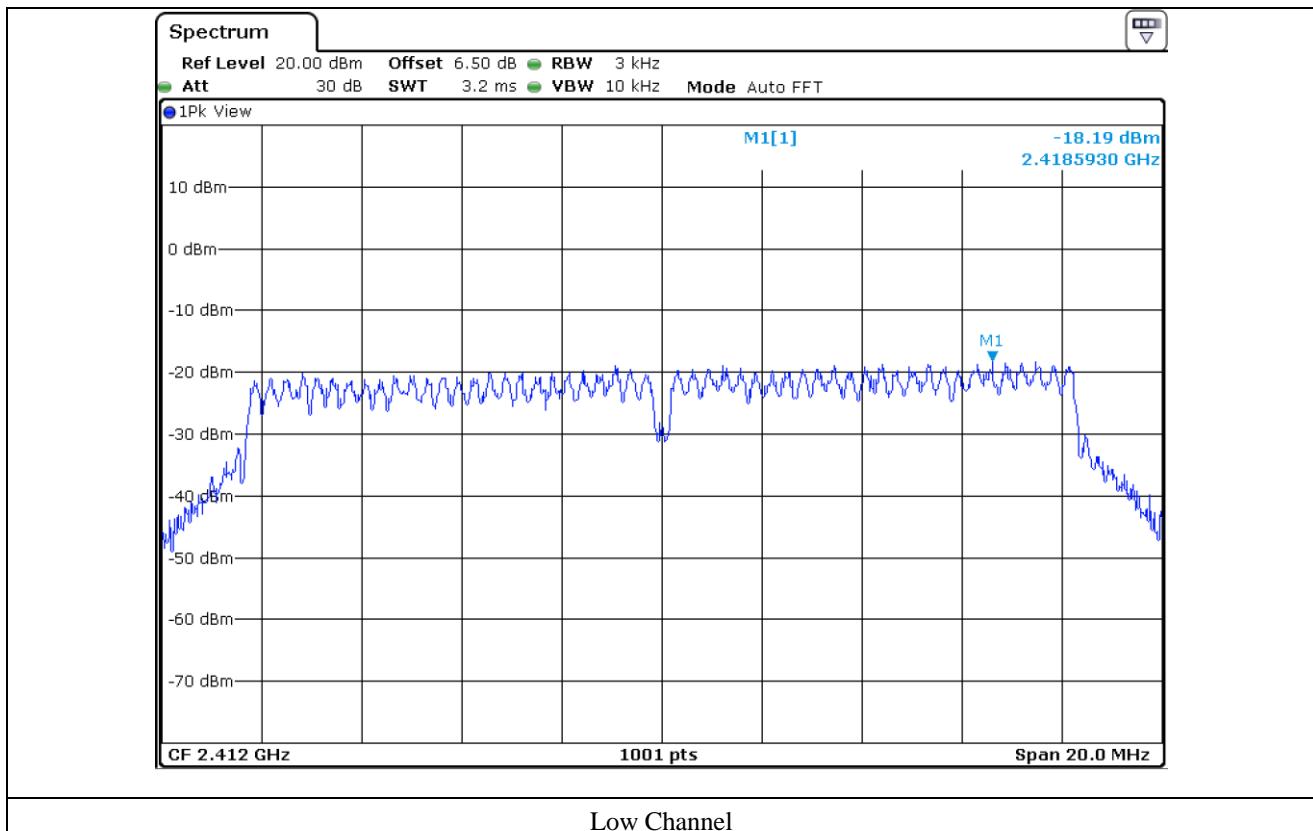
### 10.5 Test data for 802.11g WLAN Mode

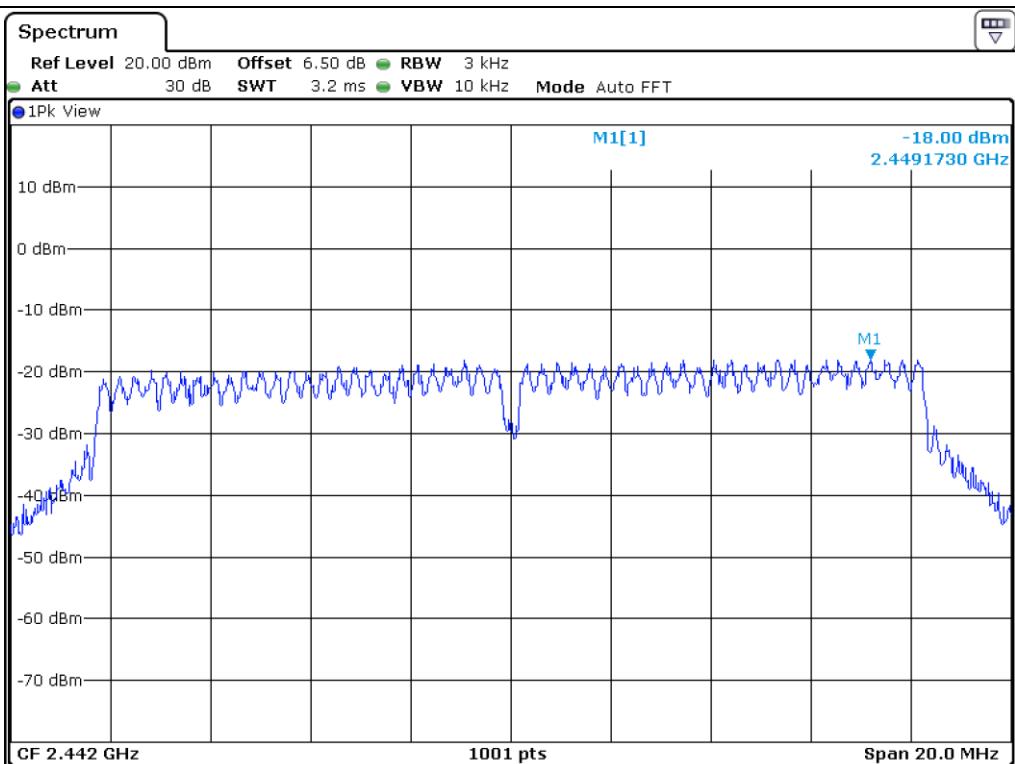
- Test Date : September 11, 2019
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

| CHANNEL | FREQUENCY(MHz) | MEASURED VALUE (dBm) | LIMIT (dBm) | MARGIN (dB) |
|---------|----------------|----------------------|-------------|-------------|
| Low     | 2 412.00       | -18.19               | 8.00        | 26.19       |
| Middle  | 2 442.00       | -18.00               | 8.00        | 26.00       |
| High    | 2 462.00       | -15.05               | 8.00        | 23.05       |

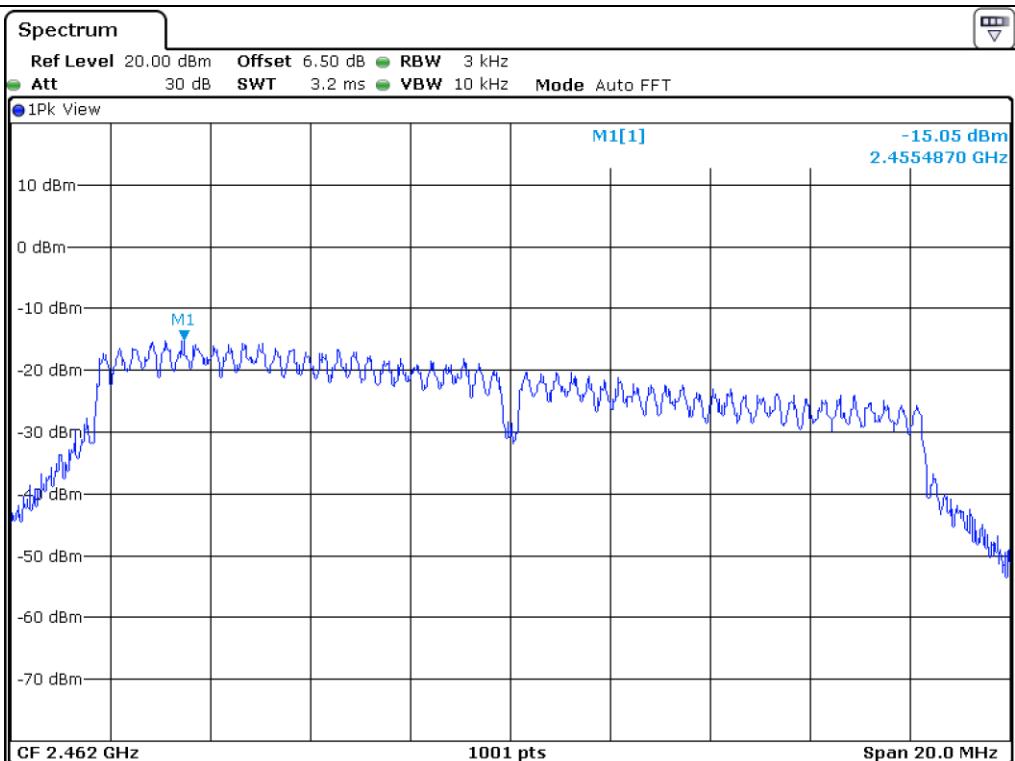
Remark. Margin = Limit – Measured value

Tested by: Yu-Seog Sim / Assistant Manager





## Middle Channel



## High Channel

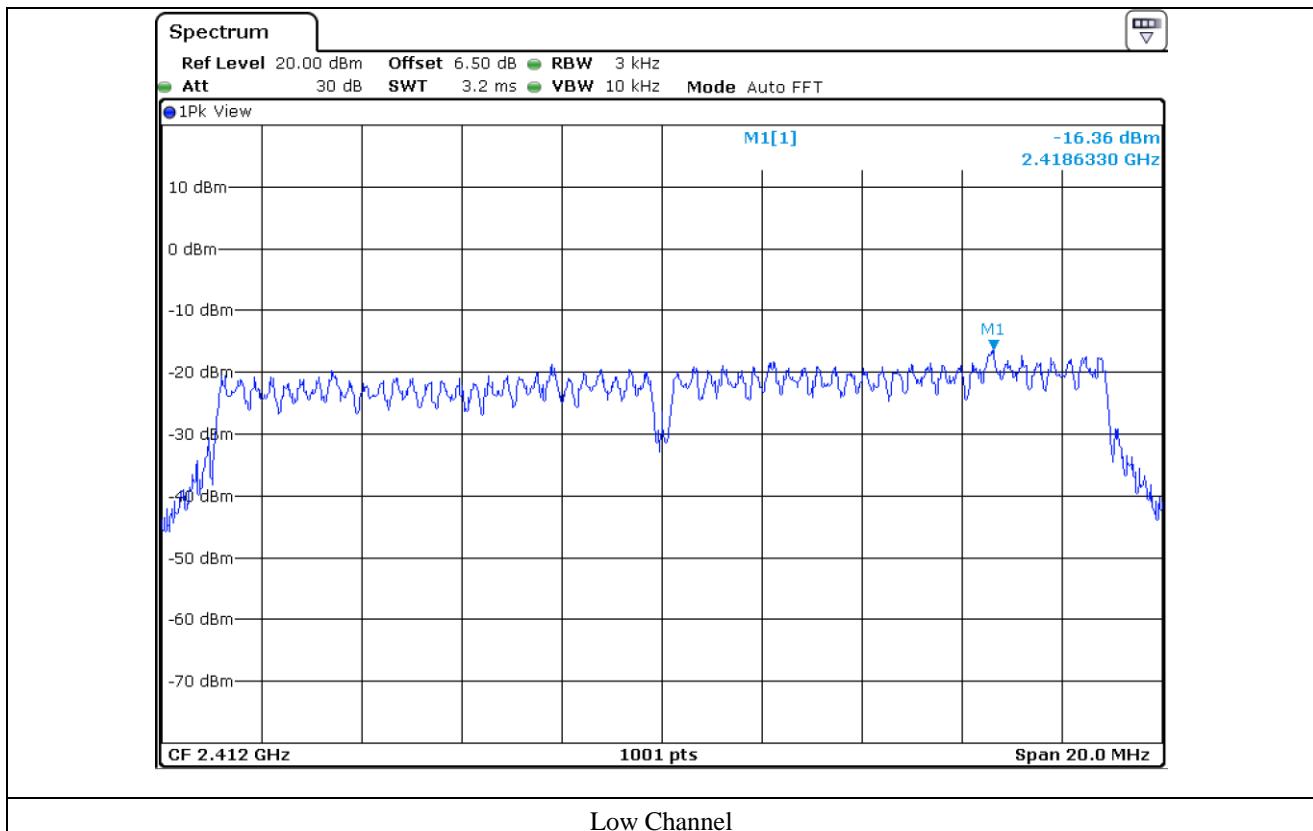
### 10.6 Test data for 802.11n (HT20) WLAN Mode

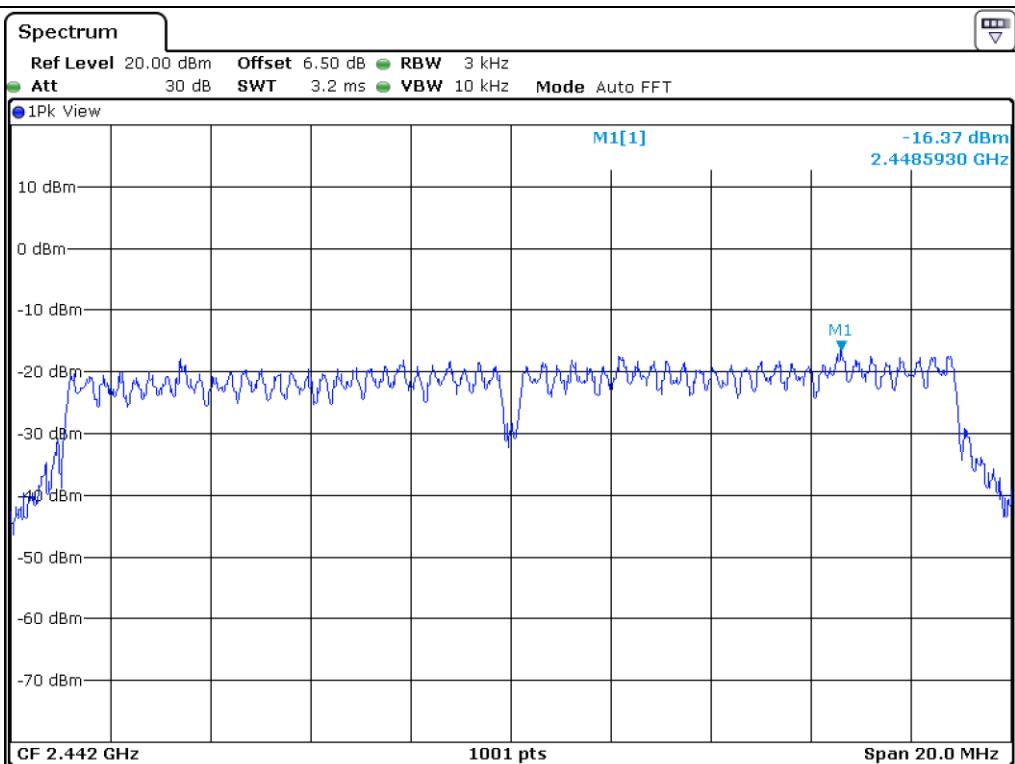
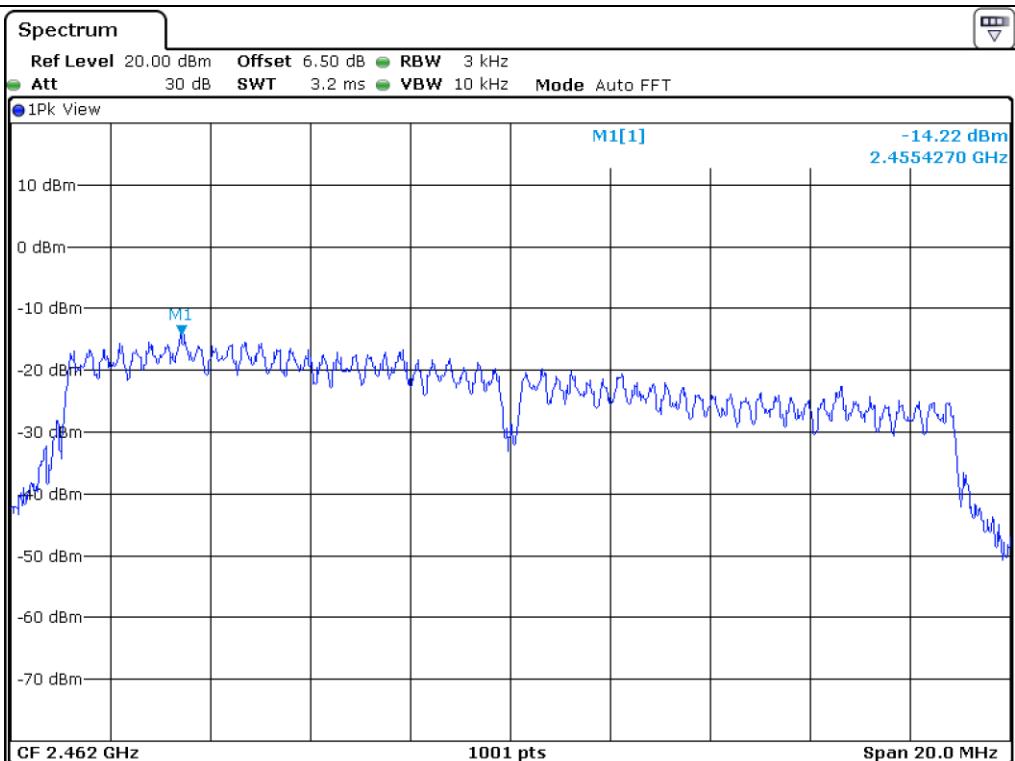
- Test Date : September 11, 2019
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

| CHANNEL | FREQUENCY(MHz) | MEASURED VALUE (dBm) | LIMIT (dBm) | MARGIN (dB) |
|---------|----------------|----------------------|-------------|-------------|
| Low     | 2 412.00       | -16.36               | 8.00        | 24.36       |
| Middle  | 2 442.00       | -16.37               | 8.00        | 24.37       |
| High    | 2 462.00       | -14.22               | 8.00        | 22.22       |

Remark. Margin = Limit – Measured value

Tested by: Yu-Seog Sim / Assistant Manager



**Middle Channel****High Channel**

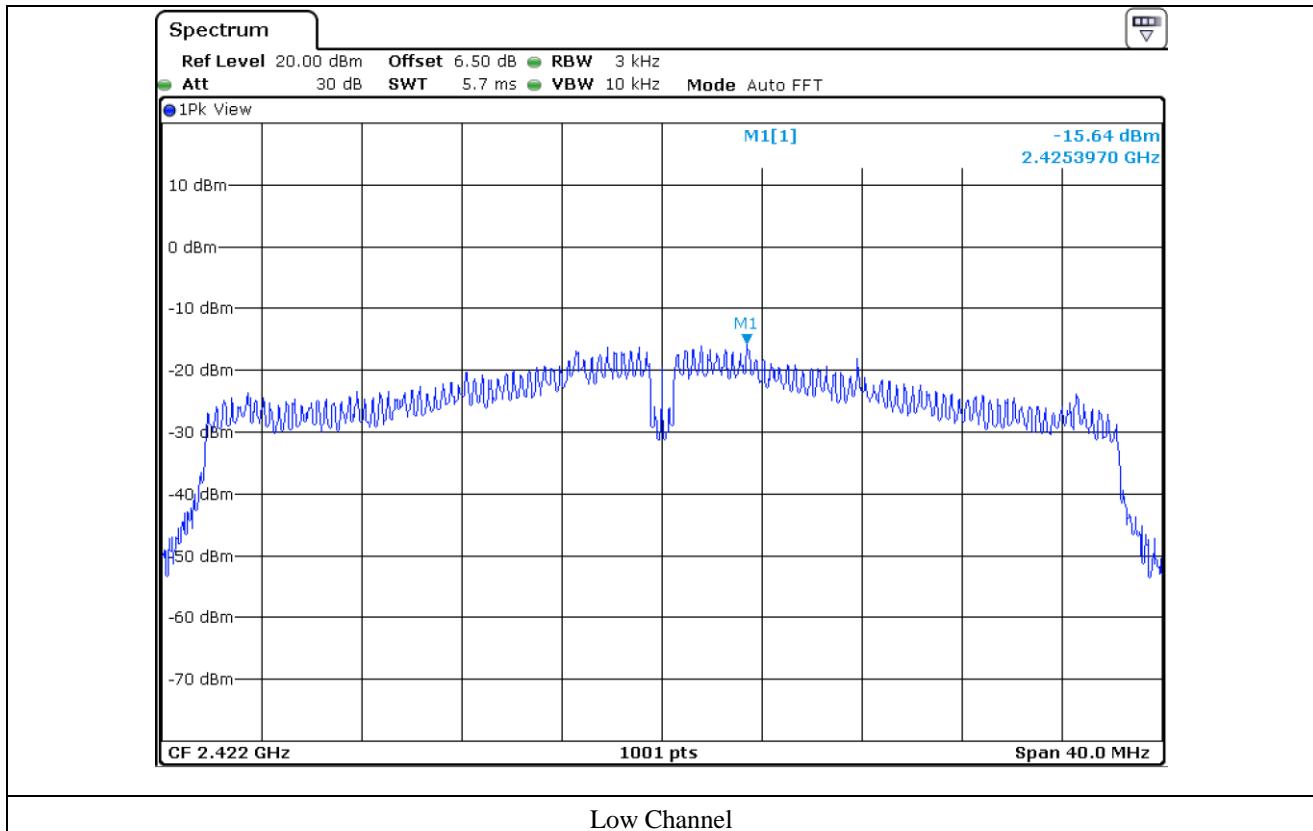
### 10.7 Test data for 802.11n (HT40) WLAN Mode

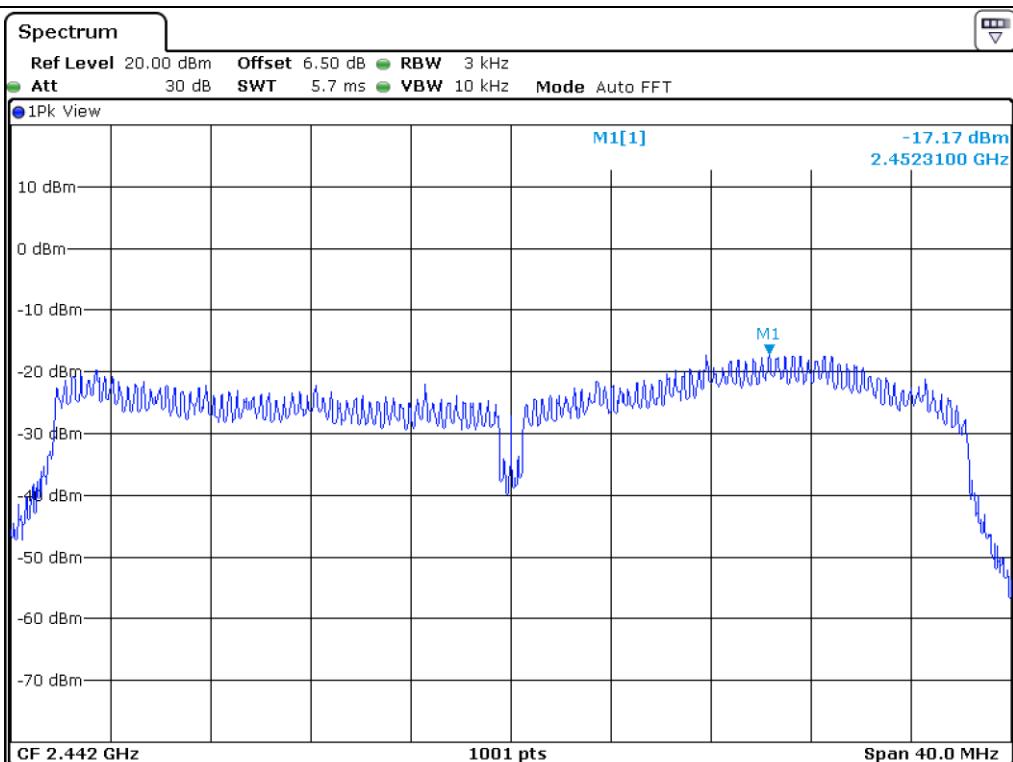
- Test Date : September 11, 2019
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

| CHANNEL | FREQUENCY(MHz) | MEASURED VALUE (dBm) | LIMIT (dBm) | MARGIN (dB) |
|---------|----------------|----------------------|-------------|-------------|
| Low     | 2 412.00       | -15.64               | 8.00        | 23.64       |
| Middle  | 2 442.00       | -17.17               | 8.00        | 25.17       |
| High    | 2 452.00       | -13.90               | 8.00        | 21.90       |

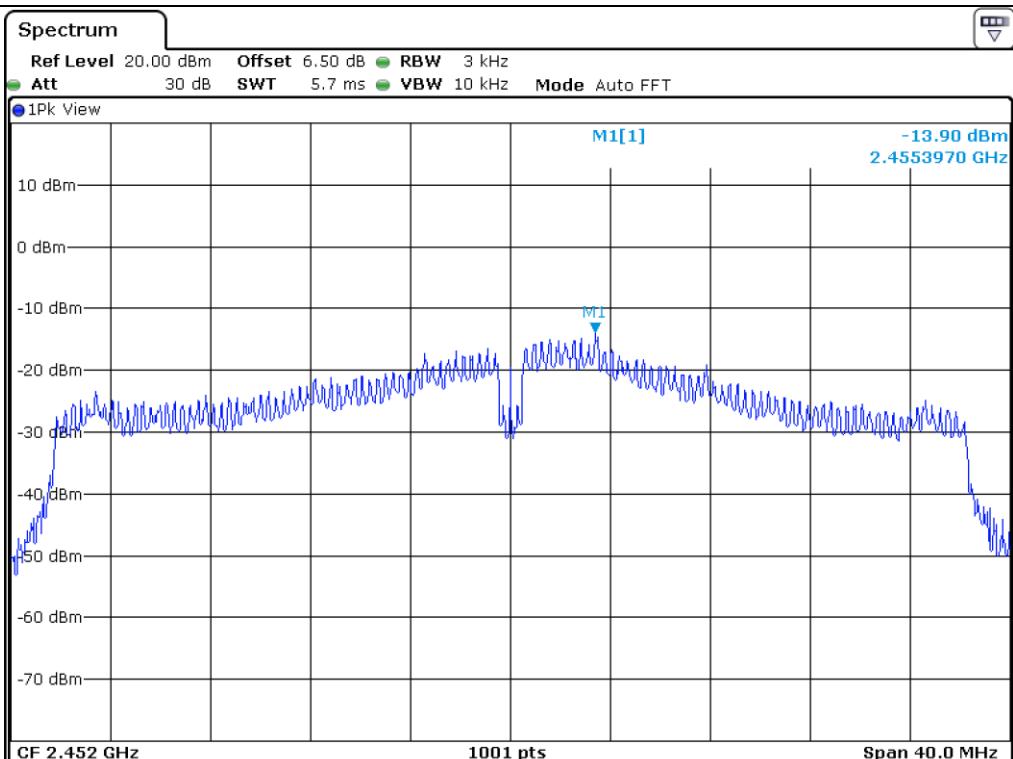
Remark. Margin = Limit – Measured value

Tested by: Yu-Seog Sim / Assistant Manager





## Middle Channel



## High Channel

## 11. RADIATED EMISSION TEST

### 11.1 Operating environment

Temperature : 24 °C

Relative humidity : 47 % R.H.

### 11.2 Test set-up

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

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

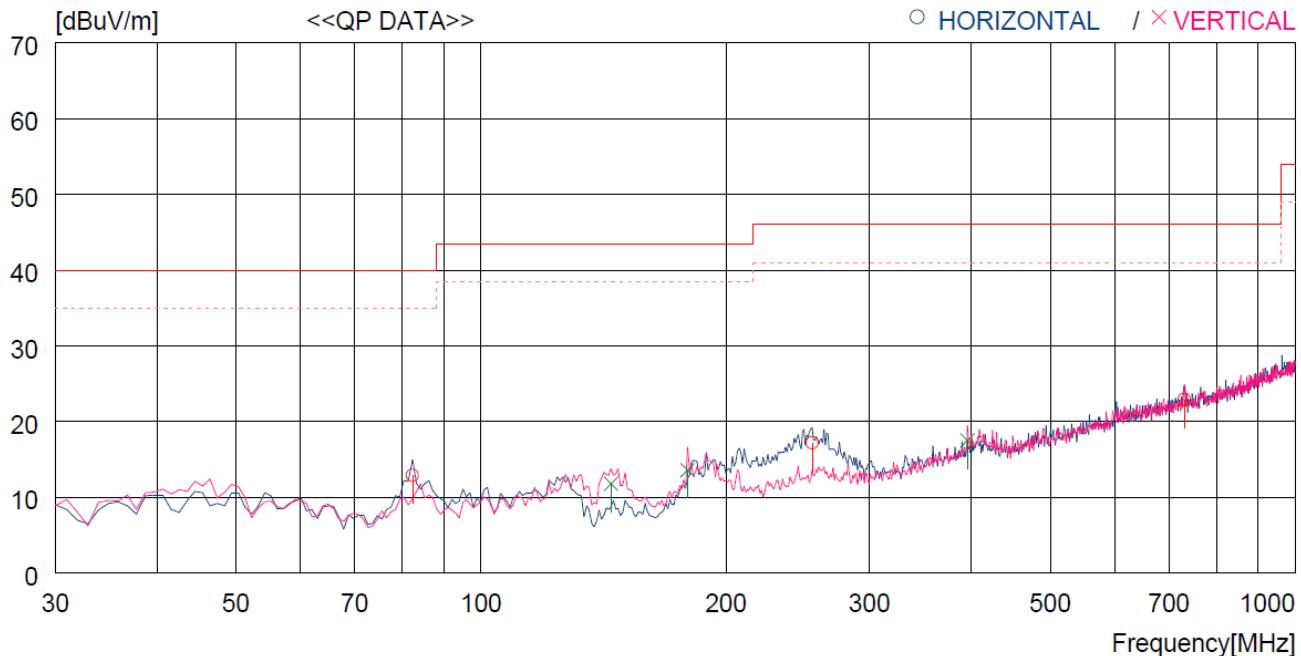
### 11.3 Test equipment used

| Model Number    | Manufacturer       | Description              | Serial Number | Last Cal. (Interval) |
|-----------------|--------------------|--------------------------|---------------|----------------------|
| □ - ESCI        | Rohde & Schwarz    | EMI Test Receiver        | 101012        | Oct. 22, 2018 (1Y)   |
| ■ - ESR         | Rohde & Schwarz    | EMI Test Receiver        | 101470        | Oct. 22, 2018 (1Y)   |
| □ - FSP         | Rohde & Schwarz    | Spectrum Analyzer        | 100017        | Jul. 25, 2019 (1Y)   |
| ■ - 310N        | Sonoma Instrument  | AMPLIFIER                | 312544        | Mar. 18, 2019 (1Y)   |
| ■ - FSV30       | Rohde & Schwarz    | Signal Analyzer          | 101200        | Jul. 24, 2019 (1Y)   |
| ■ - SCU-18      | Rohde & Schwarz    | Pre-Amplifier            | 102266        | Jul. 24, 2019 (1Y)   |
| ■ - MA-4000XPET | Innco Systems GmbH | Antenna Master           | MA4000/509    | N/A                  |
| □ - HD100       | HD GmbH            | Position Controller      | N/A           | N/A                  |
| ■ - DT3000-3t   | Innco Systems GmbH | Turn Table               | N/A           | N/A                  |
| □ - FMZB 1513   | Schwarzbeck        | LOOP ANTENNA             | 1513-235      | May. 13, 2018 (2Y)   |
| ■ - VULB9163    | Schwarzbeck        | TRILOG Broadband Antenna | 9163-419      | Aug. 09, 2018 (2Y)   |
| ■ - BBHA9120D   | Schwarzbeck        | Horn Antenna             | BBHA9120D295  | Jul. 16, 2019 (1Y)   |
| ■ - BBHA9170    | Schwarzbeck        | Horn Antenna             | BBHA91700179  | Jan. 16, 2019 (1Y)   |
| ■ - BBV 9718 B  | Schwarzbeck        | Broadband Preamplifier   | 009           | Mar. 11, 2019(1Y)    |

All test equipment used is calibrated on a regular basis.

### 11.4 Test data for 30 MHz ~ 1 GHz

- Test Date : September 09, 2019
- Resolution bandwidth : 120 kHz
- Frequency range : 30 MHz ~ 1 GHz
- Measurement distance : 3 m
- Operating mode : Transmitting mode (NFC & WLAN)



| No.                           | FREQ<br>[MHz] | READING<br>QP | ANT<br>FACTOR | LOSS<br>[dB] | GAIN<br>[dB] | RESULT<br>[dBuV/m] | LIMIT<br>[dBuV/m] | MARGIN<br>[dB] | ANTENNA<br>TABLE<br>[cm] | TABLE<br>[DEG] |
|-------------------------------|---------------|---------------|---------------|--------------|--------------|--------------------|-------------------|----------------|--------------------------|----------------|
| <b>----- Horizontal -----</b> |               |               |               |              |              |                    |                   |                |                          |                |
| 1                             | 82.380        | 34.8          | 8.4           | 2.8          | 33.1         | 12.9               | 40.0              | 27.1           | 100                      | 359            |
| 2                             | 255.040       | 33.5          | 12.7          | 4.0          | 33.0         | 17.2               | 46.0              | 28.8           | 100                      | 359            |
| 3                             | 730.334       | 29.1          | 20.4          | 6.7          | 33.3         | 22.9               | 46.0              | 23.1           | 300                      | 359            |
| <b>----- Vertical -----</b>   |               |               |               |              |              |                    |                   |                |                          |                |
| 4                             | 144.460       | 33.3          | 8.5           | 3.0          | 33.0         | 11.8               | 43.5              | 31.7           | 100                      | 0              |
| 5                             | 179.380       | 33.6          | 9.7           | 3.4          | 33.1         | 13.6               | 43.5              | 29.9           | 100                      | 63             |
| 6                             | 395.690       | 30.0          | 15.8          | 4.9          | 33.2         | 17.5               | 46.0              | 28.5           | 100                      | 0              |

  
Tested by: Yu-Seog Sim / Assistant Manager

### 11.5 Test data for Below 30 MHz

- Test Date : September 09, 2019
- 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 (NFC & WLAN)

| Frequency (MHz)   | Reading (dB $\mu$ V) | Ant. Pol. (H/V) | Ant. Height (m) | Angle (°) | Ant. Factor (dB/m) | Cable Loss | Emission Level(dB $\mu$ V/m) | Limits (dB $\mu$ V/m) | Margin (dB) |
|---|----------------------|-----------------|-----------------|-----------|--------------------|------------|------------------------------|-----------------------|-------------|
| All emissions observed were 20dB below the limit and thus not reported. |                      |                 |                 |           |                    |            |                              |                       |             |

### 11.6 Test data for above 1 GHz

- Test Date : September 09, 2019
- 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 (NFC & WLAN)

| Frequency (MHz)   | Reading (dB $\mu$ V) | Ant. Pol. (H/V) | Ant. Height (m) | Angle (°) | Ant. Factor (dB/m) | Cable Loss | Emission Level(dB $\mu$ V/m) | Limits (dB $\mu$ V/m) | Margin (dB) |
|---|----------------------|-----------------|-----------------|-----------|--------------------|------------|------------------------------|-----------------------|-------------|
| All emissions observed were 20dB below the limit and thus not reported. |                      |                 |                 |           |                    |            |                              |                       |             |

Tested by: Yu-Seog Sim / Assistant Manager

## 12. CONDUCTED EMISSION TEST

### 12.1 Operating environment

Temperature : 24 °C

Relative humidity : 47 % 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  $50 \Omega / 50 \mu\text{H} + 5 \Omega$  Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

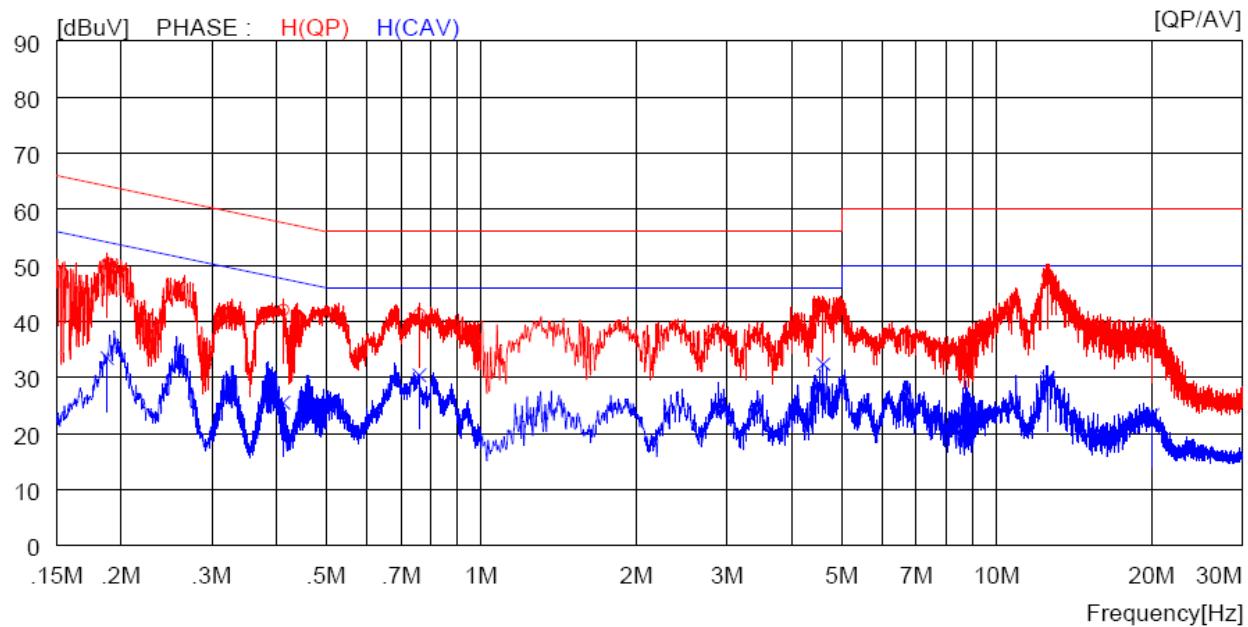
### 12.3 Test equipment used

| Model Number | Manufacturer    | Description       | Serial Number | Last Cal. (Interval) |
|--------------|-----------------|-------------------|---------------|----------------------|
| ■ - ESCI     | Rohde & Schwarz | Test Receiver     | 101420        | Mar. 28, 2019 (1Y)   |
| ■ - 3825/2   | EMCO            | AMN               | 9109-1867     | Mar. 27, 2019 (1Y)   |
| ■ - NSLK8126 | Schwarzbeck     | LISN              | 8126-480      | Oct. 22, 2018 (1Y)   |
| ■ - 11947A   | Hewlett Packard | Transient Limiter | 3107A02762    | Mar. 28, 2019 (1Y)   |

All test equipment used is calibrated on a regular basis.

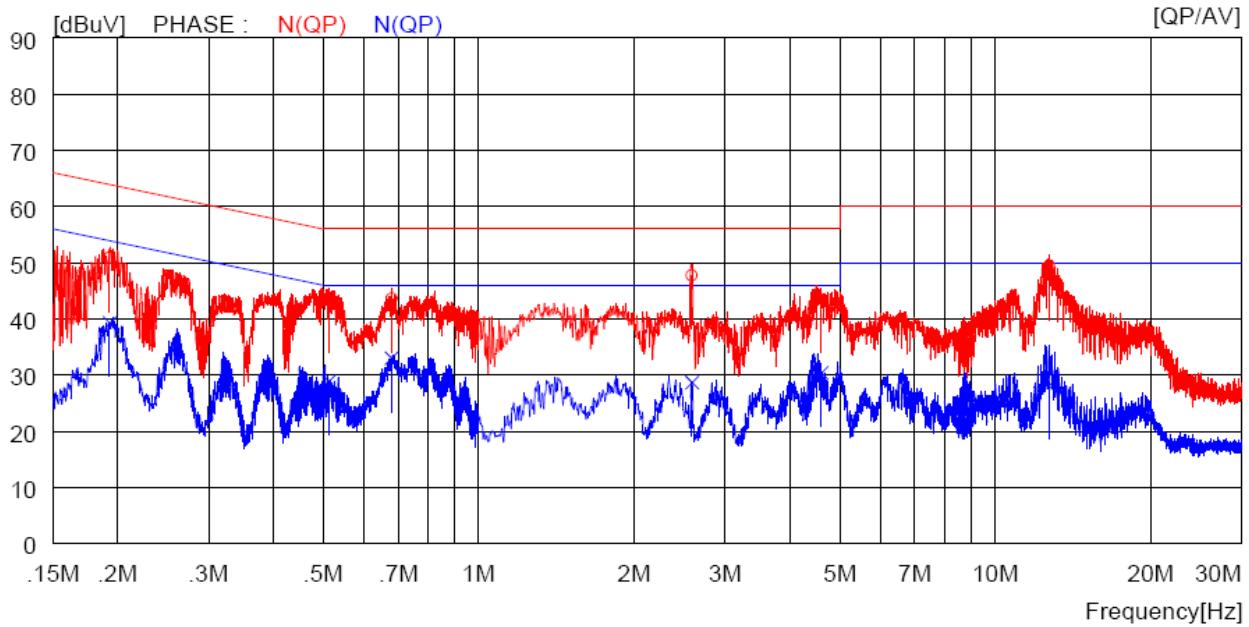
## 12.4 Test data

- Test Date : September 03, 2019
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



| NO | FREQ<br>[MHz] | READING      |              | C.FACTOR<br>[dB] | RESULT       |              | LIMIT        |              | MARGIN<br>[dBuV] | PHASE   |
|----|---------------|--------------|--------------|------------------|--------------|--------------|--------------|--------------|------------------|---------|
|    |               | QP<br>[dBuV] | AV<br>[dBuV] |                  | QP<br>[dBuV] | AV<br>[dBuV] | QP<br>[dBuV] | AV<br>[dBuV] |                  |         |
| 1  | 0.18800       | 40.1         | ----         | 10.1             | 50.2         | ----         | 64.1         | ----         | 13.9             | ---     |
| 2  | 0.41300       | 32.0         | ----         | 10.1             | 42.1         | ----         | 57.6         | ----         | 15.5             | ---     |
| 3  | 0.75900       | 31.2         | ----         | 10.1             | 41.3         | ----         | 56.0         | ----         | 14.7             | ---     |
| 4  | 4.60800       | 32.5         | ----         | 10.1             | 42.6         | ----         | 56.0         | ----         | 13.4             | ---     |
| 5  | 12.58000      | 37.9         | ----         | 10.3             | 48.2         | ----         | 60.0         | ----         | 11.8             | ---     |
| 6  | 20.08000      | 28.2         | ----         | 10.4             | 38.6         | ----         | 60.0         | ----         | 21.4             | ---     |
| 7  | 0.18800       | ----         | 23.4         | 10.1             | ----         | 33.5         | ----         | 54.1         | ----             | H (CAV) |
| 8  | 0.41300       | ----         | 15.4         | 10.1             | ----         | 25.5         | ----         | 47.6         | ----             | H (CAV) |
| 9  | 0.75900       | ----         | 20.3         | 10.1             | ----         | 30.4         | ----         | 46.0         | ----             | H (CAV) |
| 10 | 4.60800       | ----         | 22.3         | 10.1             | ----         | 32.4         | ----         | 46.0         | ----             | H (CAV) |
| 11 | 12.58000      | ----         | 19.6         | 10.3             | ----         | 29.9         | ----         | 50.0         | ----             | H (CAV) |
| 12 | 20.08000      | ----         | 13.0         | 10.4             | ----         | 23.4         | ----         | 50.0         | ----             | H (CAV) |

-. Tested Line : NEUTRAL LINE



| NO | FREQ<br>[MHz] | READING      |              | C.FACTOR<br>[dB] | RESULT       |              | LIMIT        |              | MARGIN       |              | PHASE   |
|----|---------------|--------------|--------------|------------------|--------------|--------------|--------------|--------------|--------------|--------------|---------|
|    |               | QP<br>[dBuV] | AV<br>[dBuV] |                  | QP<br>[dBuV] | AV<br>[dBuV] | QP<br>[dBuV] | AV<br>[dBuV] | QP<br>[dBuV] | AV<br>[dBuV] |         |
| 1  | 0.19300       | 40.8         | ----         | 10.1             | 50.9         | ----         | 63.9         | ----         | 13.0         | ----         | N (QP)  |
| 2  | 0.51300       | 33.4         | ----         | 10.1             | 43.5         | ----         | 56.0         | ----         | 12.5         | ----         | N (QP)  |
| 3  | 0.67900       | 33.5         | ----         | 10.1             | 43.6         | ----         | 56.0         | ----         | 12.4         | ----         | N (QP)  |
| 4  | 2.58800       | 37.7         | ----         | 10.1             | 47.8         | ----         | 56.0         | ----         | 8.2          | ----         | N (QP)  |
| 5  | 4.60800       | 33.4         | ----         | 10.1             | 43.5         | ----         | 56.0         | ----         | 12.5         | ----         | N (QP)  |
| 6  | 12.73000      | 39.1         | ----         | 10.3             | 49.4         | ----         | 60.0         | ----         | 10.6         | ----         | N (QP)  |
| 7  | 0.19300       | ----         | 29.2         | 10.1             | ----         | 39.3         | ----         | 53.9         | ----         | 14.6         | N (CAV) |
| 8  | 0.51300       | ----         | 18.8         | 10.1             | ----         | 28.9         | ----         | 46.0         | ----         | 17.1         | N (CAV) |
| 9  | 0.67900       | ----         | 22.9         | 10.1             | ----         | 33.0         | ----         | 46.0         | ----         | 13.0         | N (CAV) |
| 10 | 2.58800       | ----         | 18.6         | 10.1             | ----         | 28.7         | ----         | 46.0         | ----         | 17.3         | N (CAV) |
| 11 | 4.60800       | ----         | 20.3         | 10.1             | ----         | 30.4         | ----         | 46.0         | ----         | 15.6         | N (CAV) |
| 12 | 12.73000      | ----         | 17.8         | 10.3             | ----         | 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: Yu-Seog Sim / Assistant Manager