

## 3. 26 dB Bandwidth & 99 % Bandwidth

### 3.1. Test Setup



### 3.2. Limit

None; for reporting purpose only.

### 3.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

#### 3.3.1. 26 dB Bandwidth

1. This measurement settings are specified in section II.C.1 of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Set RBW: approximately 1 % of the emission bandwidth.
3. Set the VBW > RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1 %.

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### 3.2.2. 99 % Bandwidth

#### 3.2.2.1 FCC

1. This measurement settings are specified in section II.D of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Set center frequency to the nominal EUT channel center frequency.
3. Set span = 1.5 times to 5.0 times the OBW.
4. Set RBW = 1 % to 5 % of the OBW.
5. Set VBW  $\geq$  3 x RBW.
6. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
7. Use the 99 % power bandwidth function of the instrument (if available).
8. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99 % occupied bandwidth is the difference between these two frequencies.

In the result,

- DFS requirements are not applicable in the 5 150 MHz ~ 5 250 MHz.

#### Remark:

In case of band crossing channels 138, 142 and 144, the measurement is complied with section III.A of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

### 3.2.2.2 IC

The following conditions shall be observed for measuring the occupied bandwidth and  $x$  dB bandwidth:

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
- The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied /  $x$  dB bandwidth if the device is not transmitting continuously.
- The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the actual occupied /  $x$  dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

**Note:** It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99 % emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99 % emission bandwidth).

### 3.4. Test Result

Ambient temperature : (23 ± 1) °C

Relative humidity : 47 % R.H.

**Test mode: 11a**

| Band     | Frequency (MHz) | Ch. | Data Rate (Mbps) | 26 dB Bandwidth (MHz) | 99 % Bandwidth (MHz) |
|----------|-----------------|-----|------------------|-----------------------|----------------------|
| U-NII 1  | 5 180           | 36  | 6                | 21.013                | 17.019               |
|          | 5 220           | 44  |                  | 21.071                | 17.019               |
|          | 5 240           | 48  |                  | 21.129                | 17.077               |
| U-NII 2A | 5 260           | 52  |                  | 21.245                | 17.019               |
|          | 5 300           | 60  |                  | 21.071                | 17.077               |
|          | 5 320           | 64  |                  | 21.071                | 17.077               |
| U-NII 2C | 5 500           | 100 |                  | 21.187                | 17.077               |
|          | 5 580           | 116 |                  | 21.071                | 17.019               |
|          | 5 720           | 144 |                  | 21.245                | 17.077               |
| U-NII 3  | 5 745           | 149 |                  | 21.129                | 17.077               |
|          | 5 785           | 157 |                  | 20.955                | 17.019               |
|          | 5 825           | 165 |                  | 21.013                | 17.077               |

**Test mode: 11ac\_VHT20**

| Band     | Frequency (MHz) | Ch. | Data Rate (Mbps) | 26 dB Bandwidth (MHz) | 99 % Bandwidth (MHz) |
|----------|-----------------|-----|------------------|-----------------------|----------------------|
| U-NII 1  | 5 180           | 36  | MCS0             | 21.360                | 18.061               |
|          | 5 220           | 44  |                  | 21.360                | 18.061               |
|          | 5 240           | 48  |                  | 21.476                | 18.119               |
| U-NII 2A | 5 260           | 52  |                  | 21.129                | 18.119               |
|          | 5 300           | 60  |                  | 21.534                | 18.003               |
|          | 5 320           | 64  |                  | 21.476                | 18.061               |
| U-NII 2C | 5 500           | 100 |                  | 21.303                | 18.119               |
|          | 5 580           | 116 |                  | 21.418                | 18.061               |
|          | 5 720           | 144 |                  | 21.476                | 18.061               |
| U-NII 3  | 5 745           | 149 |                  | 21.476                | 18.119               |
|          | 5 785           | 157 |                  | 21.418                | 18.119               |
|          | 5 825           | 165 |                  | 21.418                | 18.119               |

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**Test mode: 11ac\_VHT40**

| Band     | Frequency (MHz) | Ch. | Data Rate (Mbps) | 26 dB Bandwidth (MHz) | 99 % Bandwidth (MHz) |
|----------|-----------------|-----|------------------|-----------------------|----------------------|
| U-NII 1  | 5 190           | 38  |                  | 40.174                | 36.237               |
|          | 5 230           | 46  |                  | 40.058                | 36.237               |
| U-NII 2A | 5 270           | 54  |                  | 40.174                | 36.237               |
|          | 5 310           | 62  |                  | 40.289                | 36.237               |
| U-NII 2C | 5 510           | 102 |                  | 40.174                | 36.353               |
|          | 5 550           | 110 |                  | 40.174                | 36.237               |
|          | 5 710           | 142 |                  | 39.942                | 36.237               |
| U-NII 3  | 5 755           | 151 |                  | 40.058                | 36.237               |
|          | 5 795           | 159 |                  | 40.058                | 36.353               |

**Test mode: 11ac\_VHT80**

| Band     | Frequency (MHz) | Ch. | Data Rate (Mbps) | 26 dB Bandwidth (MHz) | 99 % Bandwidth (MHz) |
|----------|-----------------|-----|------------------|-----------------------|----------------------|
| U-NII 1  | 5 210           | 42  |                  | 81.968                | 75.948               |
| U-NII 2A | 5 290           | 58  |                  | 81.505                | 75.716               |
| U-NII 2C | 5 530           | 106 |                  | 81.968                | 75.716               |
|          | 5 690           | 138 |                  | 81.968                | 75.716               |
| U-NII 3  | 5 775           | 155 |                  | 81.968                | 75.716               |

**Band-crossing channel**

| Mode       | Frequency (MHz) | Ch. | Data Rate (Mbps) | 26 dB Bandwidth (MHz) |
|------------|-----------------|-----|------------------|-----------------------|
| 11a        | 5 720           | 144 | 6                | 15.536                |
| 11ac_VHT20 | 5 720           | 144 | MCS0             | 15.709                |
| 11ac_VHT40 | 5 710           | 142 | MCS0             | 35.145                |
| 11ac_VHT80 | 5 690           | 138 | MCS1             | 75.753                |

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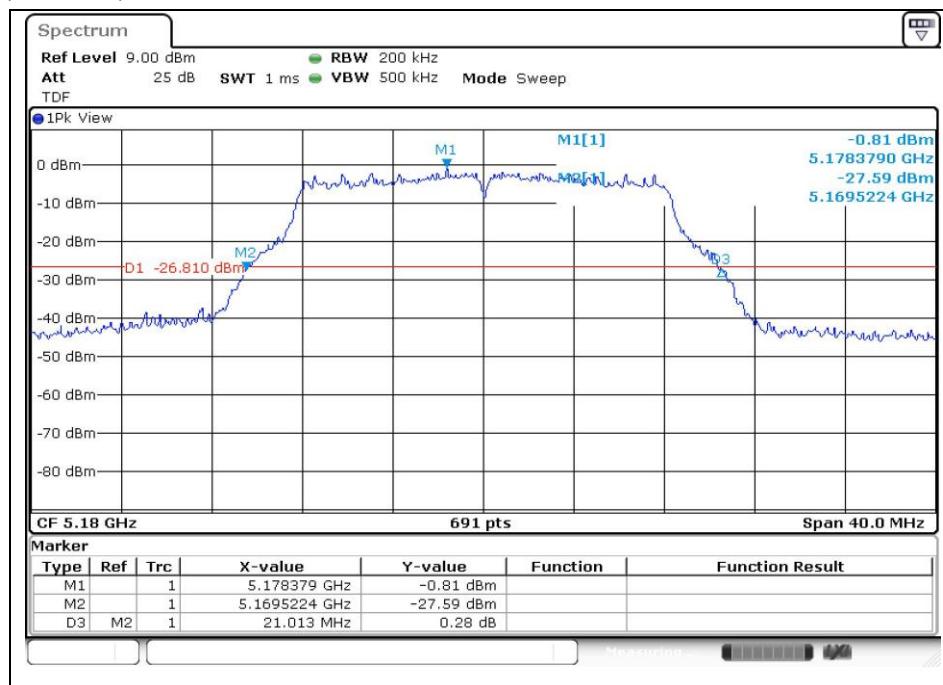
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## - Test plots

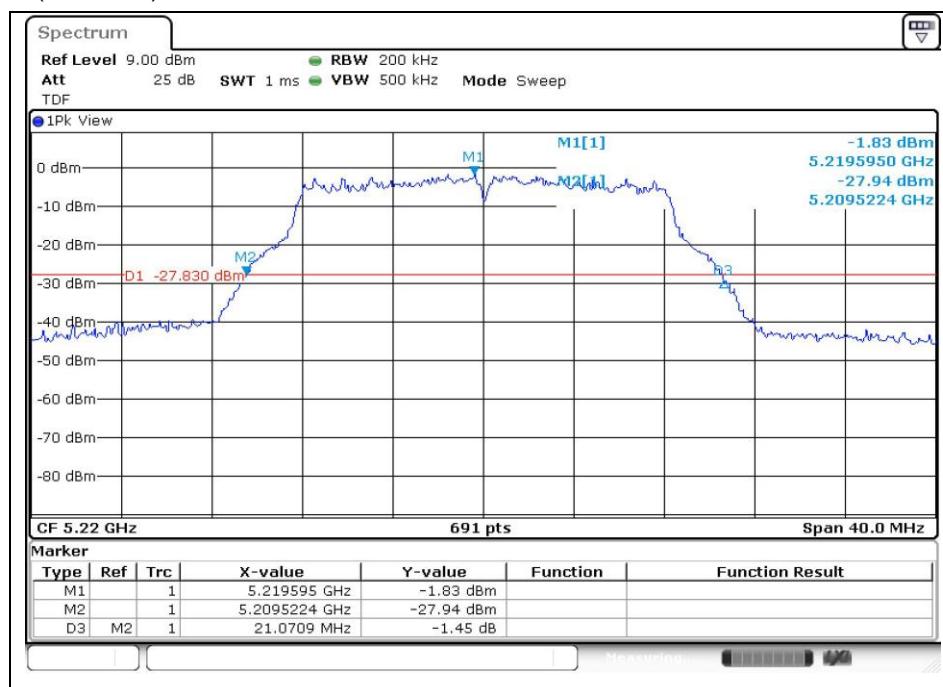
### 26 dB Bandwidth

#### 802.11a (Band 1)

Low Channel (5 180 MHz)



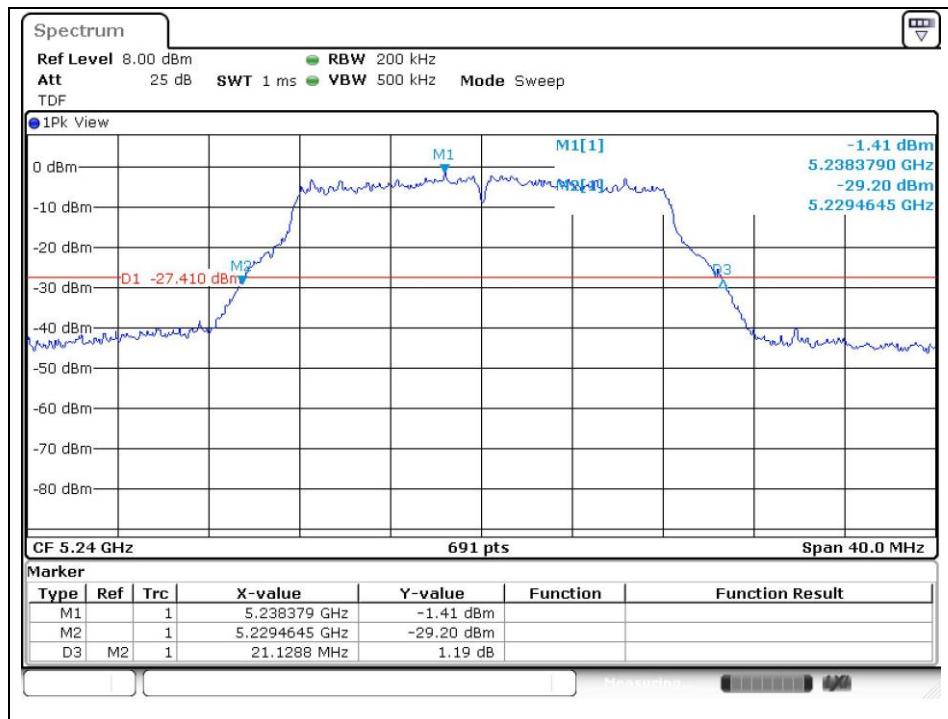
Middle Channel (5 220 MHz)



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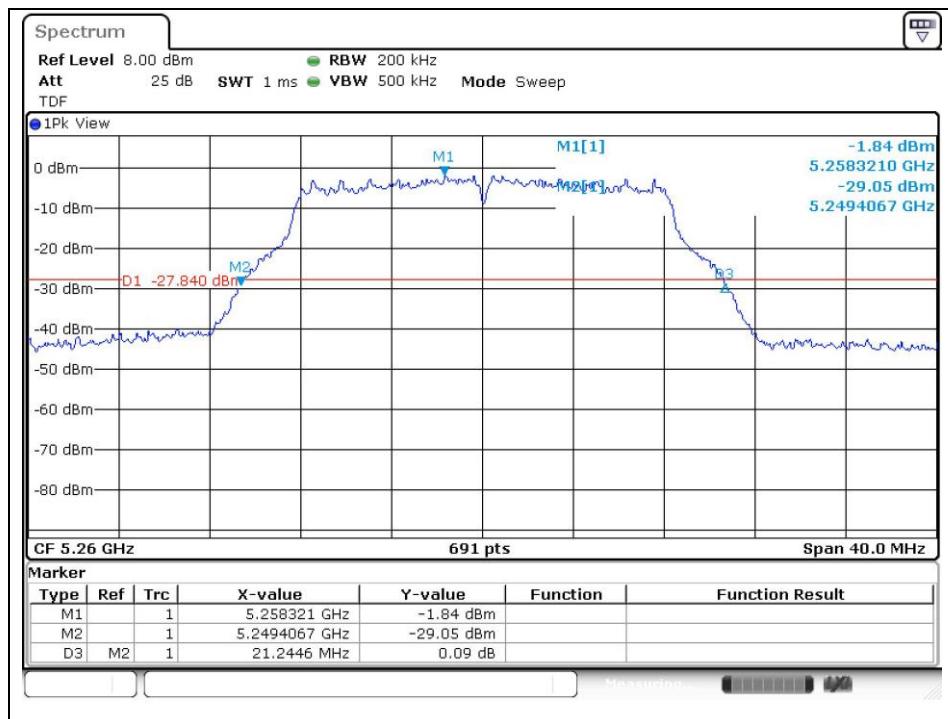
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## High Channel (5.240 MHz)



## 802.11a (Band 2A)

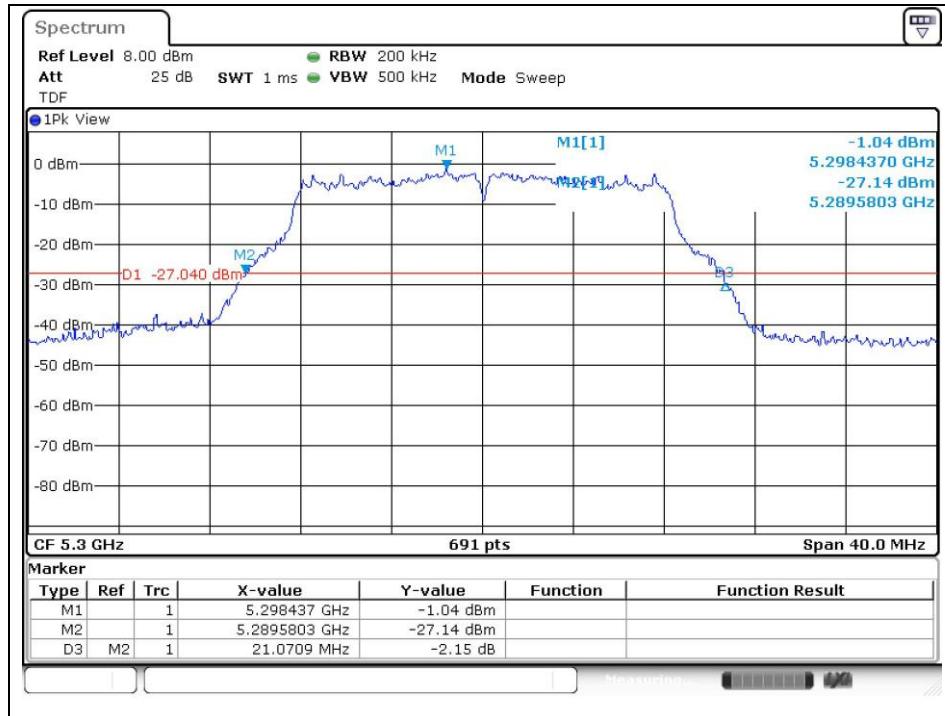
## Low Channel (5.260 MHz)



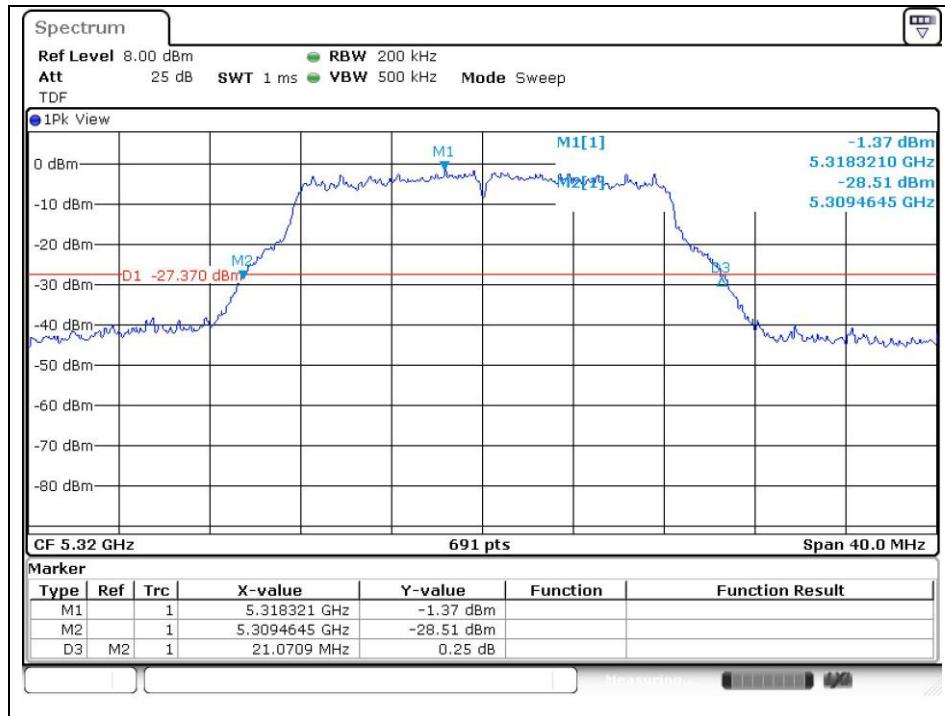
The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

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## Middle Channel (5 300 MHz)



## High Channel (5 320 MHz)

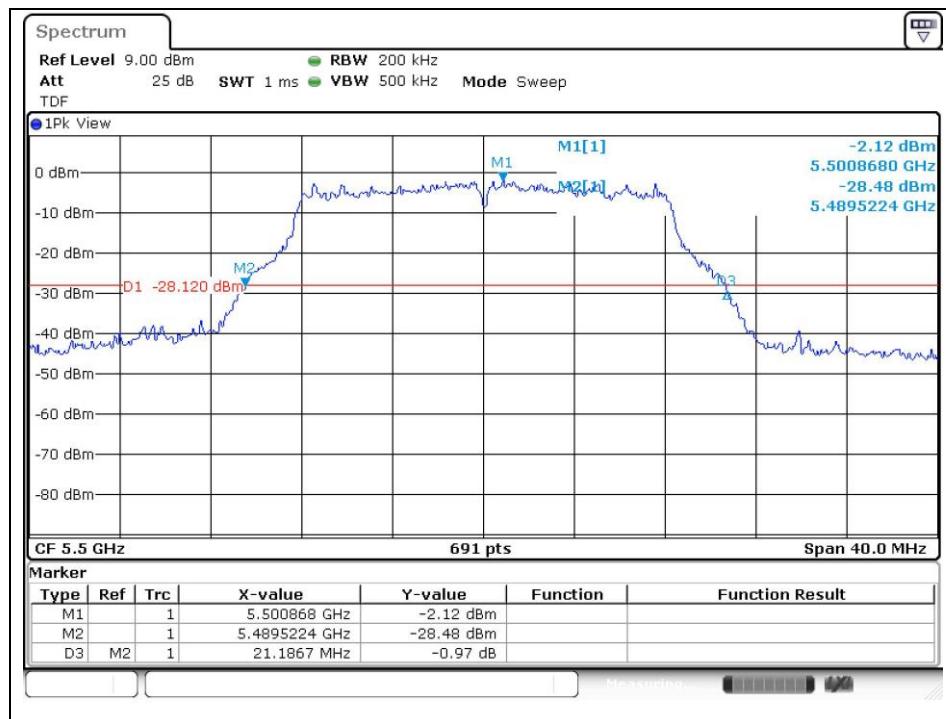


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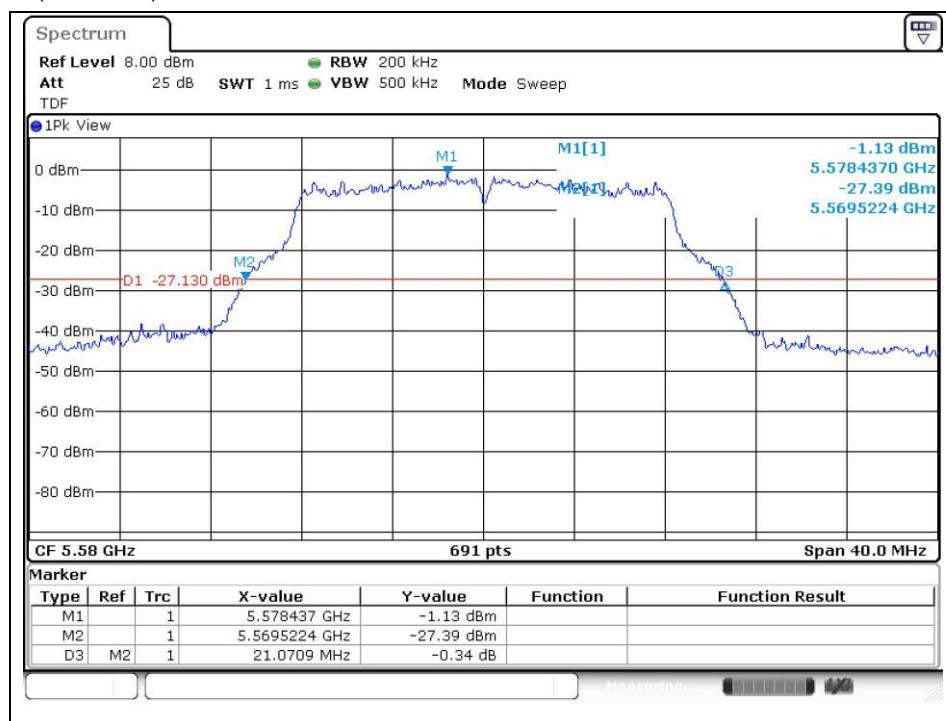
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**802.11a (Band 2C)**

Low Channel (5 500 MHz)



Middle Channel (5 580 MHz)



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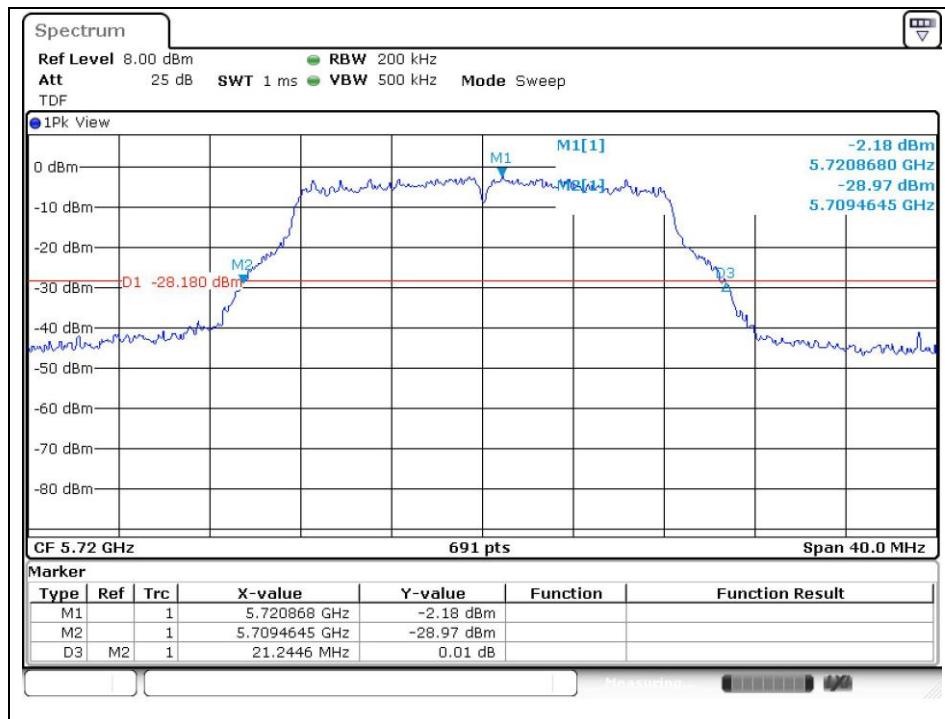
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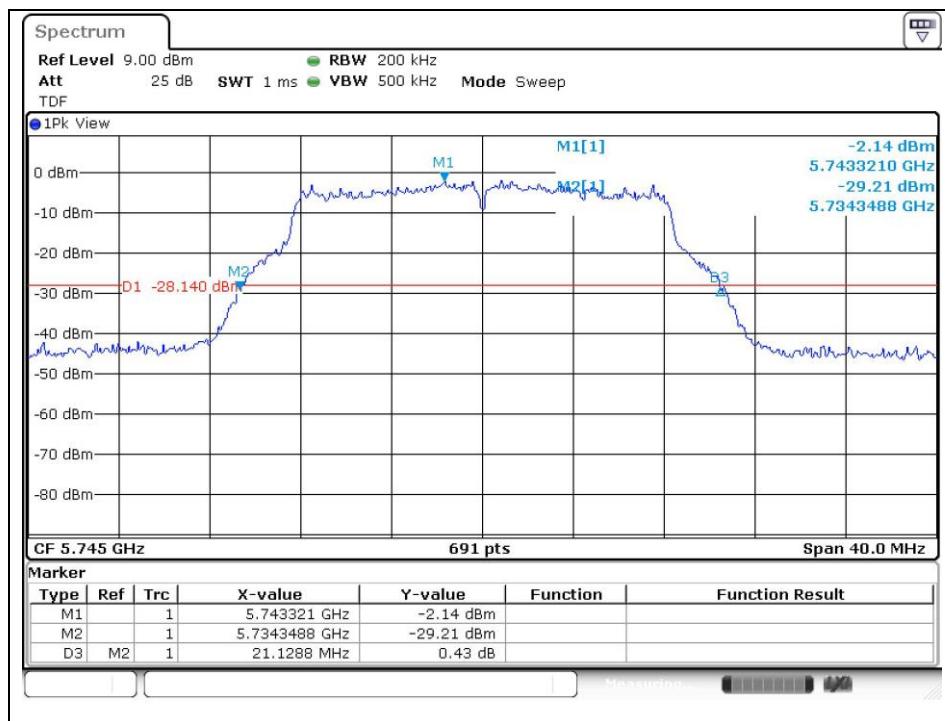
A4(210 mm x 297 mm)

## High Channel (5 720 MHz)



## 802.11a (Band 3)

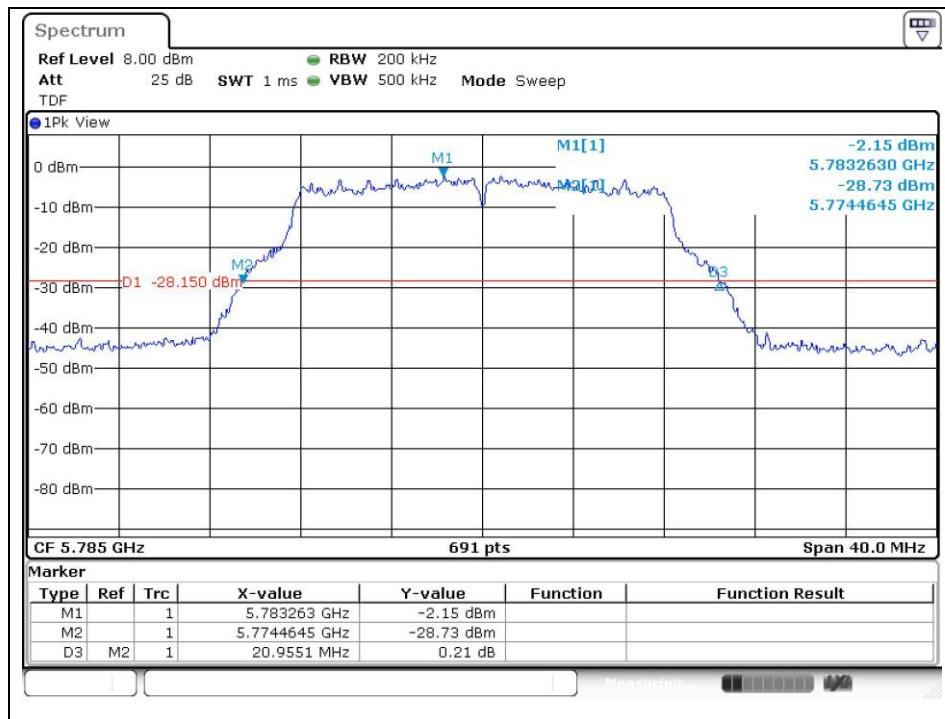
## Low Channel (5 745 MHz)



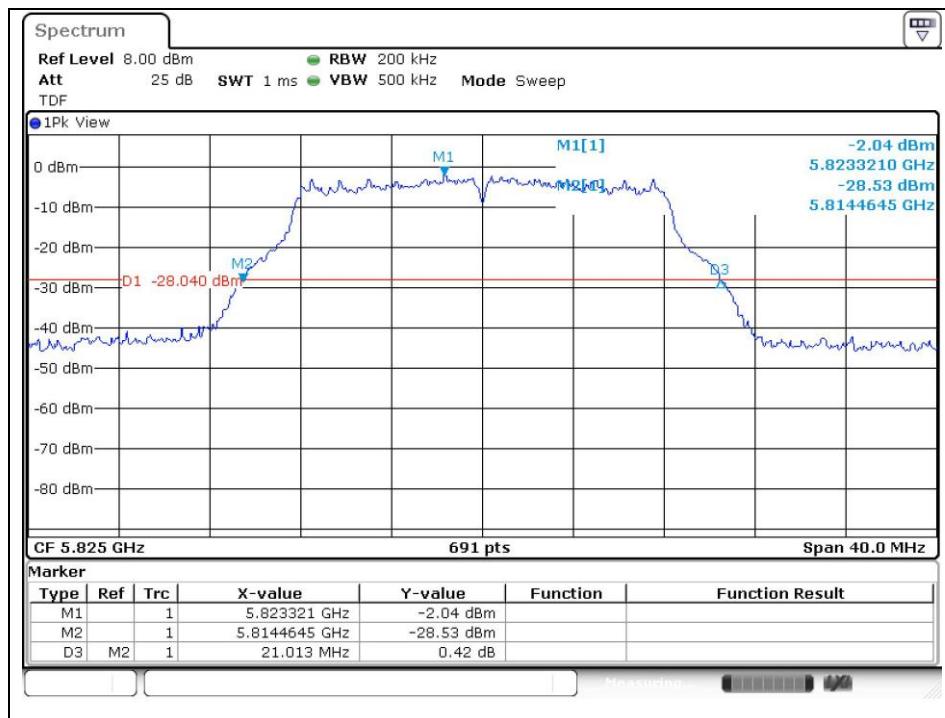
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## Middle Channel (5.785 MHz)



## High Channel (5.825 MHz)

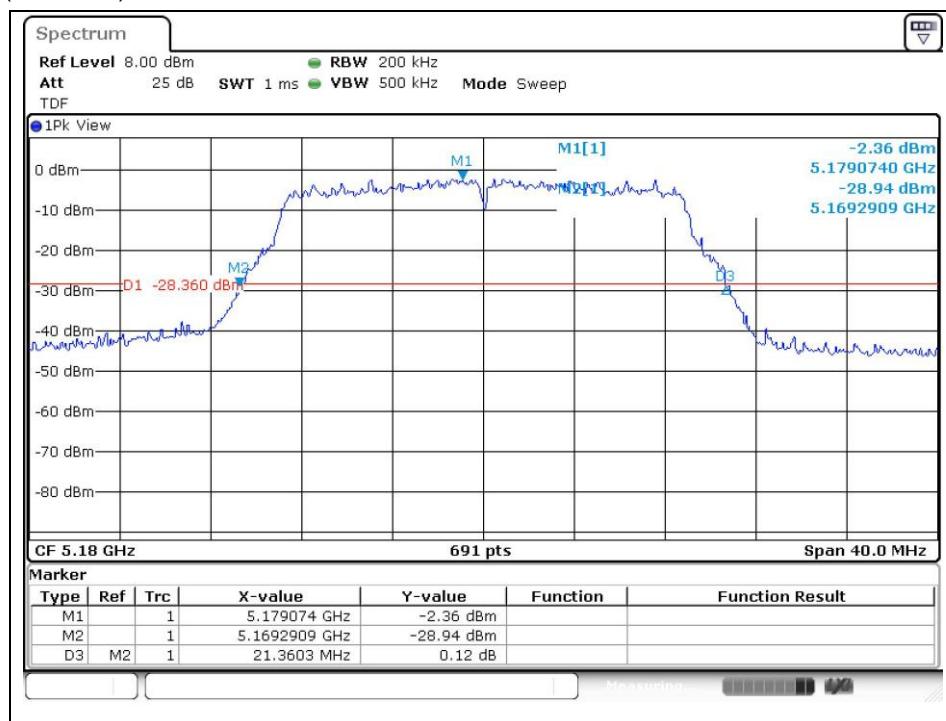


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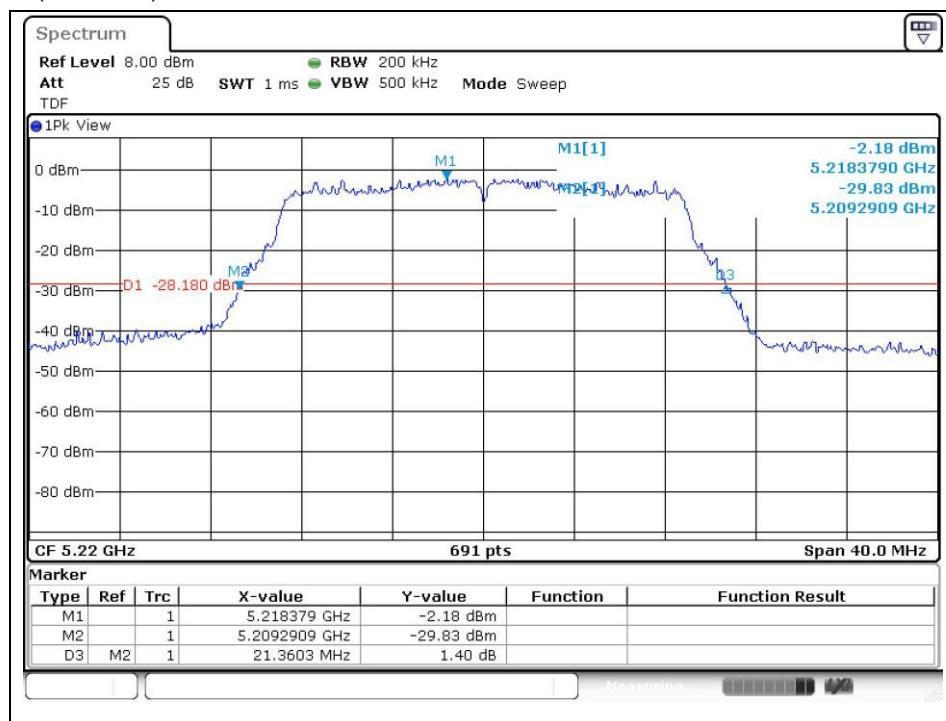
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**802.11ac\_VHT20 (Band 1)**

Low Channel (5 180 MHz)



Middle Channel (5 220 MHz)



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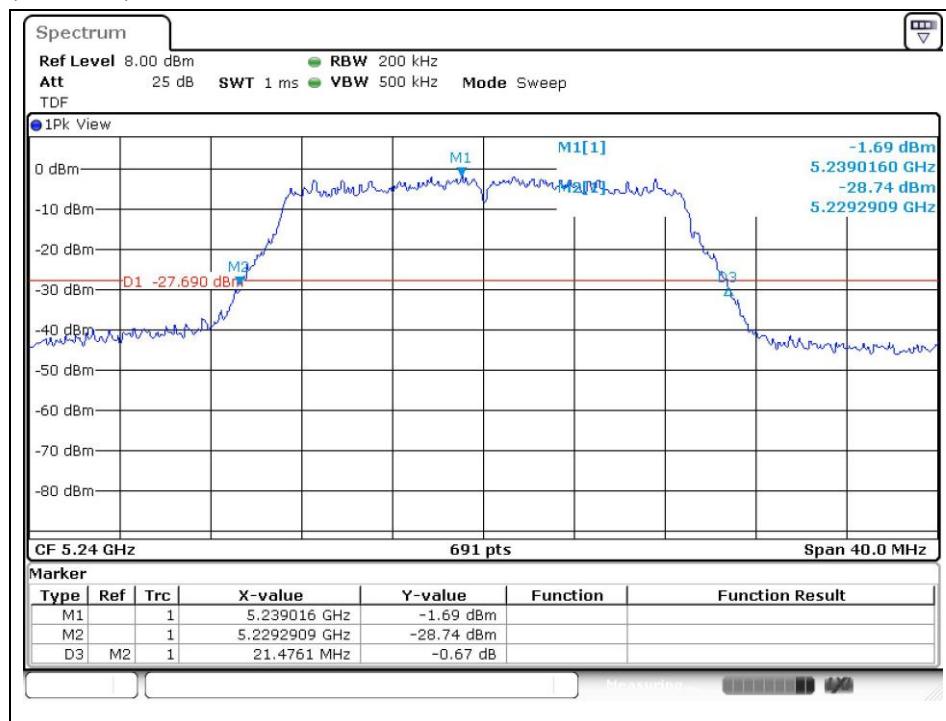
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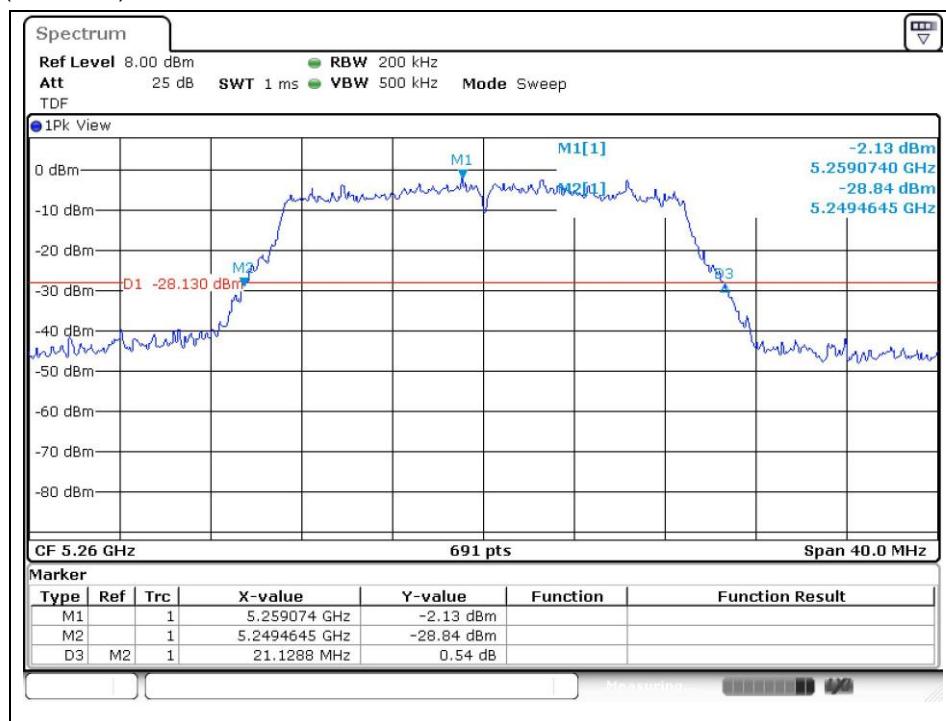
A4(210 mm x 297 mm)

## High Channel (5.240 MHz)



## 802.11n\_HT20 (Band 2A)

## Low Channel (5.260 MHz)



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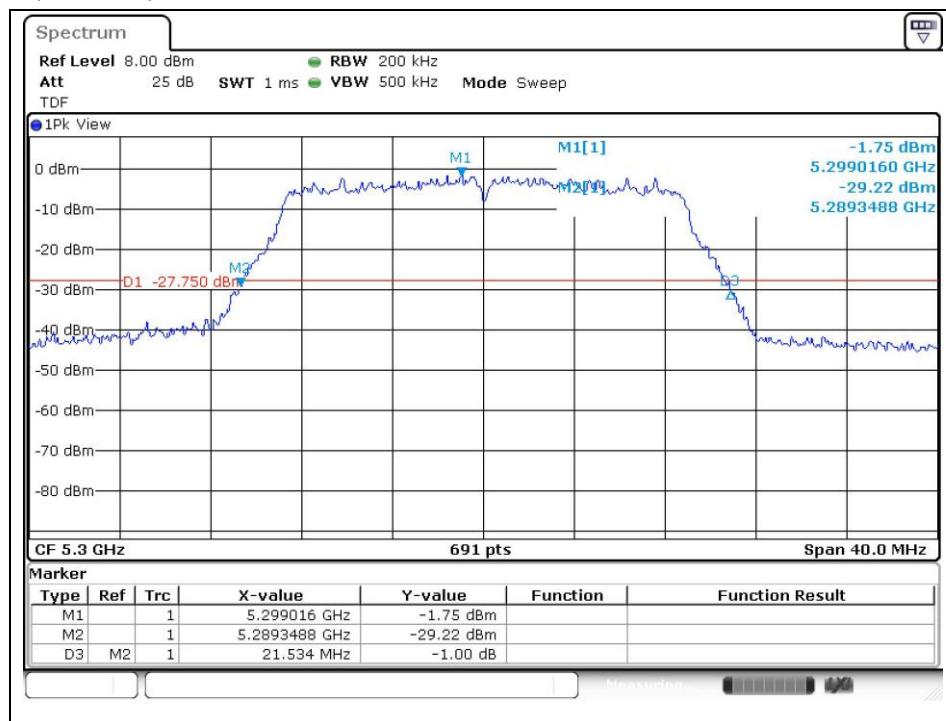
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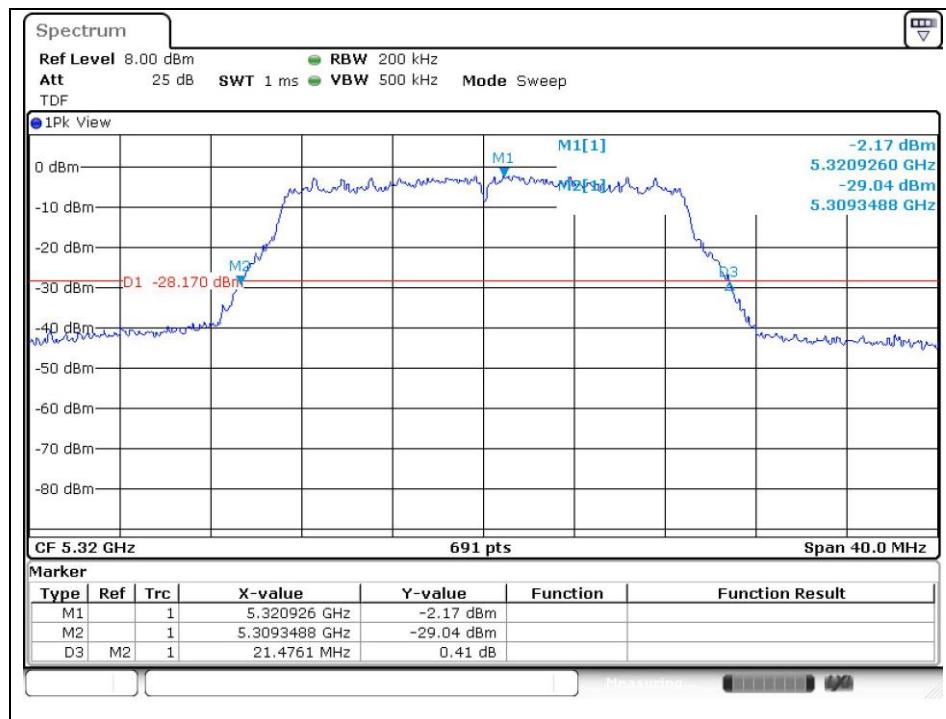
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A4(210 mm x 297 mm)

## Middle Channel (5 300 MHz)



## High Channel (5 320 MHz)



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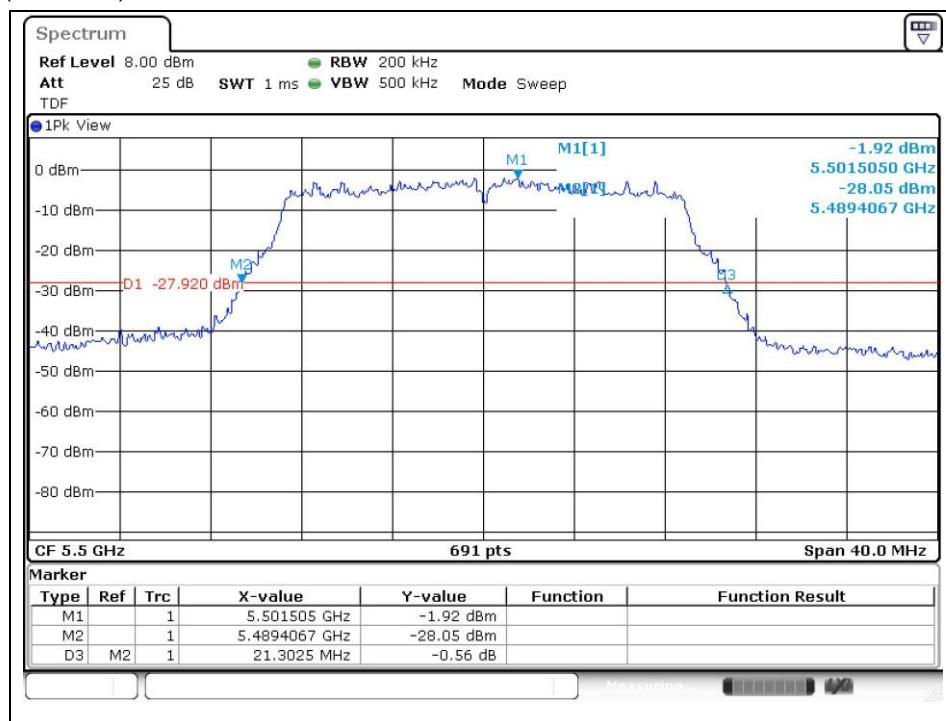
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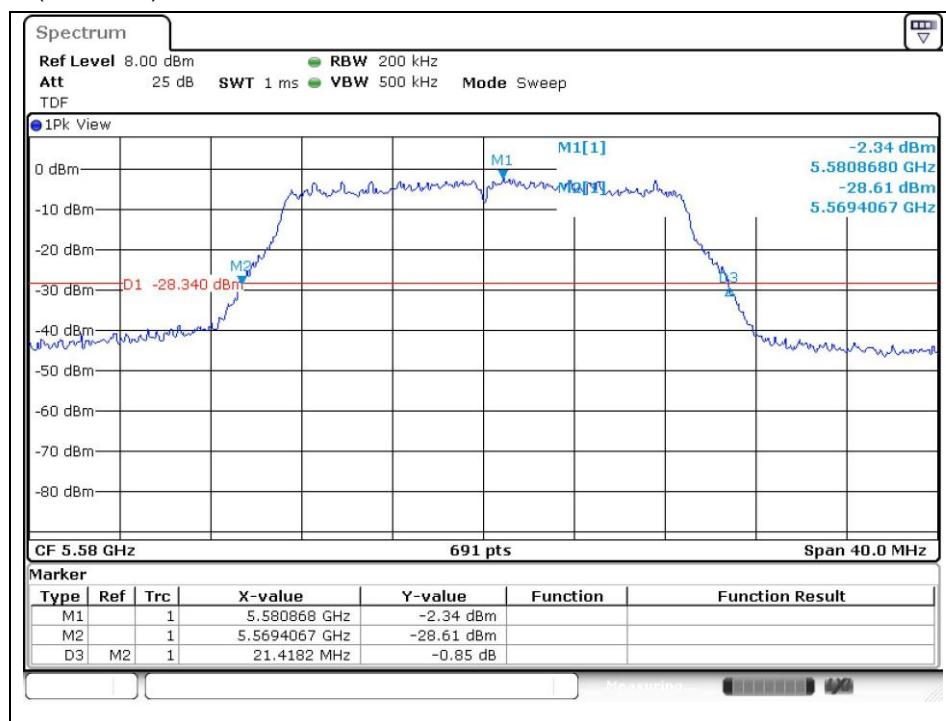
A4(210 mm x 297 mm)

**802.11n\_HT20 (Band 2C)**

Low Channel (5 500 MHz)



Middle Channel (5 580 MHz)



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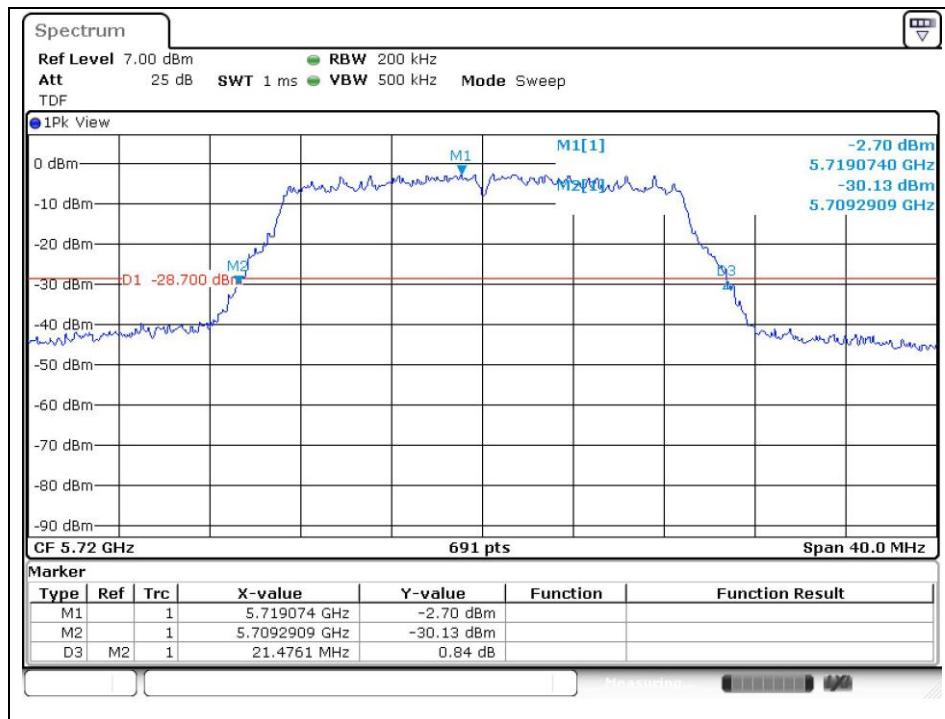
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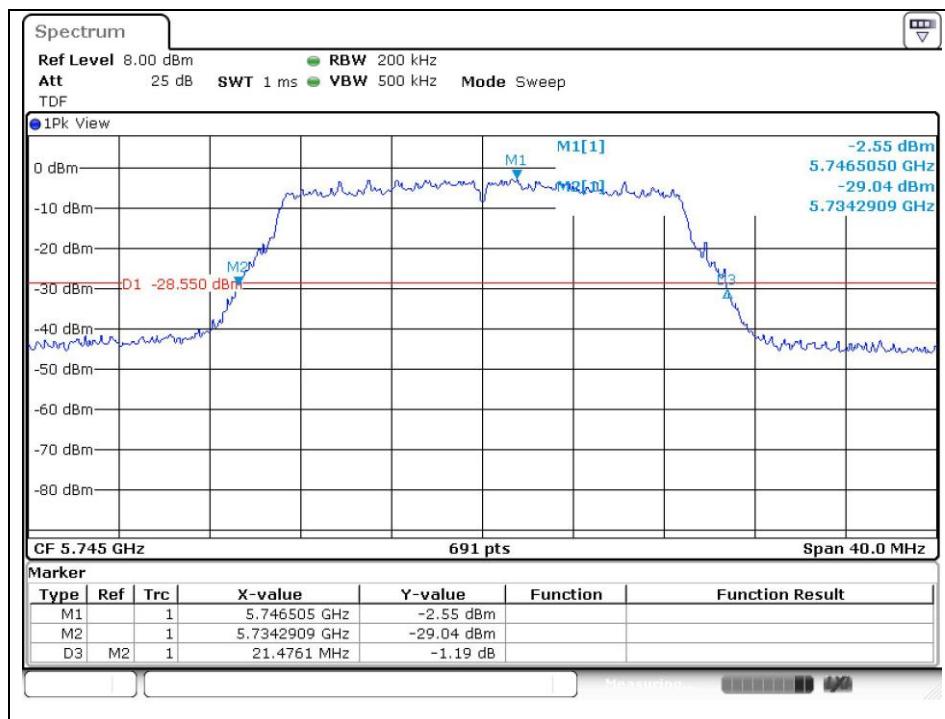
A4(210 mm x 297 mm)

## High Channel (5 720 MHz)



## 802.11n\_HT20 (Band 3)

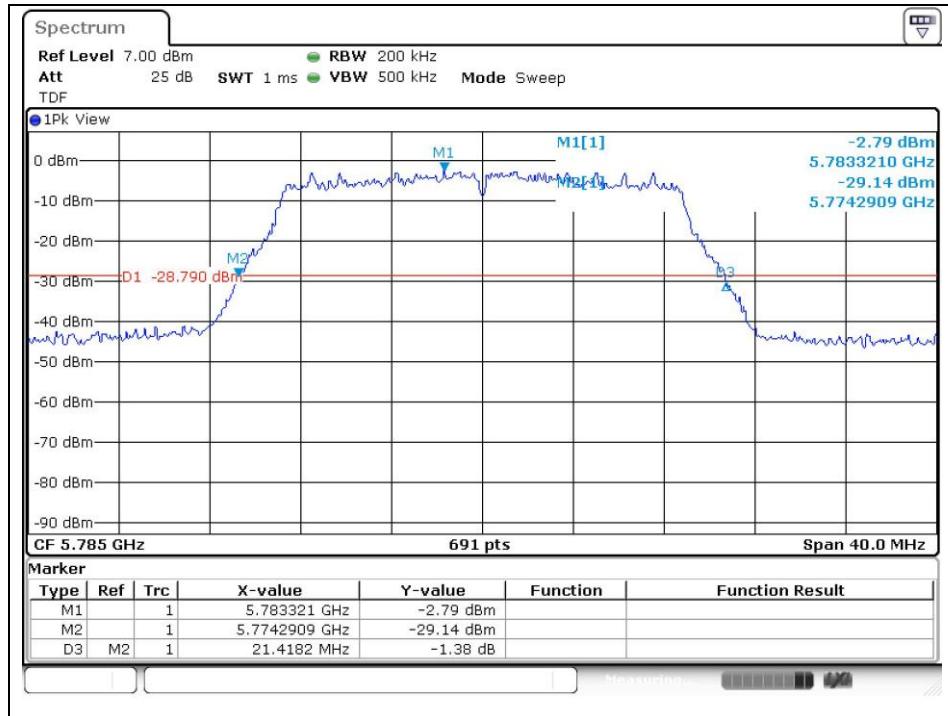
## Low Channel (5 745 MHz)



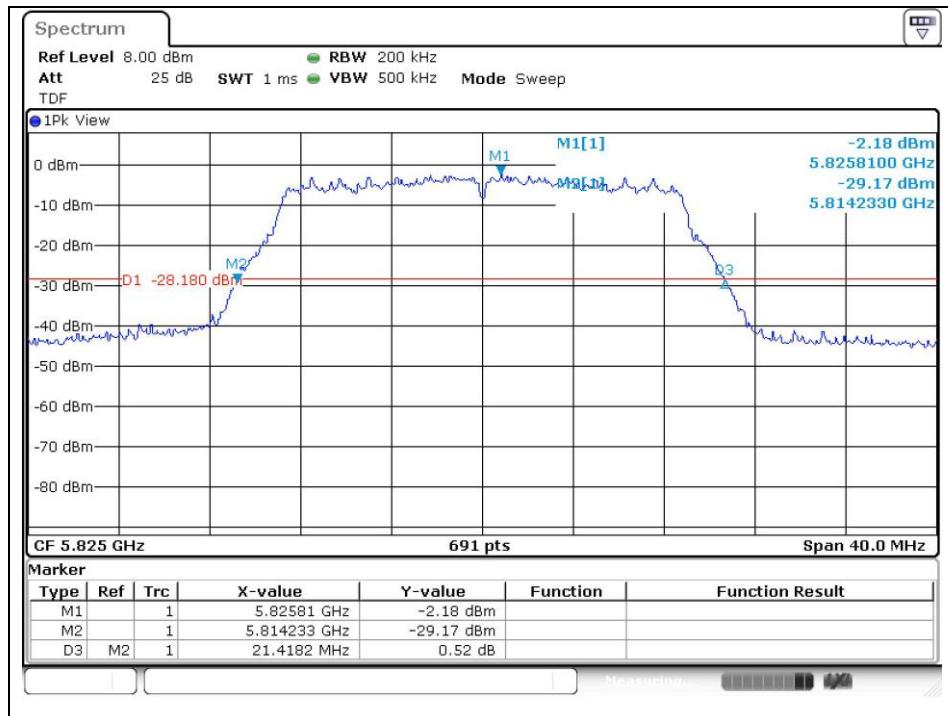
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## Middle Channel (5.785 MHz)



## High Channel (5.825 MHz)

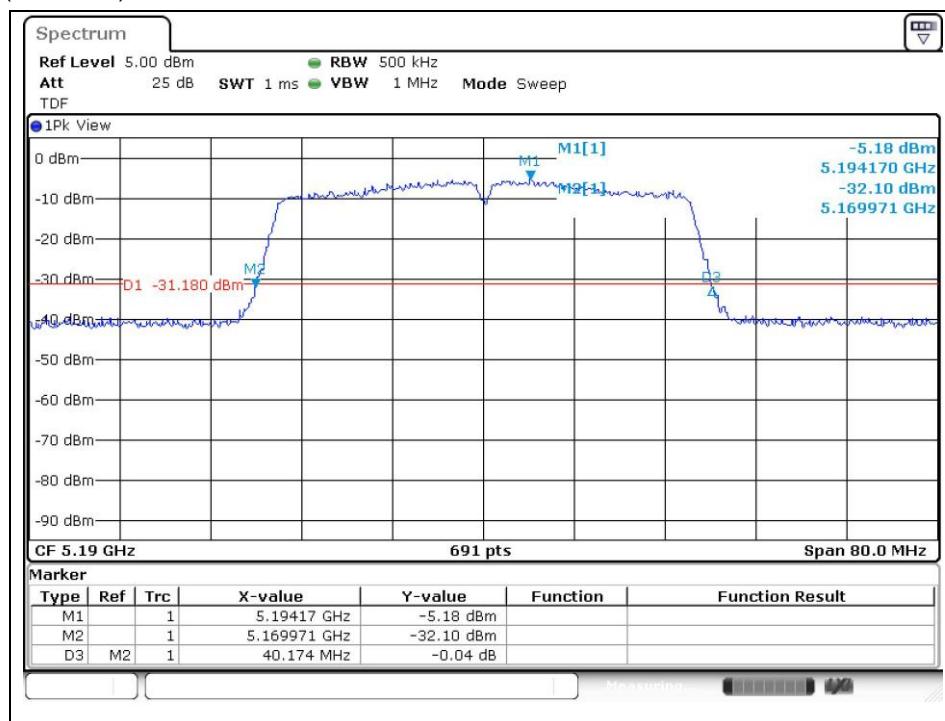


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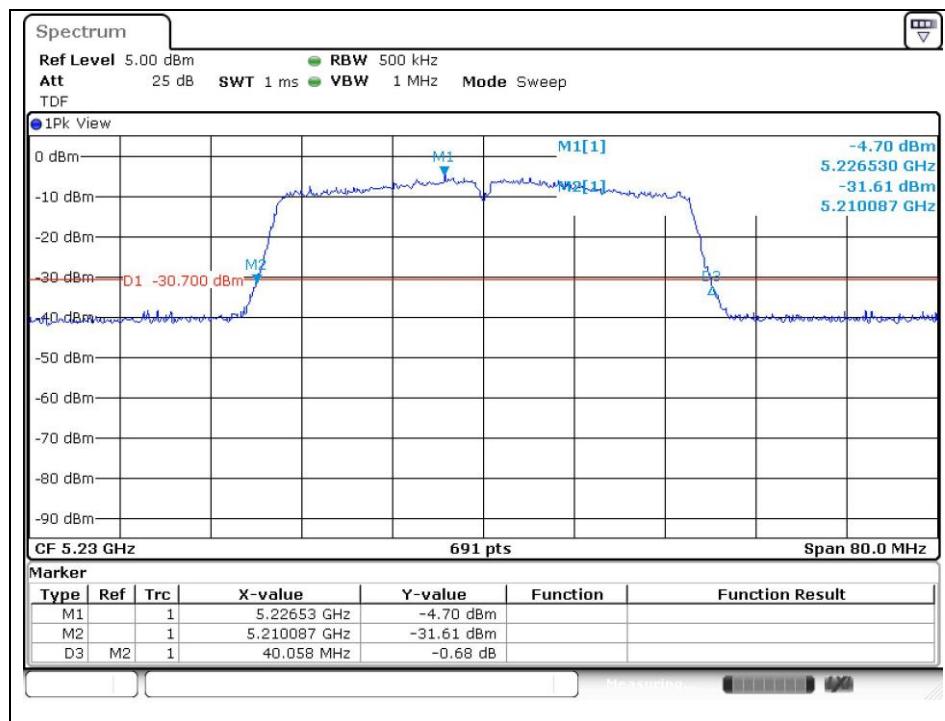
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**802.11ac\_VHT40 (Band 1)**

Low Channel (5 190 MHz)



High Channel (5 230 MHz)



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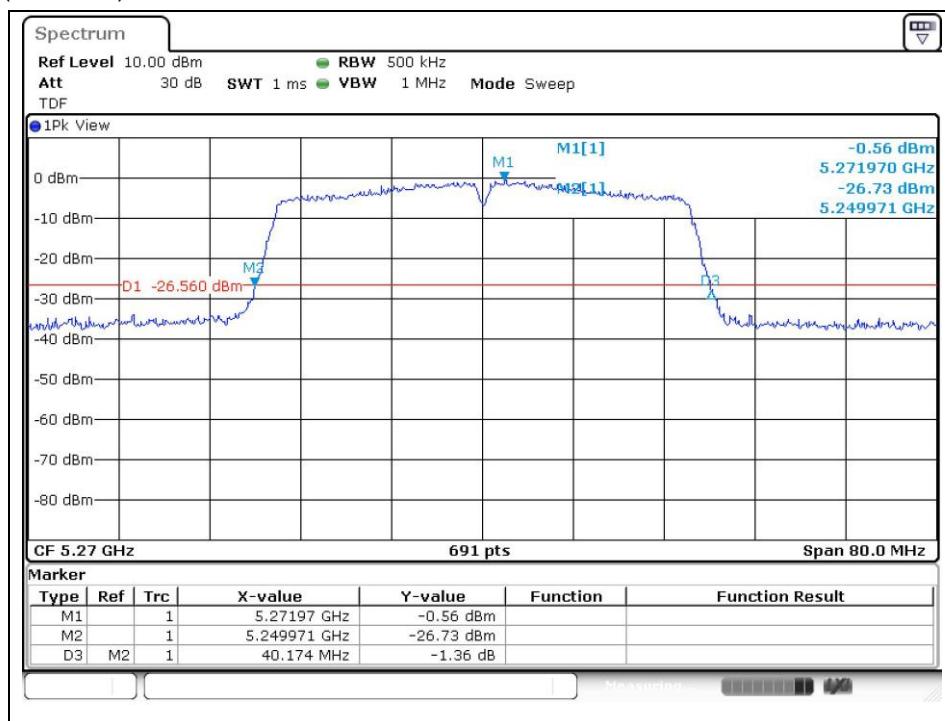
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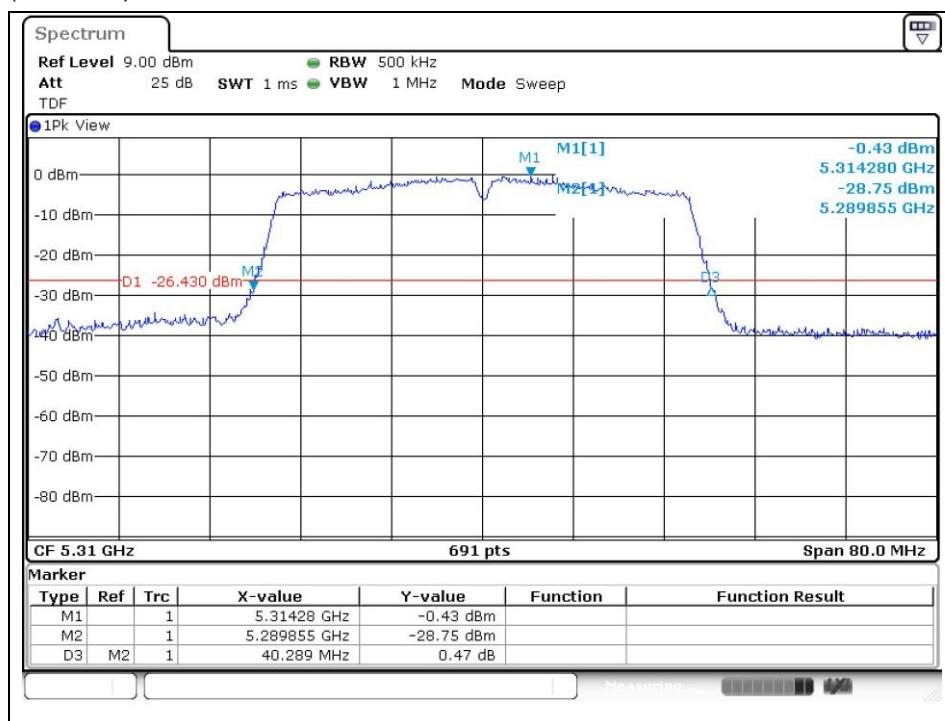
A4(210 mm x 297 mm)

**802.11n\_HT40 (Band 2A)**

Low Channel (5 270 MHz)



High Channel (5 310 MHz)



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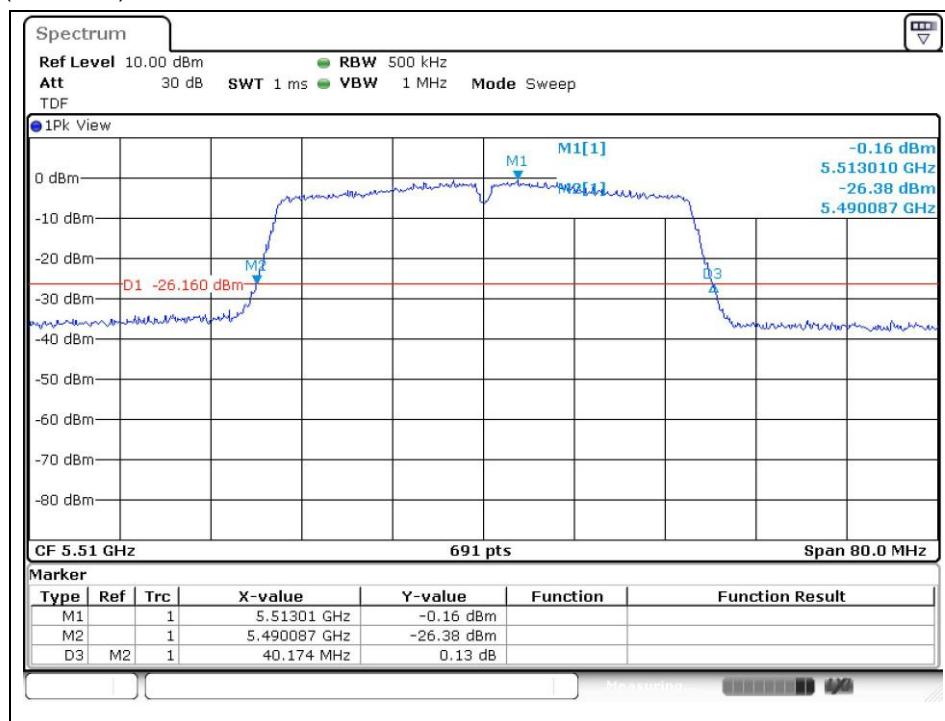
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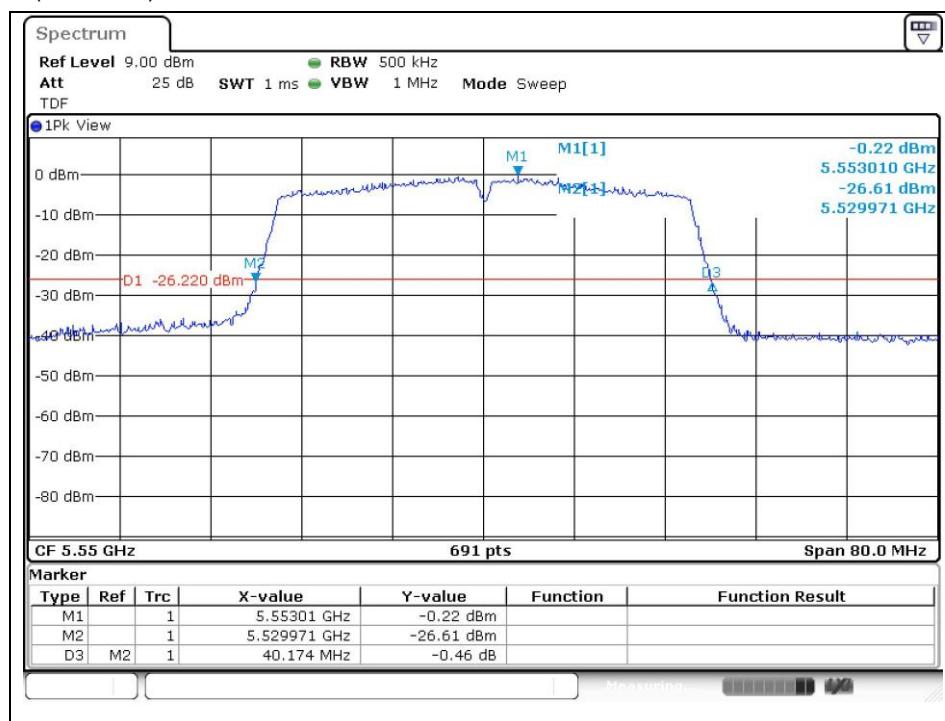
A4(210 mm x 297 mm)

**802.11n\_HT40 (Band 2C)**

Low Channel (5 510 MHz)



Middle Channel (5 550 MHz)



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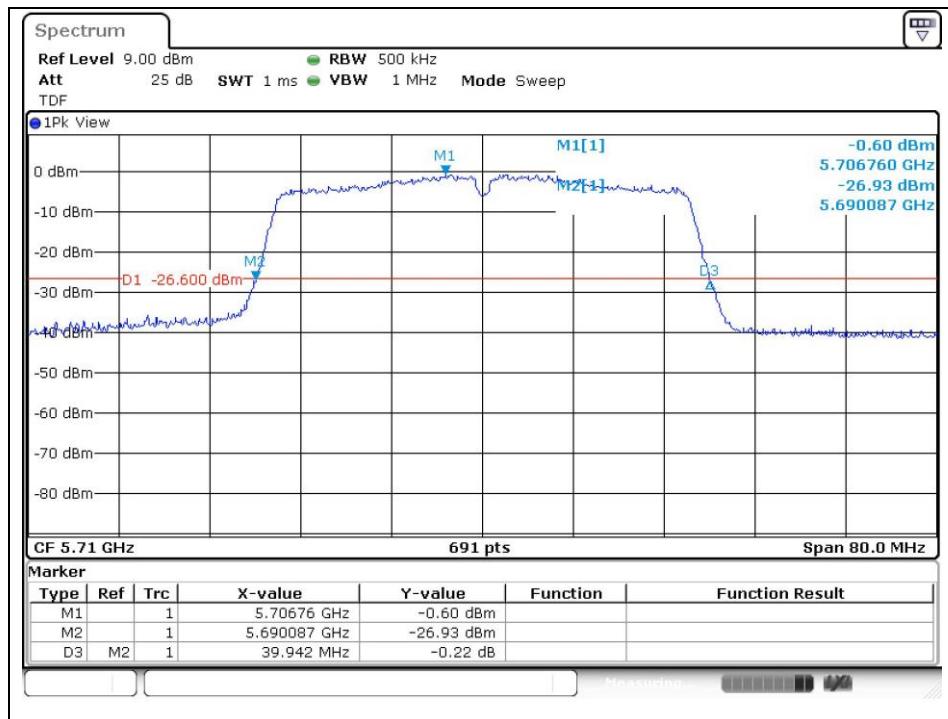
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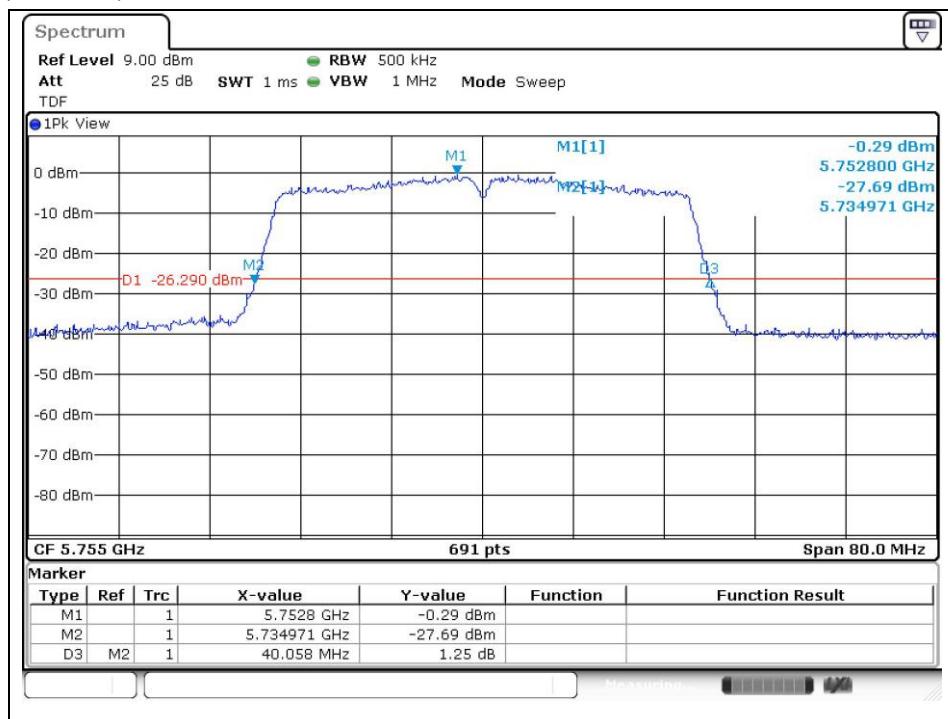
A4(210 mm x 297 mm)

## High Channel (5 710 MHz)



## 802.11n\_HT40 (Band 3)

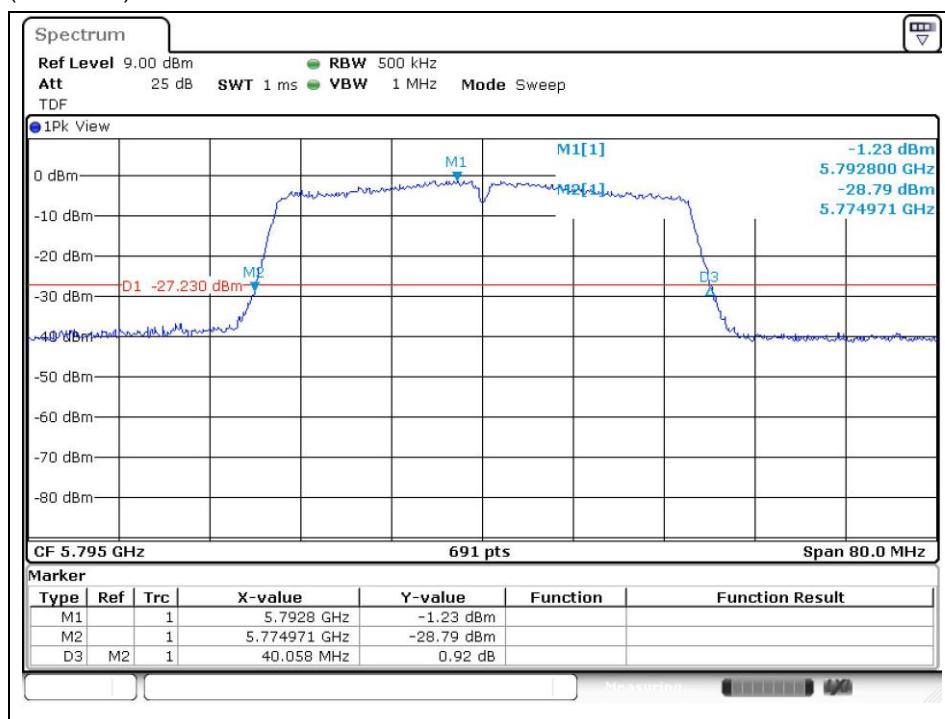
## Low Channel (5 755 MHz)



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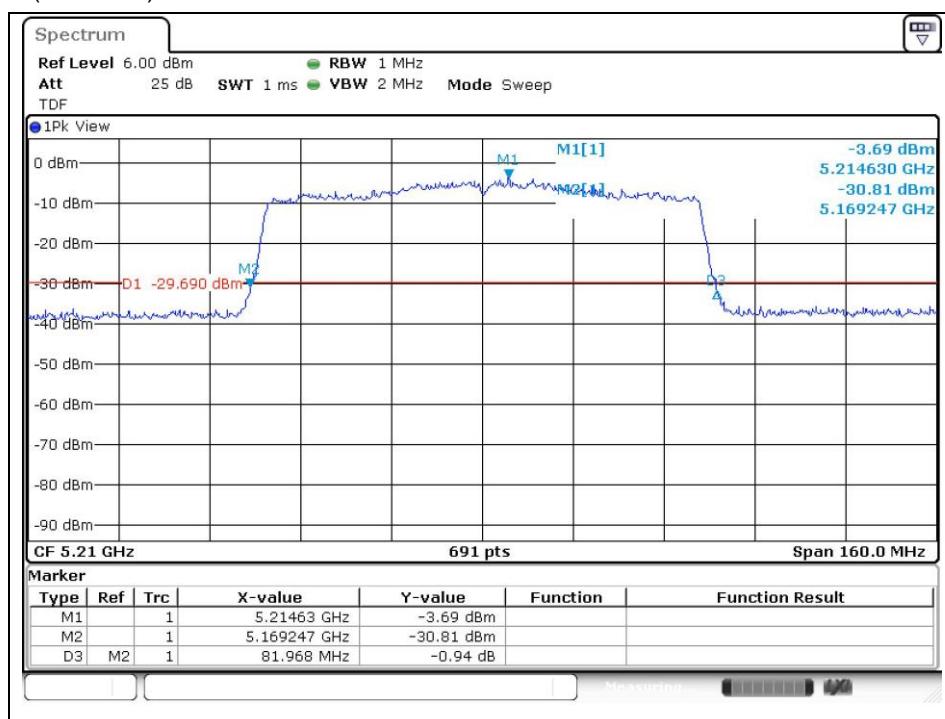
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## High Channel (5 795 MHz)



## 802.11ac\_VHT80 (Band 1)

## Middle Channel (5 210 MHz)



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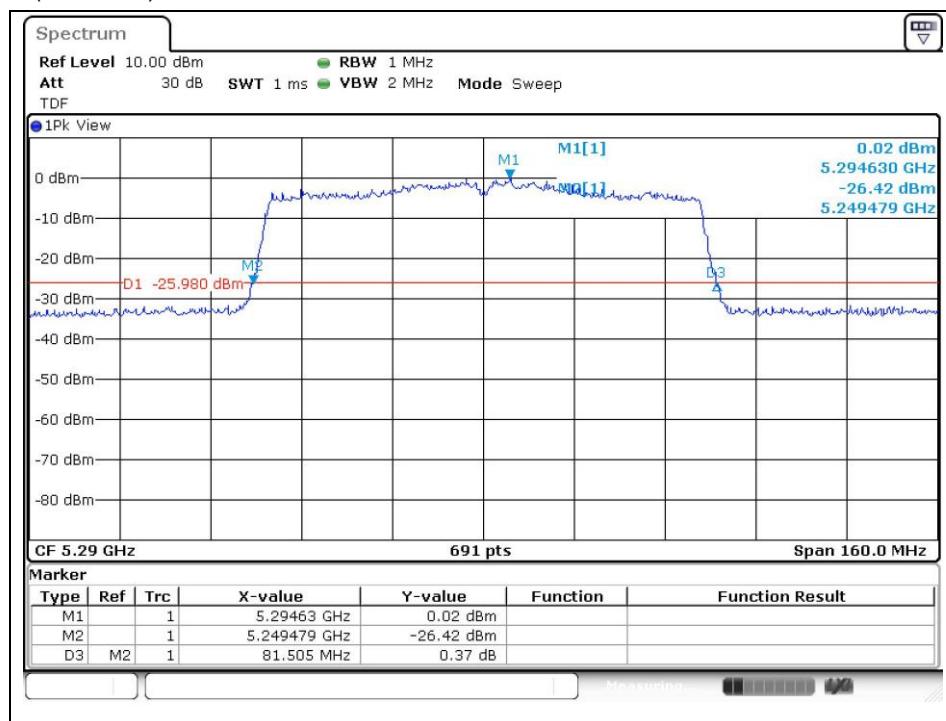
RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

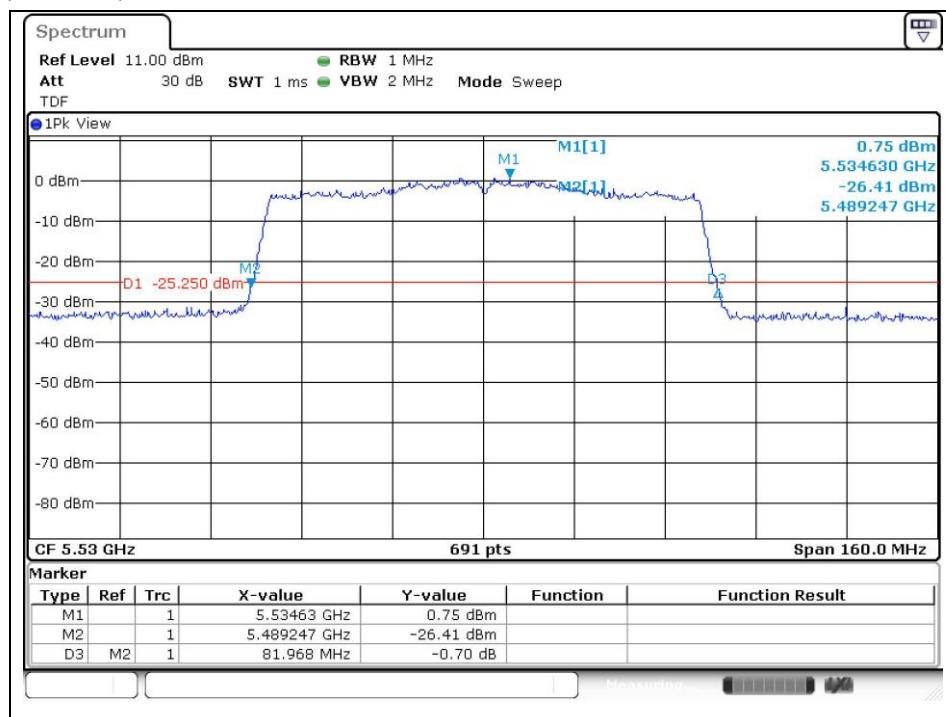
### 802.11ac\_VHT80 (Band 2A)

Middle Channel (5 290 MHz)



### 802.11ac\_VHT80 (Band 2C)

Low Channel (5 530 MHz)



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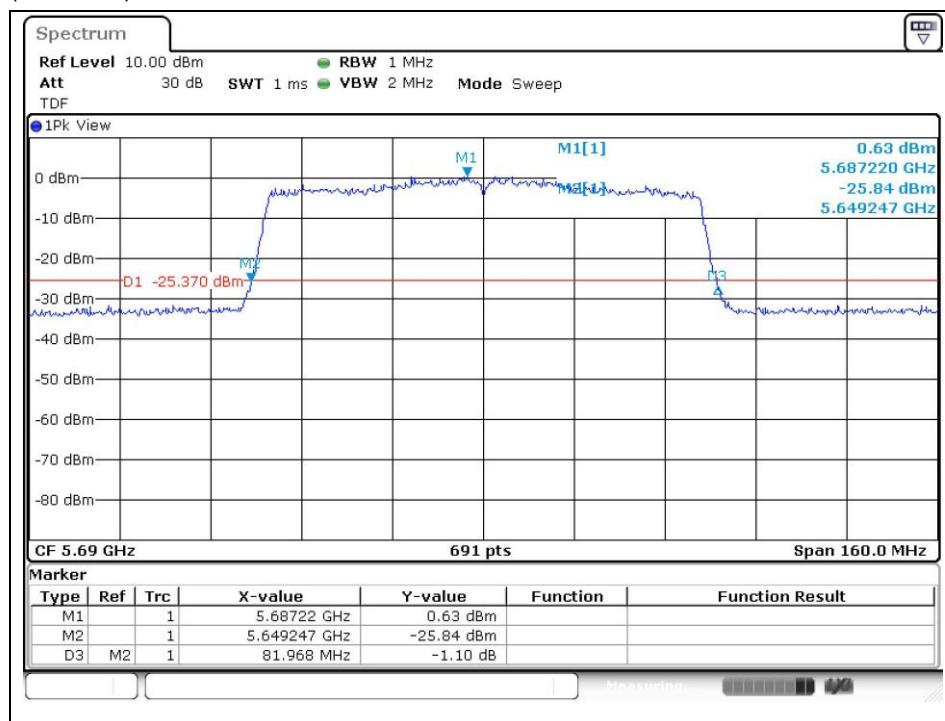
RTT5041-19(2019.04.24)(1)

Tel. +82 31 428 5700 / Fax. +82 31 427 2370

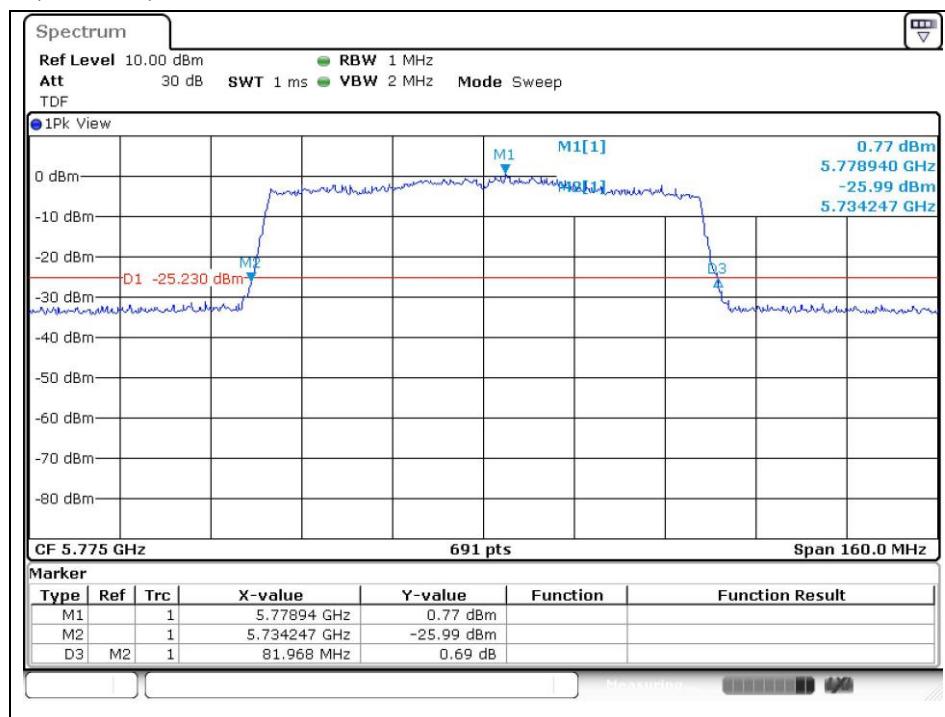
A4(210 mm x 297 mm)

**802.11ac\_VHT80 (Band 2C)**

High Channel (5 690 MHz)

**802.11ac\_VHT80 (Band 3)**

Middle Channel (5 775 MHz)



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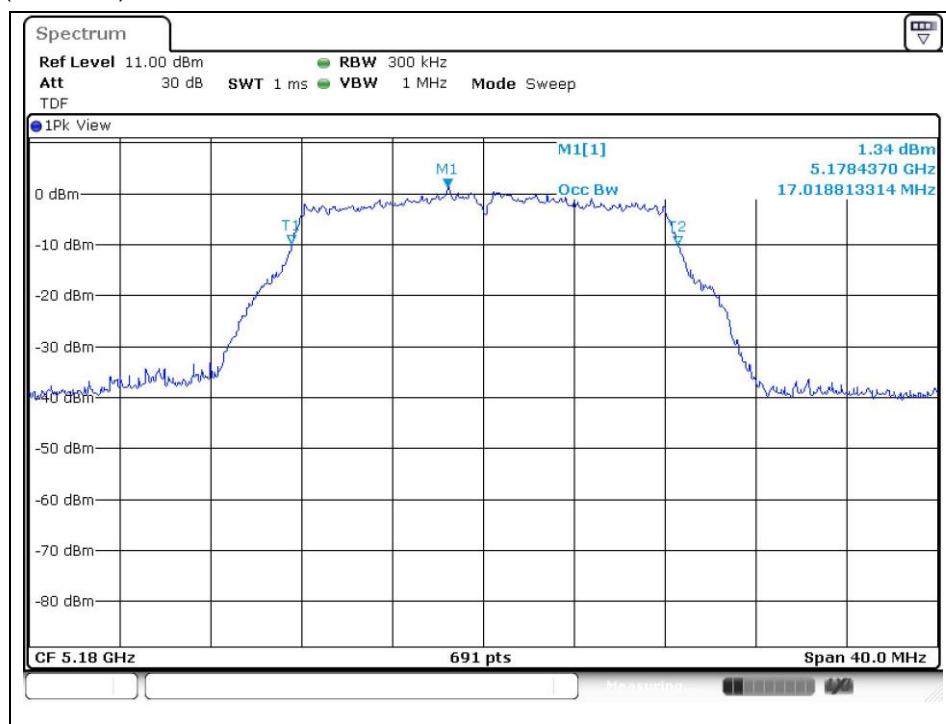
RTT5041-19(2019.04.24)(1)

Tel. +82 31 428 5700 / Fax. +82 31 427 2370

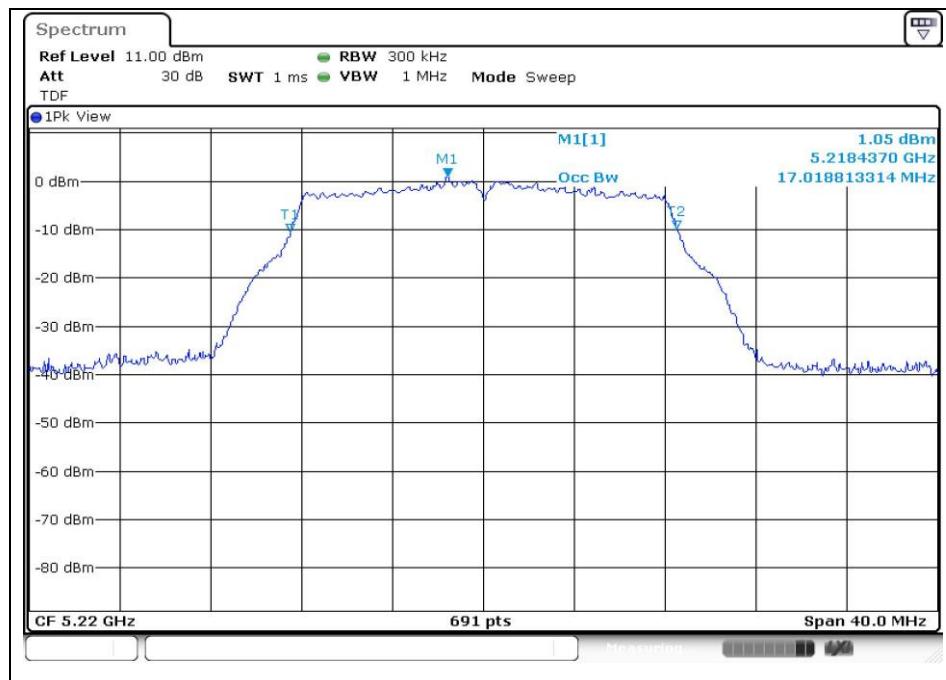
A4(210 mm x 297 mm)

**99 % Bandwidth****802.11a (Band 1)**

Low Channel (5 180 MHz)



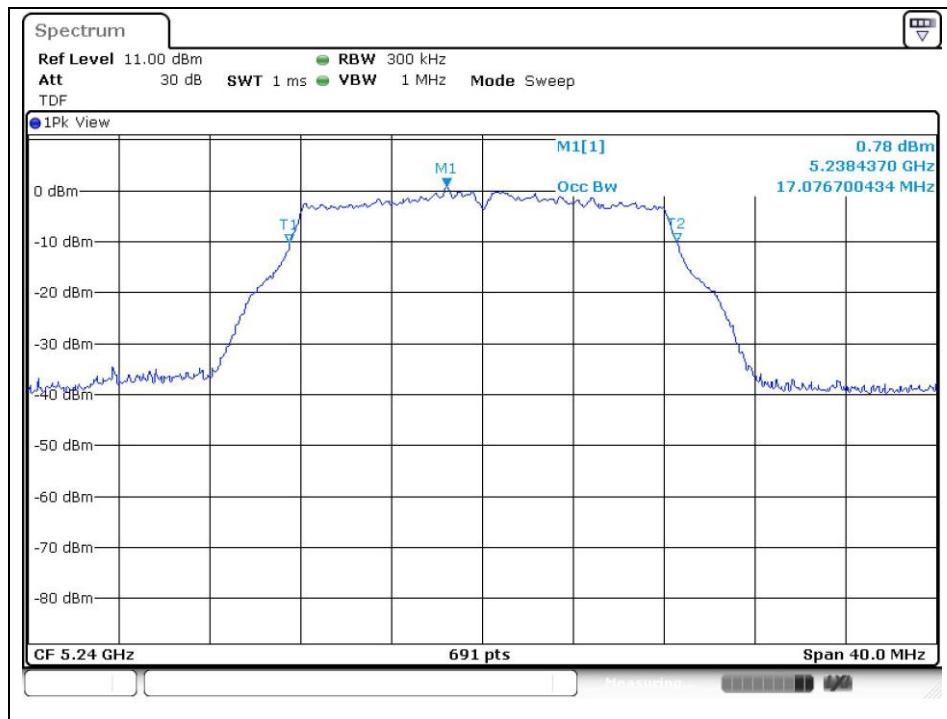
Middle Channel (5 220 MHz)



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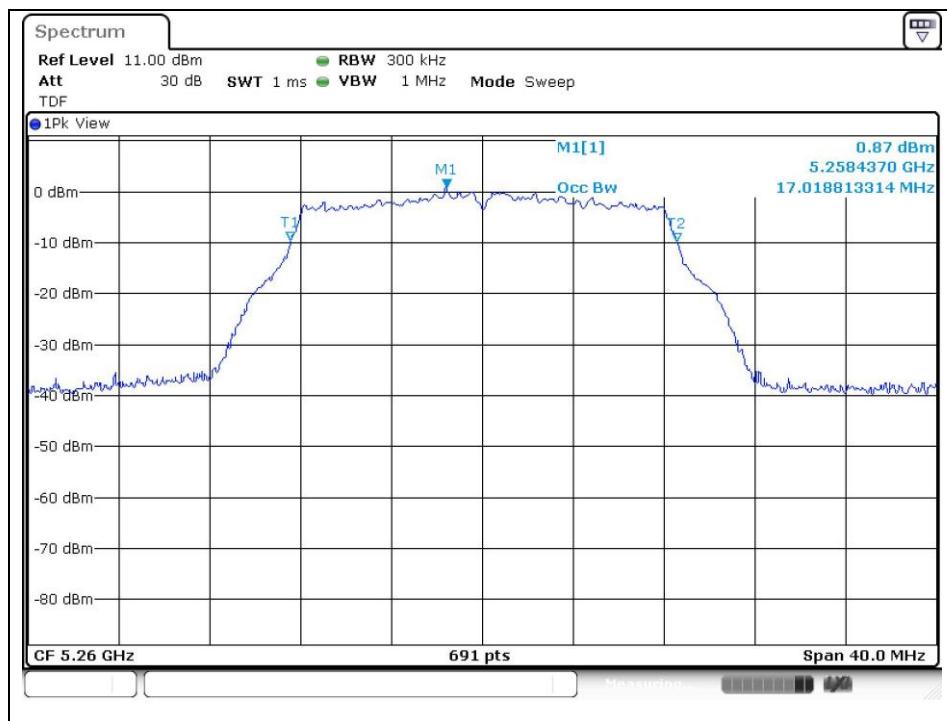
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## High Channel (5.240 GHz)



## 802.11a (Band 2A)

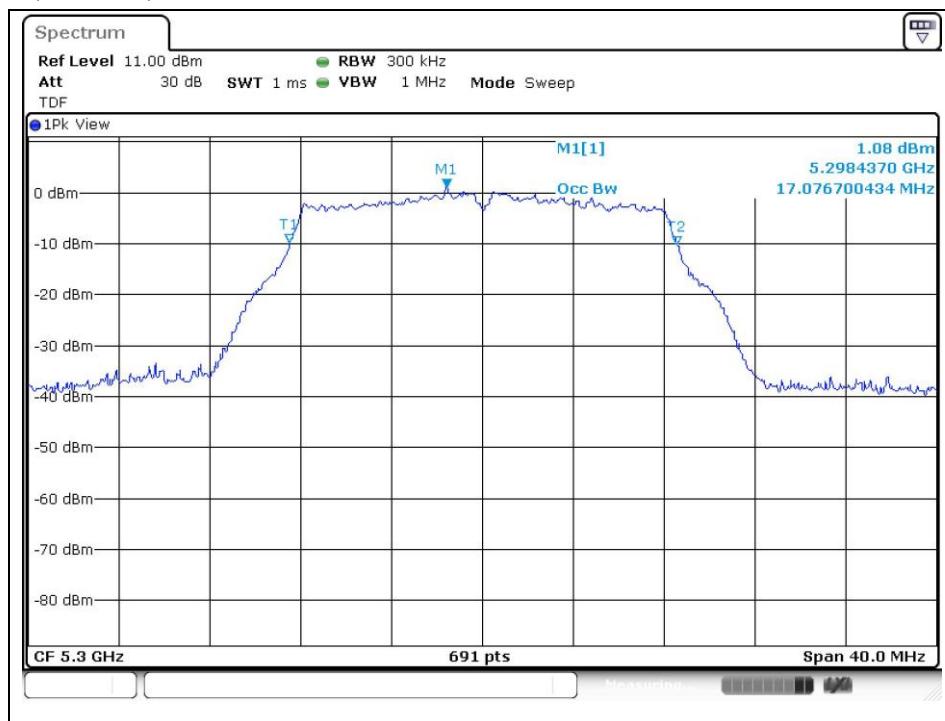
## Low Channel (5.260 GHz)



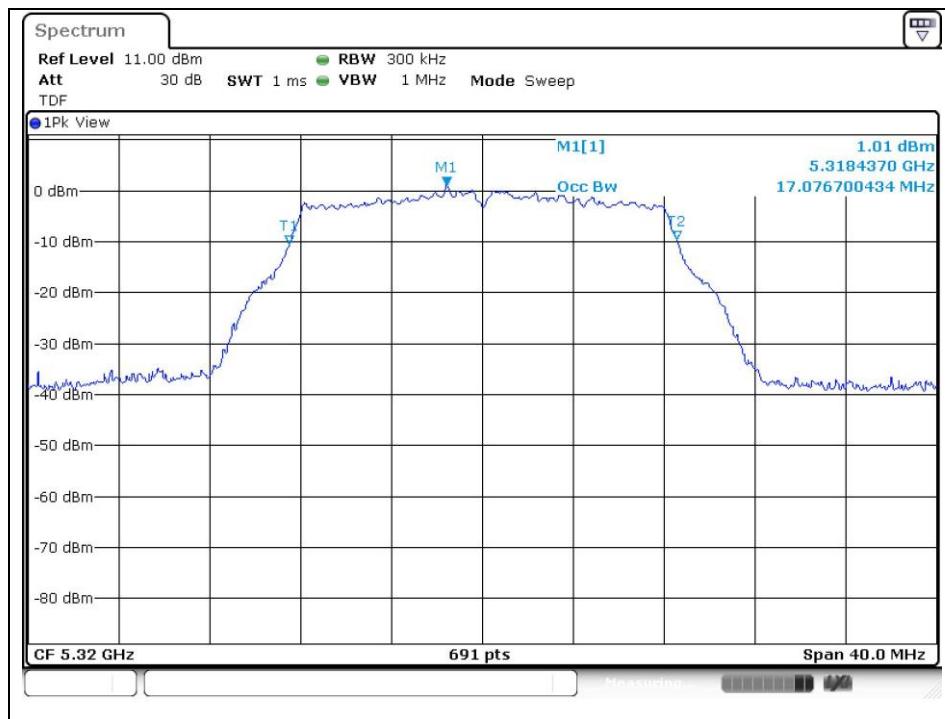
The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

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## Middle Channel (5 300 MHz)



## High Channel (5 320 MHz)



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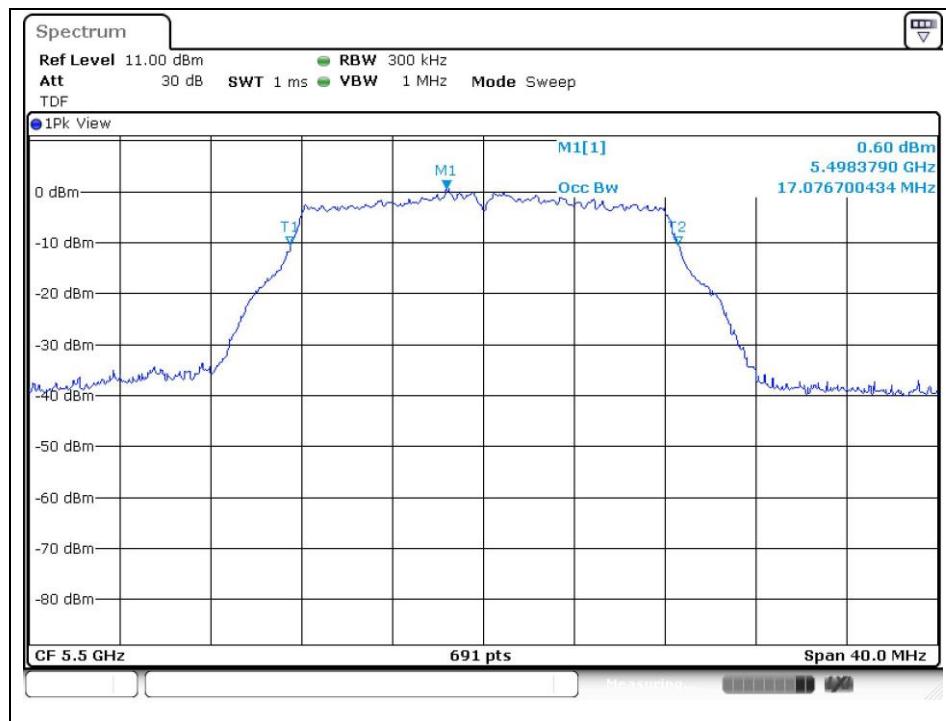
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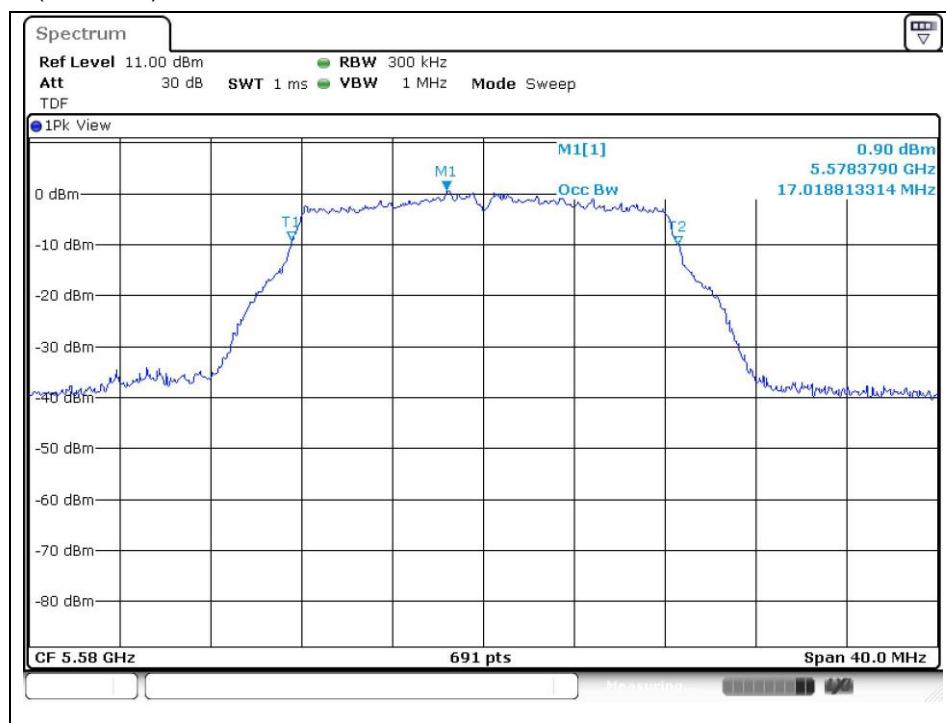
A4(210 mm x 297 mm)

**802.11a (Band 2C)**

Low Channel (5 500 MHz)



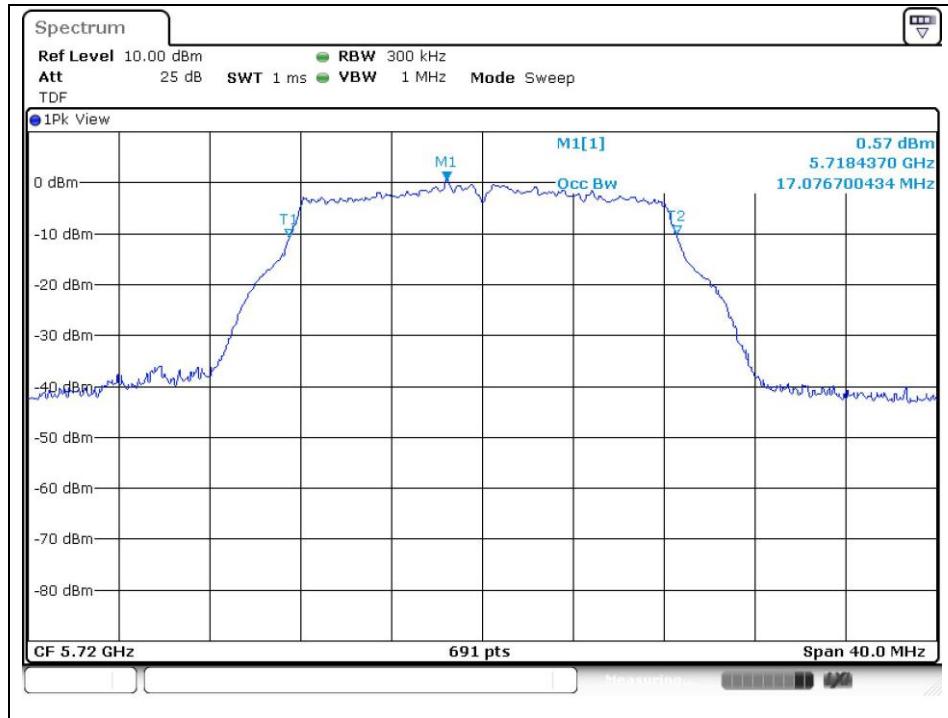
Middle Channel (5 580 MHz)



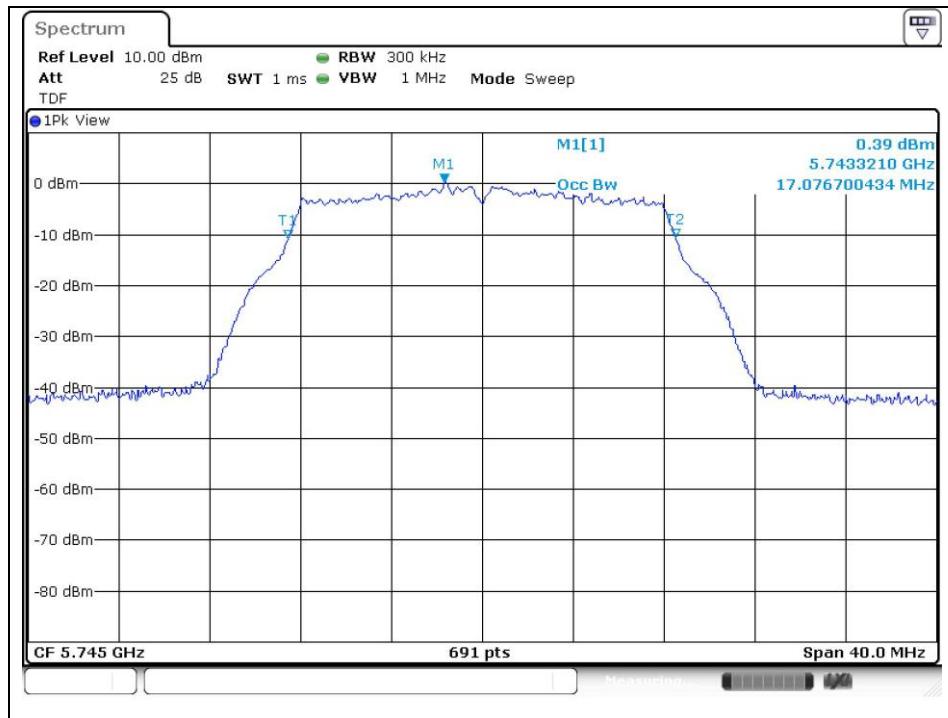
The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

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## High Channel (5 720 MHz)

**802.11a (Band 3)**

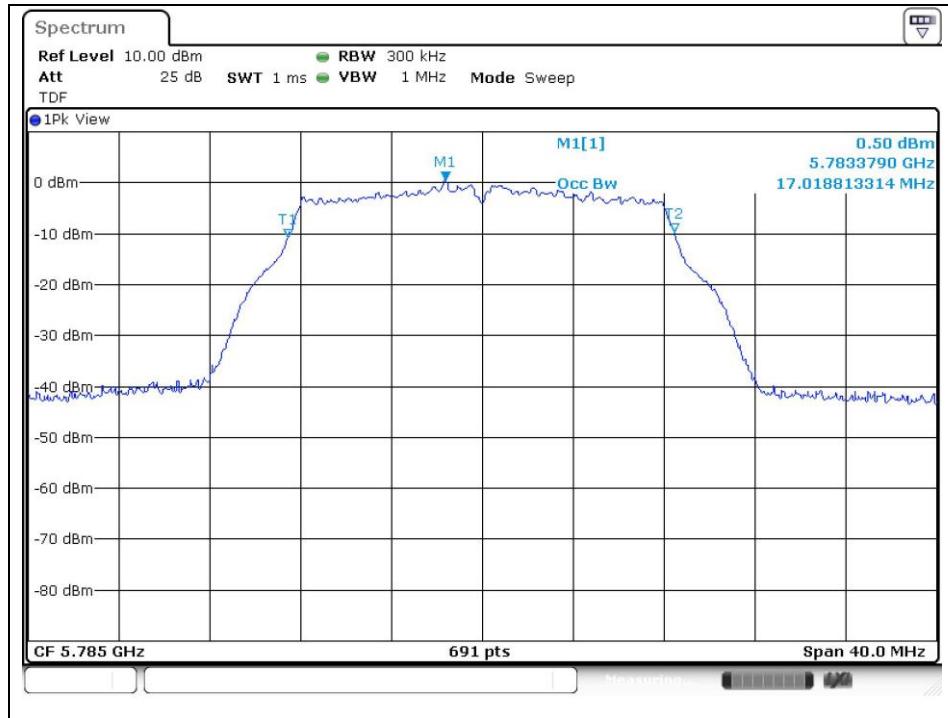
## Low Channel (5 745 MHz)



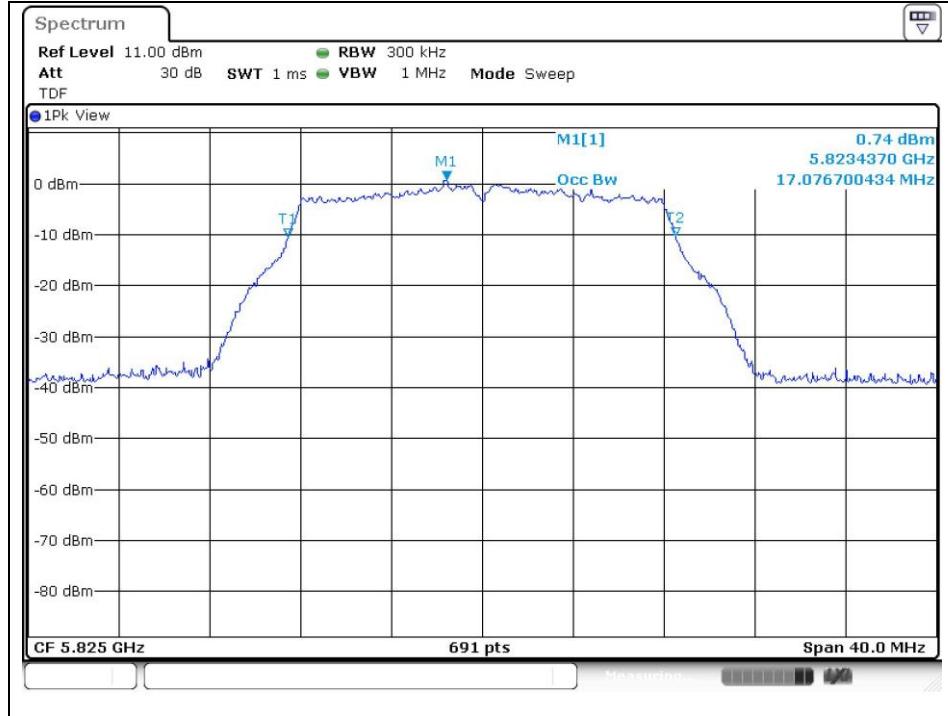
The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

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## Middle Channel (5 785 MHz)



## High Channel (5 825 MHz)

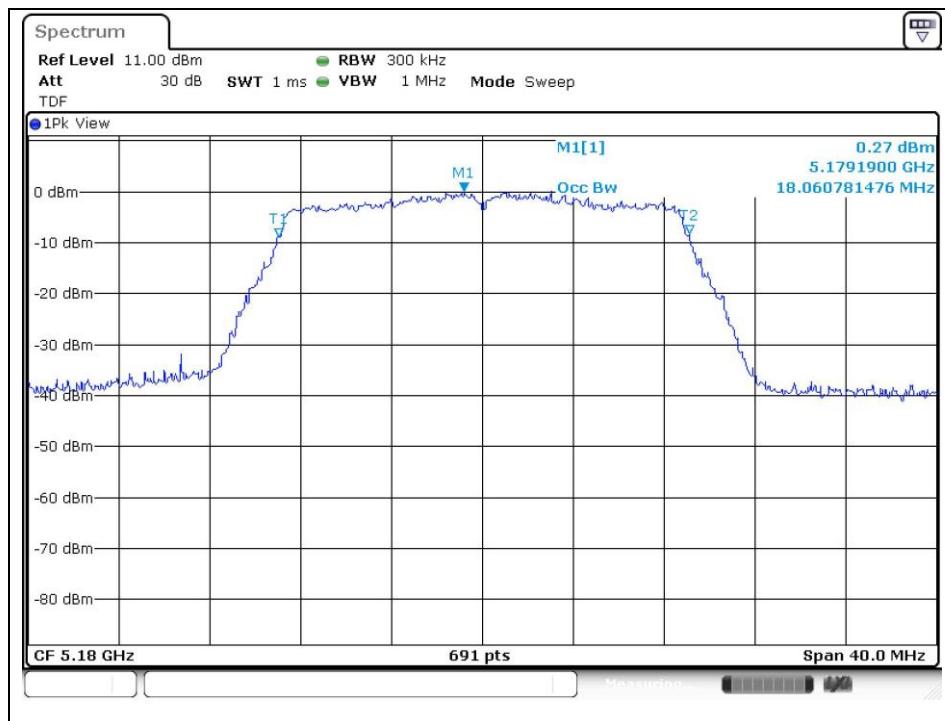


The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

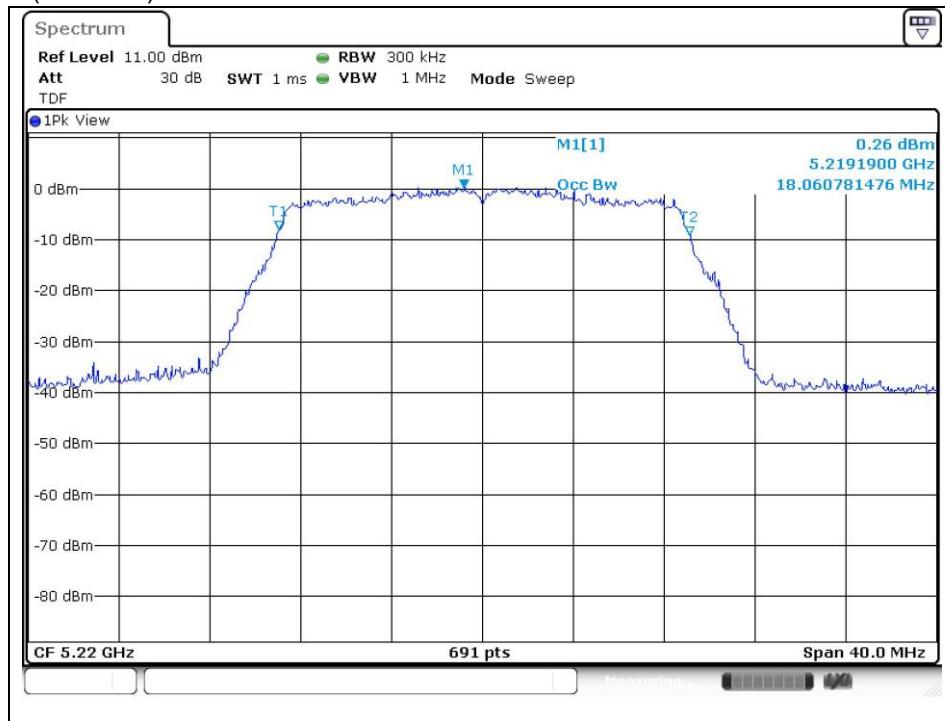
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**802.11ac\_VHT20 (Band 1)**

Low Channel (5 180 MHz)



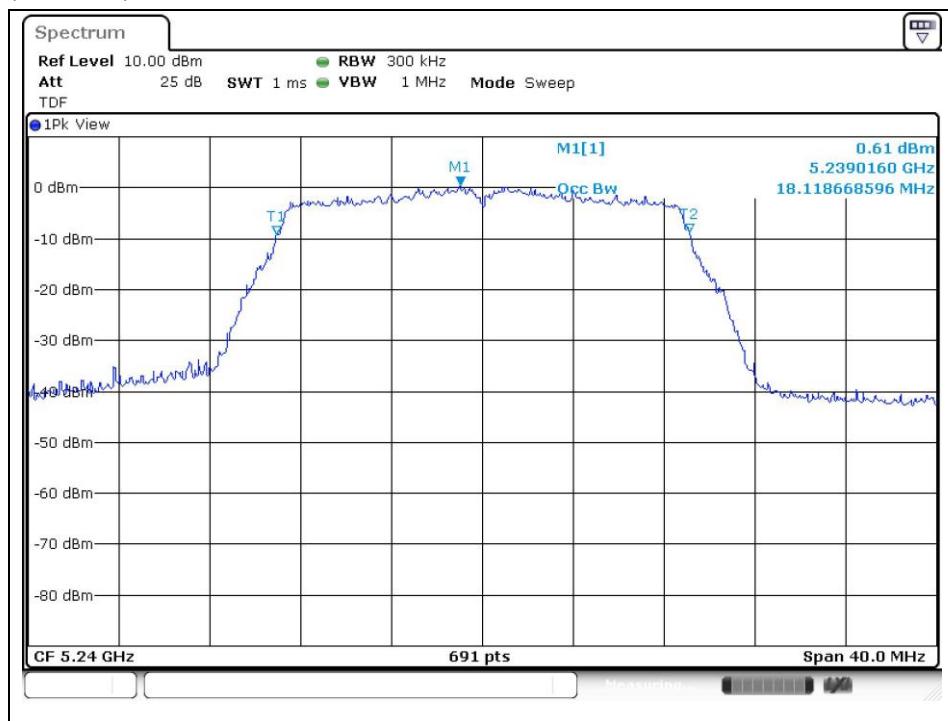
Middle Channel (5 220 MHz)



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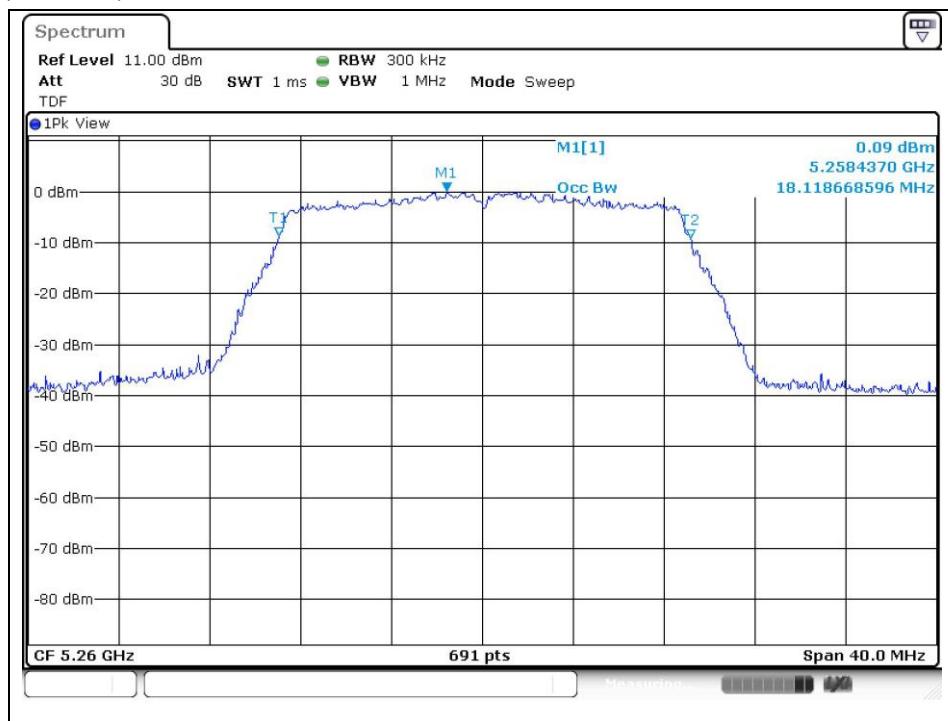
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## High Channel (5 240 MHz)



## 802.11ac\_VHT20 (Band 2A)

## Low Channel (5 260 MHz)



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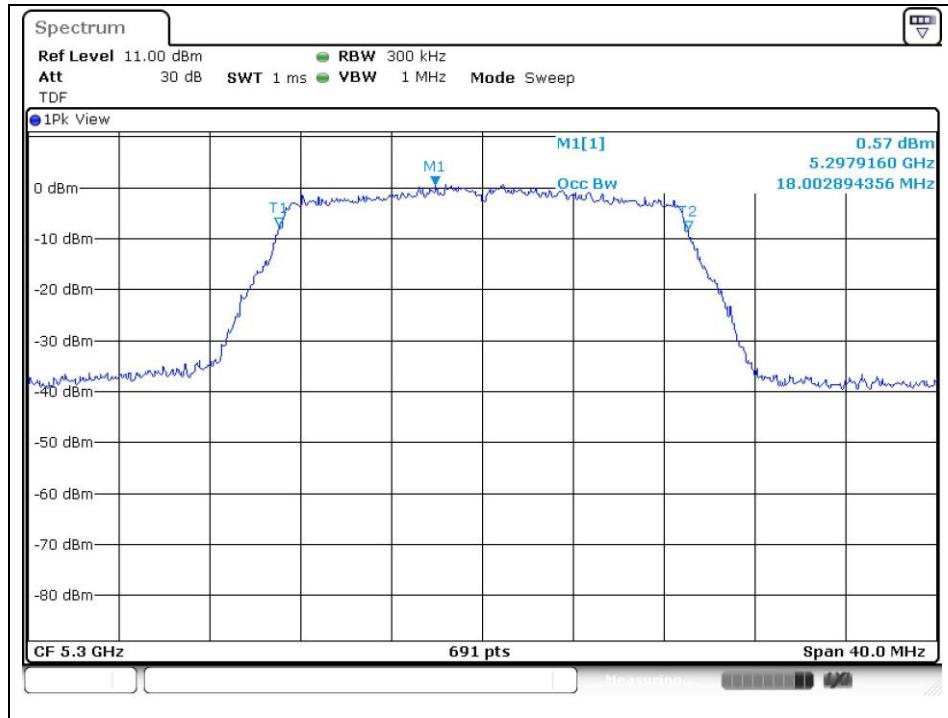
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RTT5041-19(2019.04.24)(1)

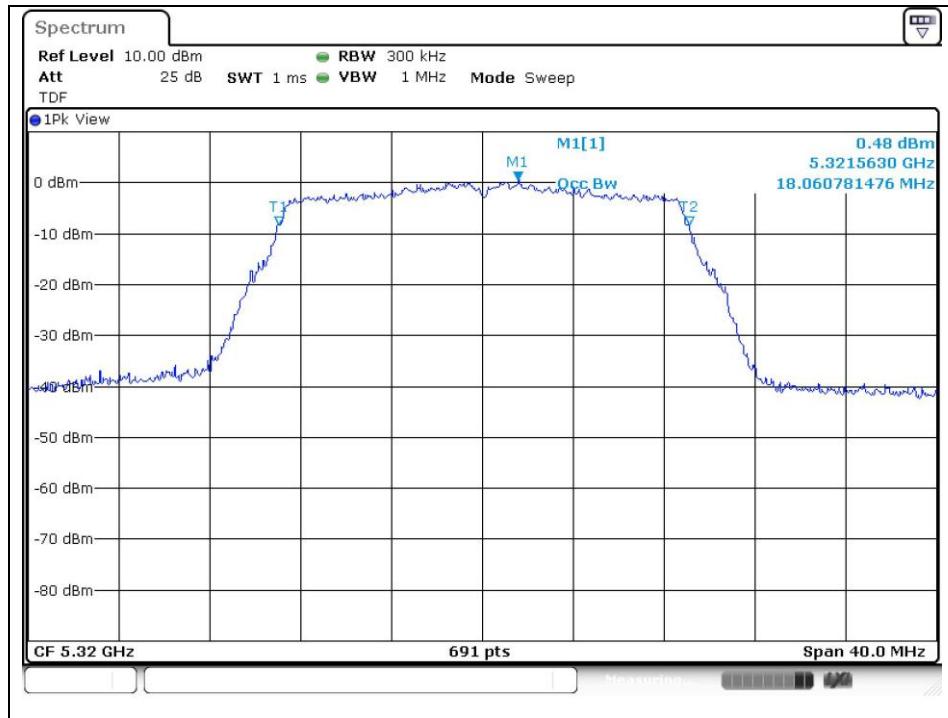
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

## Middle Channel (5 300 MHz)



## High Channel (5 320 MHz)

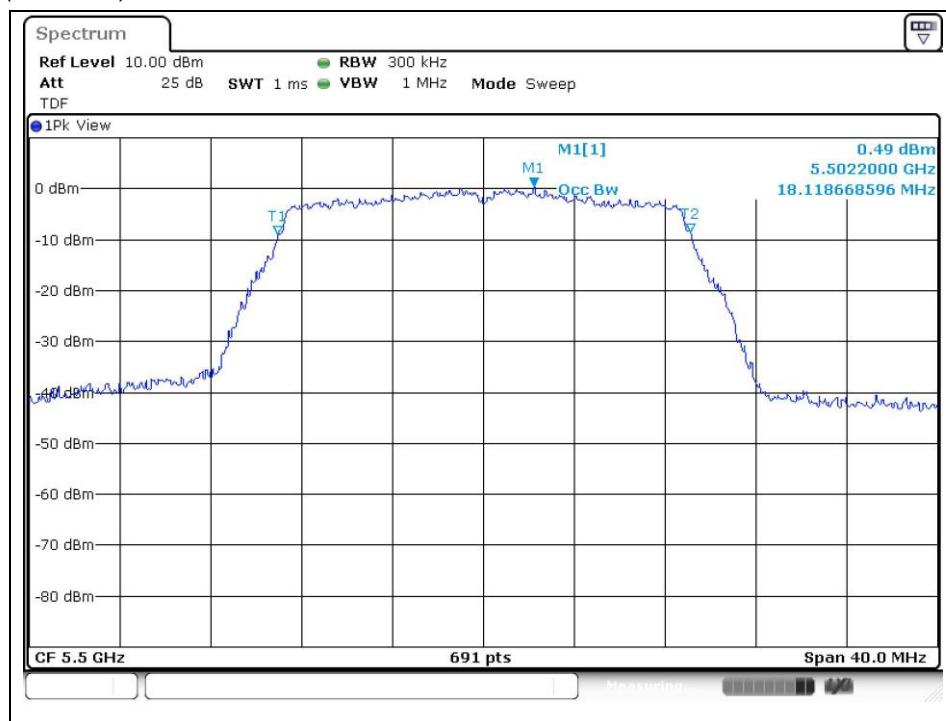


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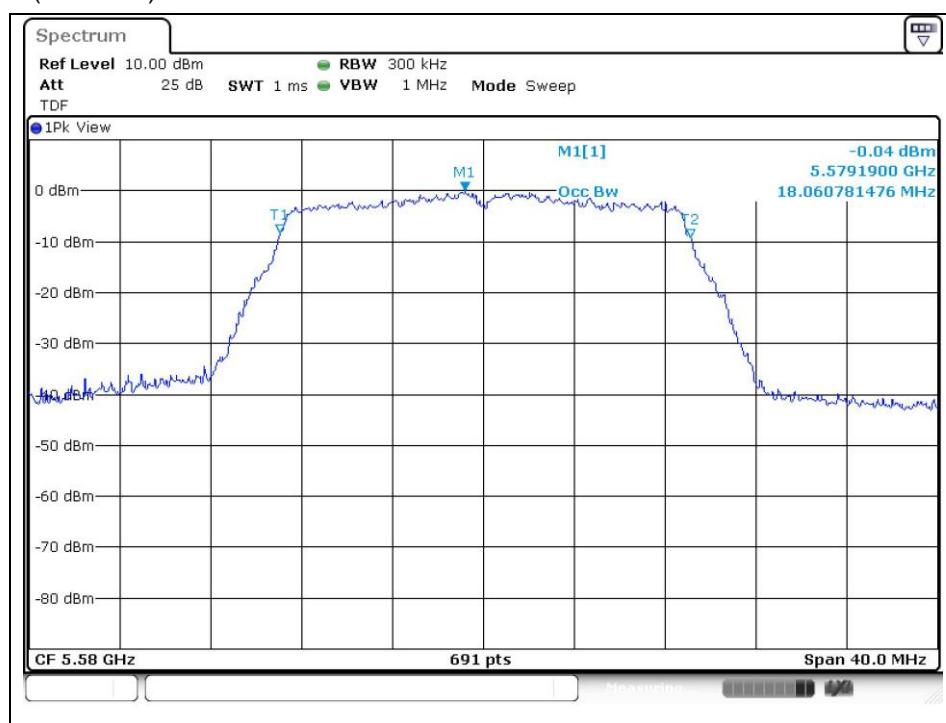
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**802.11ac\_VHT20 (Band 2C)**

Low Channel (5 500 MHz)



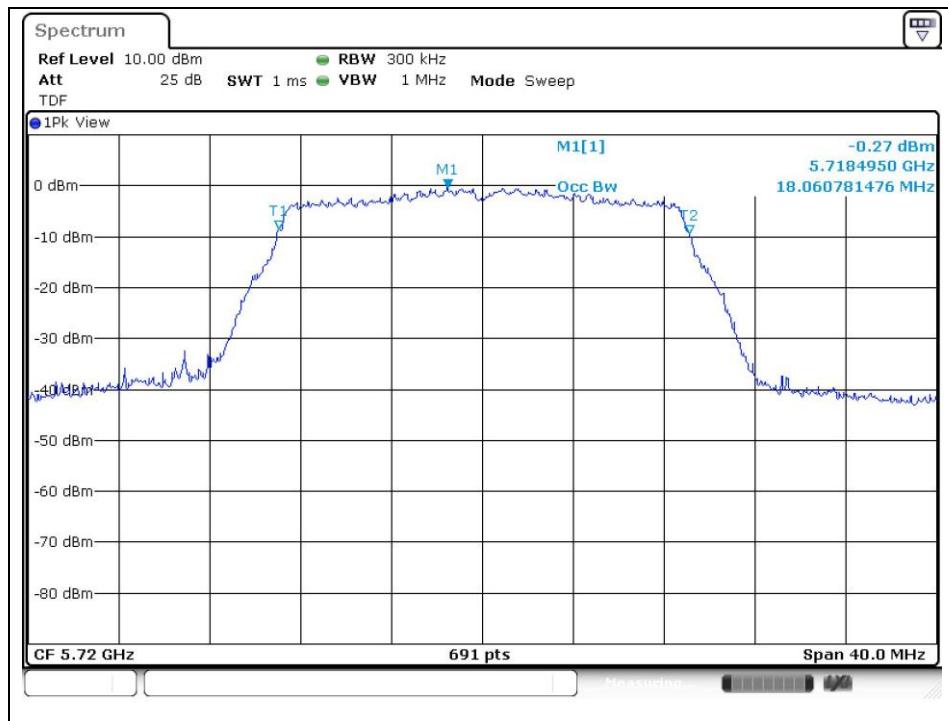
Middle Channel (5 580 MHz)



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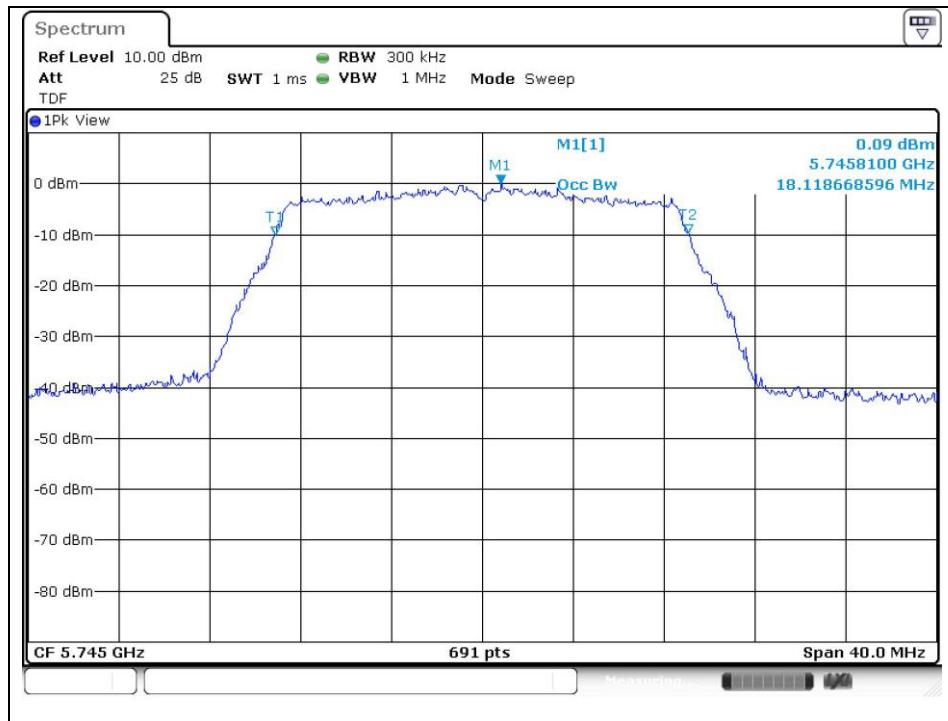
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## High Channel (5 720 MHz)



## 802.11ac\_VHT20 (Band 3)

## Low Channel (5 745 MHz)



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