

4. 6 dB Bandwidth

4.1. Test Setup



4.2. Limit

4.2.1. FCC

According to §15.407(e), within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

4.2.2. IC

According to RSS-247 Issue 2, 6.2.4.1, the minimum -6 dB Bandwidth shall be at least 500 kHz.

4.3. 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.

1. This measurement settings are specified in section C.2 of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Set RBW = 100 kHz.
3. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. Sweep = auto couple.
7. Allow the trace to stabilize.
8. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

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.

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A4(210 mm x 297 mm)

4.4. Test result

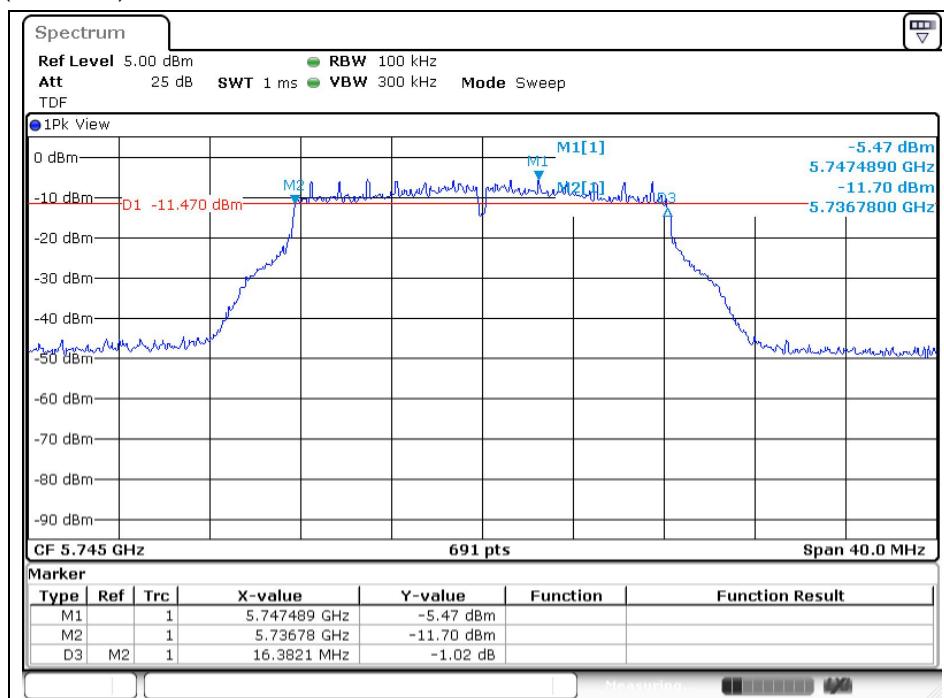
Ambient temperature : $(23 \pm 1)^\circ\text{C}$
 Relative humidity : 47 % R.H.

Band	Mode	Frequency (MHz)	Ch.	Data Rate (Mbps)	6 dB Bandwidth (MHz)	Minimum Bandwidth (kHz)
U-NII 3	11a	5 745	149	6	16.382	500
		5 785	157		16.382	
		5 825	165		16.382	
	11n_HT20	5 745	149	MCS0	17.656	
		5 785	157		17.656	
		5 825	165		17.656	
	11n_HT40	5 755	151	MCS0	36.006	
		5 795	159		35.890	
	11ac_VHT80	5 775	155	MCS0	75.948	
U-NII 3 (Band-crossing channels)	11a	5 720	144	6	3.162	
	11n_HT20	5 720	144	MCS0	3.799	
	11n_HT40	5 710	142	MCS0	3.180	
	11ac_VHT80	5 690	138	MCS0	2.710	

- Test plots

802.11a (Band 3)

Low Channel (5 745 MHz)



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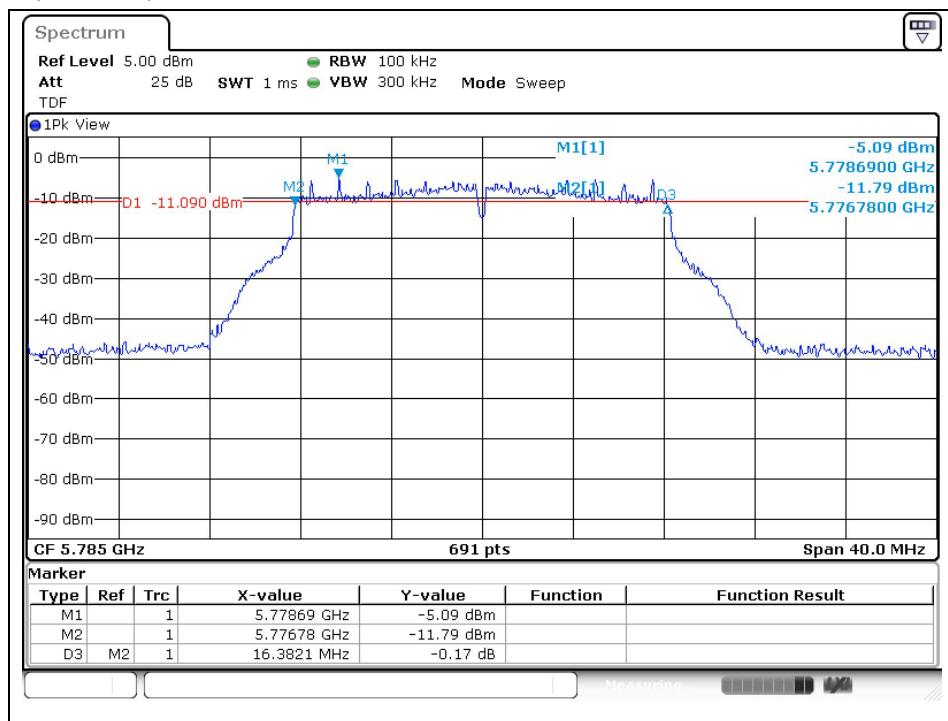
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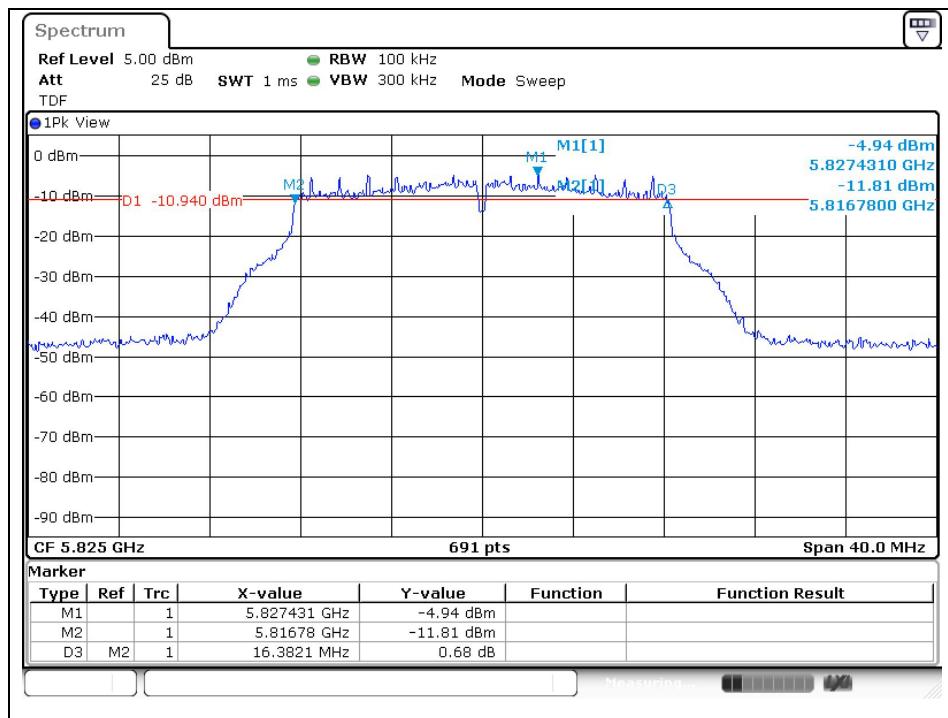
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Middle Channel (5 785 MHz)



High Channel (5 825 MHz)



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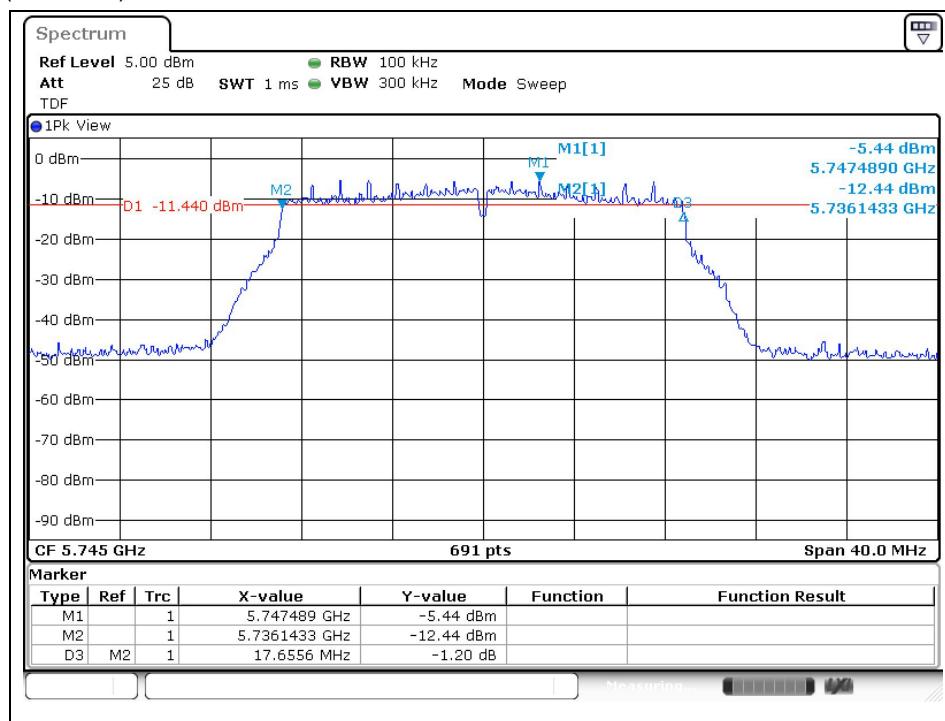
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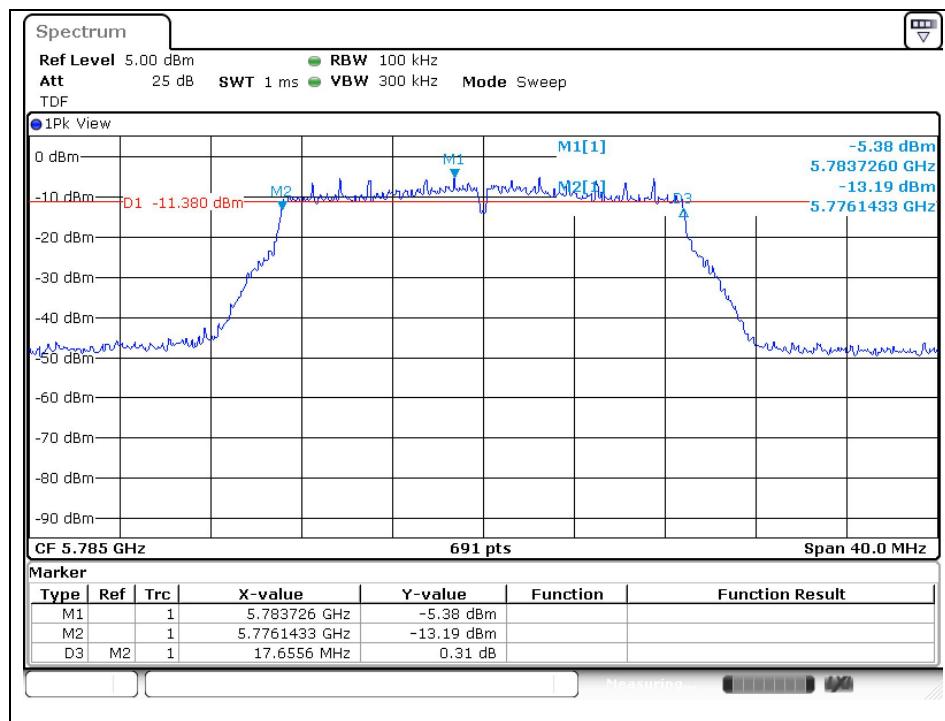
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802.11n_HT20 (Band 3)

Low Channel (5 745 MHz)



Middle Channel (5 785 MHz)



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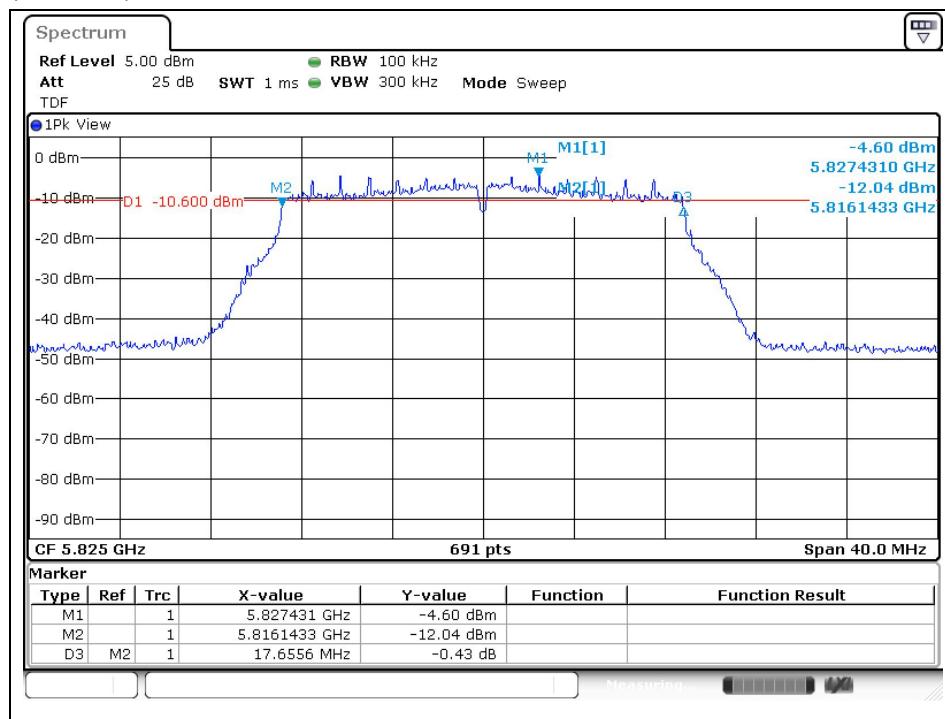
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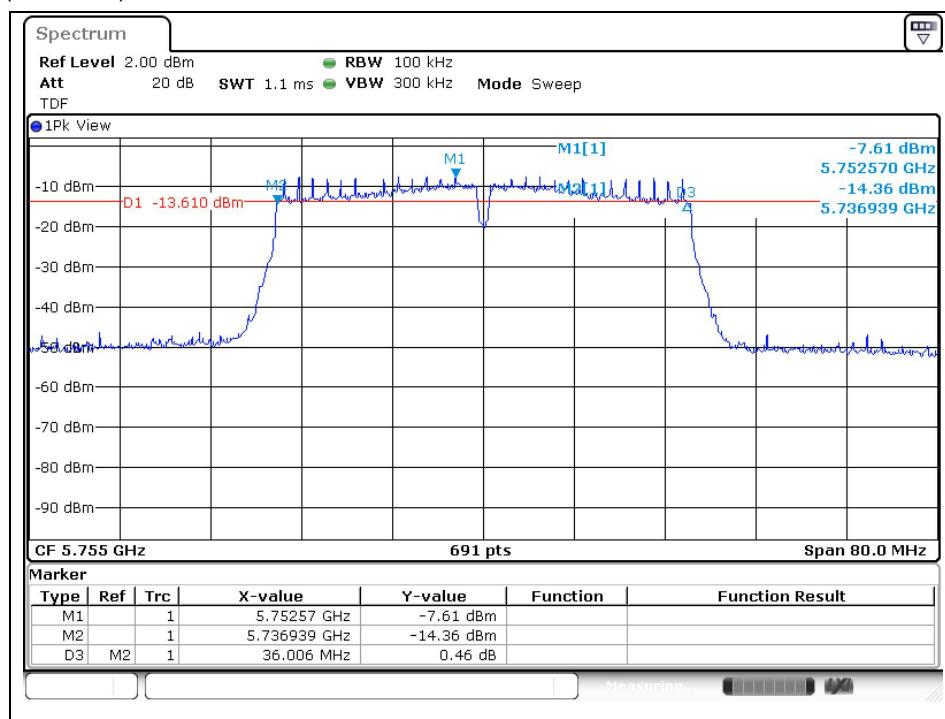
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High Channel (5.825 MHz)



802.11n_HT40 (Band 3)

Low Channel (5.755 MHz)



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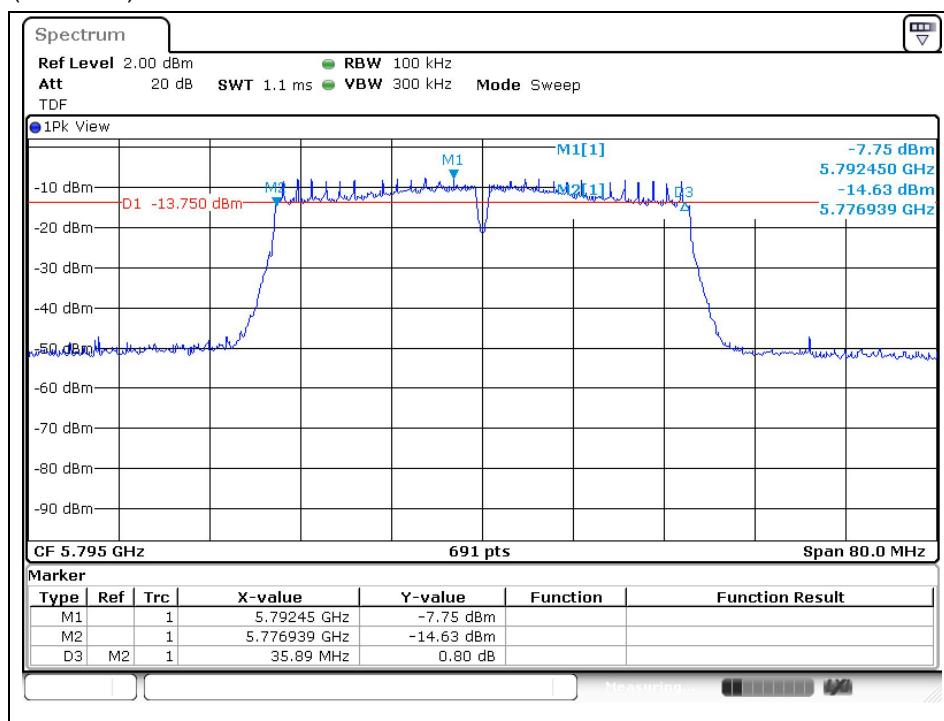
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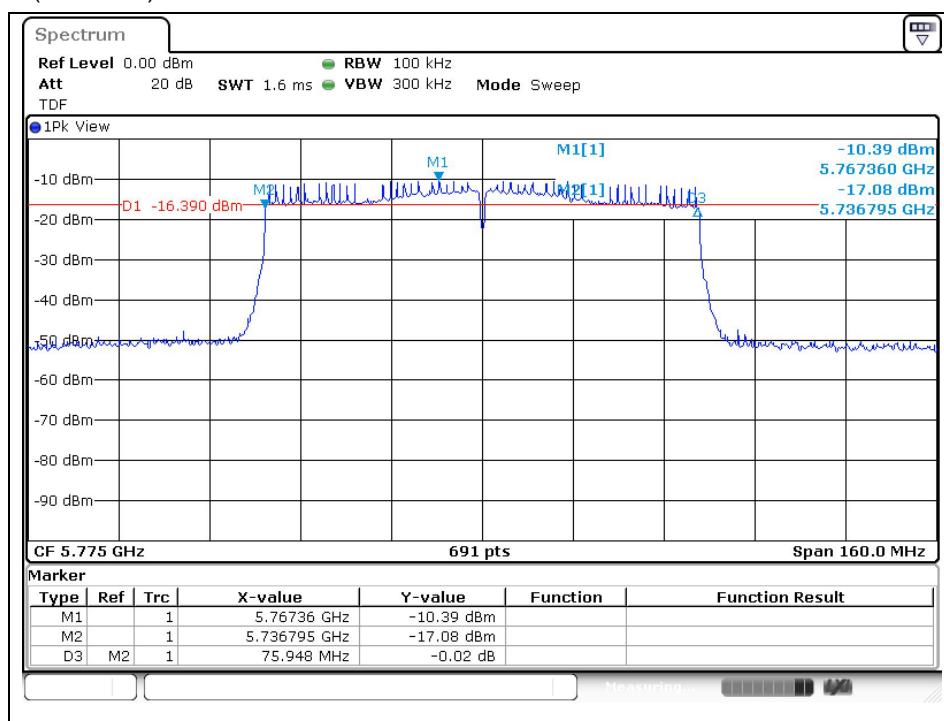
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High Channel (5 795 MHz)



802.11ac_VHT80 (Band 3)

Middle Channel (5 775 MHz)



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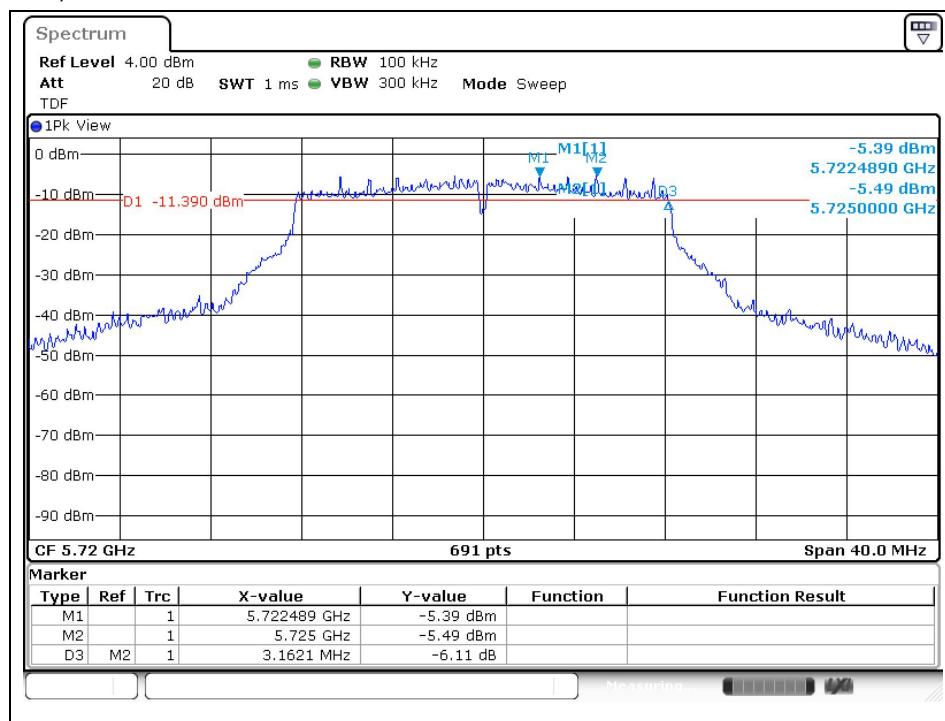
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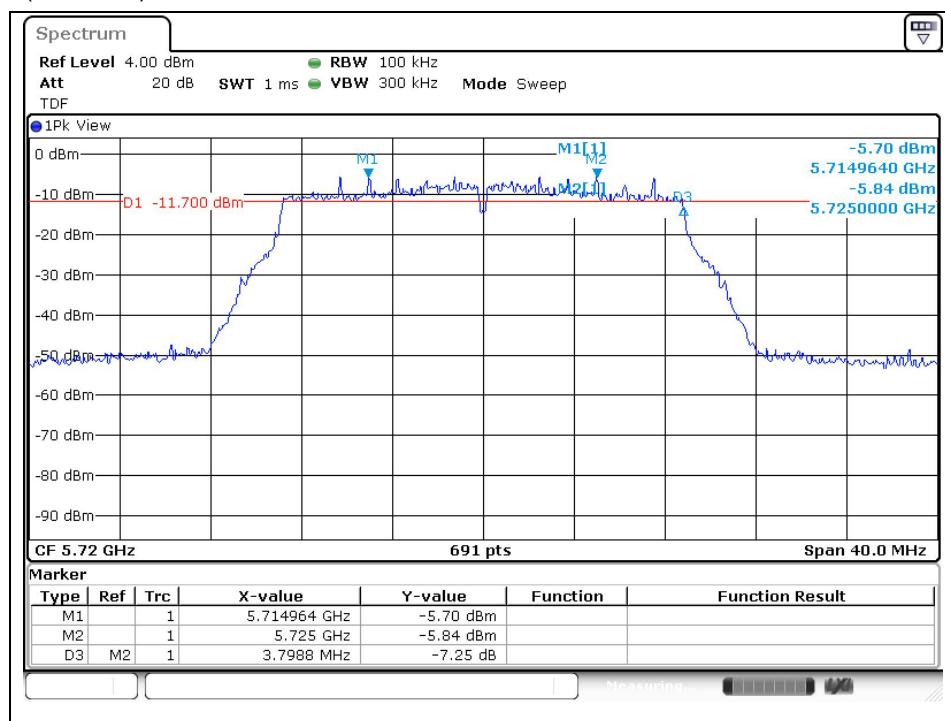
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Band-crossing channels

802.11a (5 720 MHz)



802.11n-HT20 (5 720 MHz)



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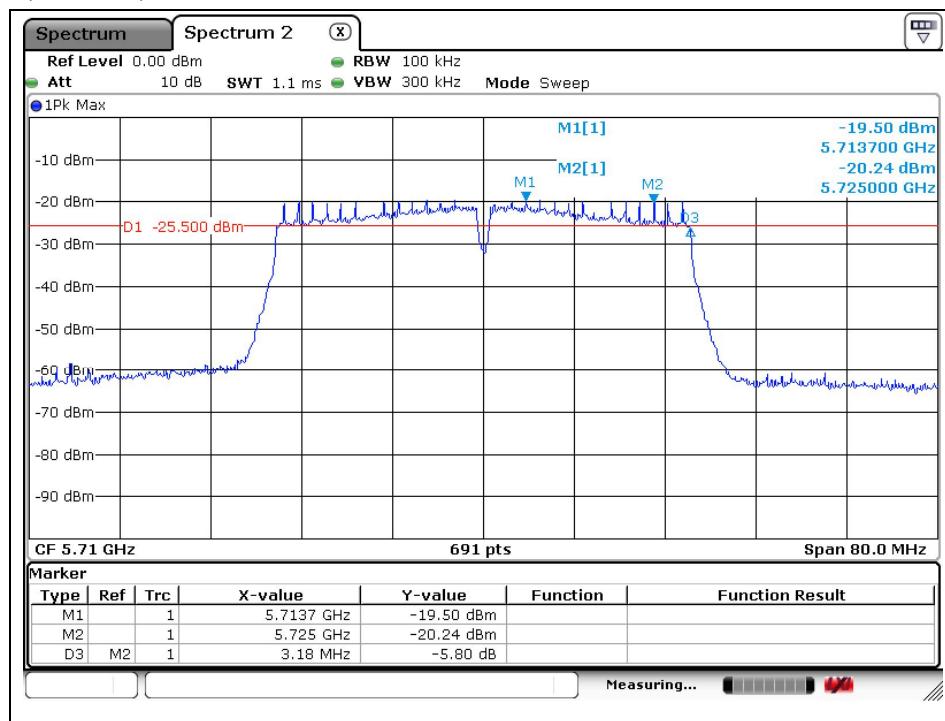
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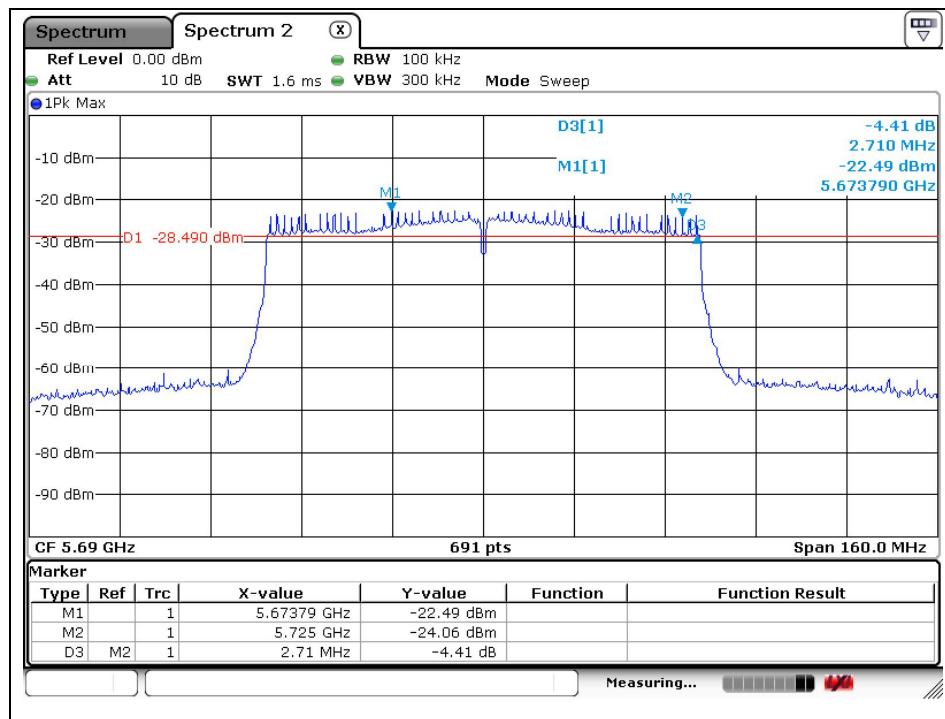
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802.11n_HT40 (5 710 MHz)



802.11ac_VHT80 (5 690 MHz)



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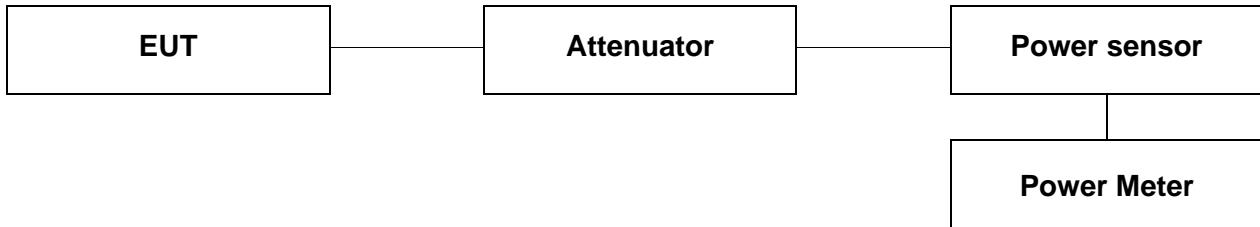
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5. Maximum Conducted Output Power

5.1. Test Setup



5.2. Limit

5.2.1. FCC

According to 15.407(a)(1)(iv)

For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dB i. In addition, the maximum power spectral density shall not exceed 11 dB m in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dB i are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dB i.

According to 15.407(a)(2)

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dB m} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dB m in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dB i are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dB i.

According to 15.407(a)(3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dB m in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dB i are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dB i. However, fixed point-to point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dB i without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

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5.2.2. IC

According to RSS-247 Issue 2,

6.2.1.1 Frequency band 5 150-5 250 MHz

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or $1.76 + 10\log_{10}B$, dBm, whichever is less. Devices shall implement transmitter power control (TPC) in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

For other devices, the maximum e.i.r.p. shall not exceed 200 mW or $10 + 10\log_{10}B$, dBm, whichever power is less. B is the 99 % emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

6.2.2.1 Frequency band 5 250-5 350 MHz

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or $1.76 + 10\log_{10}B$, dBm, whichever is less. Devices shall implement TPC in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

Devices, other than devices installed in vehicles, shall comply with the following:

- a) The maximum conducted output power shall not exceed 250 mW or $11 + 10\log_{10}B$, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band;
- b) The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10\log_{10}B$, dBm, whichever is less. B is the 99 % emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

6.2.3.1 Frequency band 5 470-5 600 MHz and 5 650-5 725 MHz

The maximum conducted output power shall not exceed 250 mW or $11 + 10\log_{10}B$, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10\log_{10}B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

6.2.4.1 Frequency band 5 725-5 850 MHz

For equipment operating in the band 5 725-5 850 MHz, the minimum 6 dB bandwidth shall be at least 500 kHz. The maximum conducted output power shall not exceed 1 W. The output power spectral density shall not exceed 30 dB m in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dB i are used, both the maximum conducted output power and the output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dB i. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dB i without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint³ systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

5.3. 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.

1. This measurement settings are specified in section E.3.a of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied:
 - The EUT is configured to transmit continuously or to transmit with a consistent duty cycle.
 - At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
 - The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
3. If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in section II.B.
4. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
5. Adjust the measurement in dB m by adding $10 \log(1/x)$ where x is the duty cycle (e.g., $10 \log(1/0.25)$ if the duty cycle is 25 %).
6. 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.

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A4(210 mm x 297 mm)

5.4. Test result

Ambient temperature : (23 ± 1) °C
 Relative humidity : 47 % R.H.

Test mode: 11a

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power (dB m)	Duty Cycle Correction Factor (dB)	Average Power Result (dB m)
U-NII 1	5 180	6	8.59	0.30	8.89
	5 220		8.72		9.02
	5 240		8.80		9.10
U-NII 2A	5 260	6	8.77	0.30	9.07
	5 300		8.78		9.08
	5 320		8.64		8.94
U-NII 2C	5 500	6	8.13	0.30	8.43
	5 580		8.15		8.45
	5 700		7.97		8.27
U-NII 3	5 745	6	8.00	0.30	8.30
	5 785		7.98		8.28
	5 825		8.01		8.31

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power Result (dB m)	Antenna Gain (dB i)	E.I.R.P. (dB m)
U-NII 1	5 180	6	8.89	2.75	11.64
	5 220		9.02		11.77
	5 240		9.10		11.85

Band	FCC Limit							
	Frequency (MHz)	Fixed Limit (dB m)	26 dB BW (MHz)	11+10LogB (dB m)	Antenna Gain (dB i)	Limit (dB m)		
U-NII 1	5 180	23.98	\			2.75		
	5 220		\					
	5 240		\					
U-NII 2A	5 260	23.98	21.129	24.25	2.75	23.98		
	5 300		21.013	24.22				
	5 320		21.013	24.22				
U-NII 2C	5 500	23.98	21.129	24.25	-0.80	23.98		
	5 580		21.013	24.22				
	5 700		21.013	24.22				
U-NII 3	5 745	30	\			-1.24		
	5 785		\					
	5 825		\					

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A4(210 mm × 297 mm)

Band	IC Limit					
	Frequency (MHz)	Fixed Limit (dB m)	99 % BW (MHz)	1.76+10Log ₁₀ B (dB m)	Antenna Gain (dB i)	Limit (dB m)
U-NII 1	5 180	14.77	17.019	14.07	2.75	14.07
	5 220		17.019	14.07		14.07
	5 240		17.019	14.07		14.07
U-NII 2A	5 260	14.77	17.077	14.08	2.75	14.08
	5 300		17.019	14.07		14.07
	5 320		17.019	14.07		14.07

Band	IC Limit						
	Frequency (MHz)	Fixed Limit (dB m)	99 % BW (MHz)	11+10Log ₁₀ B (dB m)	Antenna Gain (dB i)	Limit (dB m)	
U-NII 2C	5 500	23.98	17.077	23.32	-0.80	23.32	
	5 580		17.077	23.32		23.32	
	5 700		17.077	23.32		23.32	
U-NII 3	5 745	30	\			30	
	5 785		\			30	
	5 825		\			30	

Remark:

1. Average Power Result (dB m) = Average Power (dB m) + Duty Cycle Correction Factor (dB)
2. E.I.R.P. (dB m) = Average Power Result (dB m) + Antenna Gain (dB i)

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A4(210 mm x 297 mm)

Test mode: 11n HT20

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power (dB m)	Duty Cycle Correction Factor (dB)	Average Power Result (dB m)
U-NII 1	5 180	MCS0	8.67	0.32	8.99
	5 220		8.55		8.87
	5 240		8.58		8.90
U-NII 2A	5 260	MCS0	8.59	0.32	8.91
	5 300		8.62		8.94
	5 320		8.54		8.86
U-NII 2C	5 500	MCS0	8.01	0.32	8.33
	5 580		8.05		8.37
	5 700		7.84		8.16
U-NII 3	5 745	MCS0	7.83	0.32	8.15
	5 785		7.84		8.16
	5 825		7.91		8.23

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power Result (dB m)	Antenna Gain (dB i)	E.I.R.P. (dB m)
U-NII 1	5 180	MCS0	8.99	2.75	11.74
	5 220		8.87		11.62
	5 240		8.90		11.65

Band	FCC Limit							
	Frequency (MHz)	Fixed Limit (dB m)	26 dB BW (MHz)	11+10LogB (dB m)	Antenna Gain (dB i)	Limit (dB m)		
U-NII 1	5 180	23.98	\			2.75		
	5 220		\					
	5 240		\					
U-NII 2A	5 260	23.98	21.418	24.31	2.75	23.98		
	5 300		21.418	24.31				
	5 320		21.476	24.32				
U-NII 2C	5 500	23.98	21.476	24.32	-0.80	23.98		
	5 580		21.476	24.32				
	5 700		21.303	24.28				
U-NII 3	5 745	30	\			-1.24		
	5 785		\					
	5 825		\					

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A4(210 mm x 297 mm)

Band	IC Limit					
	Frequency (MHz)	Fixed Limit (dB m)	99 % BW (MHz)	1.76+10Log ₁₀ B (dB m)	Antenna Gain (dB i)	Limit (dB m)
U-NII 1	5 180	14.77	18.061	14.33	2.75	14.33
	5 220		18.119	14.34		14.34
	5 240		18.119	14.34		14.34
U-NII 2A	5 260	14.77	18.177	14.36	2.75	14.36
	5 300		18.119	14.34		14.34
	5 320		18.177	14.36		14.36

Band	IC Limit						
	Frequency (MHz)	Fixed Limit (dB m)	99 % BW (MHz)	11+10Log ₁₀ B (dB m)	Antenna Gain (dB i)	Limit (dB m)	
U-NII 2C	5 500	23.98	18.119	23.58	-0.80	23.58	
	5 580		18.061	23.57		23.57	
	5 700		18.119	23.58		23.58	
U-NII 3	5 745	30	\			30	
	5 785		\			30	
	5 825		\			30	

Remark:

1. Average Power Result (dB m) = Average Power (dB m) + Duty Cycle Correction Factor (dB)
2. E.I.R.P. (dB m) = Average Power Result (dB m) + Antenna Gain (dB i)

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RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

Test mode: 11n HT40

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power (dB m)	Duty Cycle Correction Factor (dB)	Average Power Result (dB m)
U-NII 1	5 190	MCS0	3.84	0.61	4.45
	5 230		3.82		4.43
U-NII 2A	5 270	MCS0	8.23	0.61	8.84
	5 310		8.14		8.75
U-NII 2C	5 510	MCS0	7.52	0.61	8.13
	5 550		7.39		8.00
U-NII 3	5 670	MCS0	7.06	0.61	7.67
	5 755		7.36		7.97
	5 795		7.35		7.96

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power Result (dB m)	Antenna Gain (dB i)	E.I.R.P. (dB m)
U-NII 1	5 190	MCS0	4.45	2.75	7.20
	5 230		4.43		7.18

Band	FCC Limit					
	Frequency (MHz)	Fixed Limit (dB m)	26 dB BW (MHz)	11+10LogB (dB m)	Antenna Gain (dB i)	Limit (dB m)
U-NII 1	5 190	23.98			2.75	23.98
	5 230					
U-NII 2A	5 270	23.98	40.058	27.03	2.75	23.98
	5 310		40.058	27.03		
U-NII 2C	5 510	23.98	40.058	27.03	-0.80	23.98
	5 550		40.174	27.04		
	5 670		40.289	27.05		
U-NII 3	5 755	30			-1.24	30
	5 795					

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A4(210 mm x 297 mm)

Band	IC Limit					
	Frequency (MHz)	Fixed Limit (dB m)	99 % BW (MHz)	1.76+10Log ₁₀ B (dB m)	Antenna Gain (dB i)	Limit (dB m)
U-NII 1	5 190	14.77	36.237	17.35	2.75	14.77
	5 230		36.237	17.35		
U-NII 2A	5 270	14.77	36.237	17.35	2.75	14.77
	5 310		36.237	17.35		

Band	IC Limit						
	Frequency (MHz)	Fixed Limit (dB m)	99 % BW (MHz)	11+10Log ₁₀ B (dB m)	Antenna Gain (dB i)	Limit (dB m)	
U-NII 2C	5 510	23.98	36.237	26.59	-0.80	23.98	
	5 550		36.353	26.61			
	5 670		36.353	26.61			
U-NII 3	5 755	30				-1.24	
	5 795						

Remark;

1. Average Power Result (dB m) = Average Power (dB m) + Duty Cycle Correction Factor (dB)
2. E.I.R.P. (dB m) = Average Power Result (dB m) + Antenna Gain (dB i)

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A4(210 mm x 297 mm)

Test mode: 11ac_VHT80

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power (dB m)	Duty Cycle Correction Factor (dB)	Average Power Result (dB m)
U-NII 1	5 210	MCS0	3.01	1.16	4.17
U-NII 2A	5 290		6.71		7.87
U-NII 2C	5 530		6.93		8.09
U-NII 3	5 755		6.78		7.94

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power Result (dB m)	Antenna Gain (dB i)	E.I.R.P. (dB m)
U-NII 1	5 210	MCS0	4.17	2.75	6.92

Band	FCC Limit					
	Frequency (MHz)	Fixed Limit (dB m)	26 dB BW (MHz)	11+10LogB (dB m)	Antenna Gain (dB i)	Limit (dB m)
U-NII 1	5 210	23.98			2.75	23.98
U-NII 2A	5 290	23.98	81.968	30.14	2.75	23.98
U-NII 2C	5 530	23.98	82.431	30.16	-0.80	23.98
U-NII 3	5 775	30			-1.24	30

Band	IC Limit					
	Frequency (MHz)	Fixed Limit (dB m)	99 % BW (MHz)	1.76+10Log ₁₀ B (dB m)	Antenna Gain (dB i)	Limit (dB m)
U-NII 1	5 210	14.77	75.485	20.54	2.75	14.77
U-NII 2A	5 290	14.77	75.485	20.54	2.75	14.77

Band	IC Limit					
	Frequency (MHz)	Fixed Limit (dB m)	99 % BW (MHz)	11+10Log ₁₀ B (dB m)	Antenna Gain (dB i)	Limit (dB m)
U-NII 2C	5 530	23.98	75.948	29.81	-0.80	23.98
U-NII 3	5 775	30			-1.24	30

Remark:

1. Average Power Result (dB m) = Average Power (dB m) + Duty Cycle Correction Factor (dB)
2. E.I.R.P. (dB m) = Average Power Result (dB m) + Antenna Gain (dB i)

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A4(210 mm x 297 mm)

- Band-crossing channels

Mode	Band	Frequency (MHz)	Data Rate (Mbps)	Average Power (dB m)	Duty Cycle Correction Factor (dB)	Average Power Result (dB m)
11a	U-NII 2C	5 720	6	6.38	0.30	6.68
	U-NII 3			-0.92		-0.62
11n_HT20	U-NII 2C	5 720	MCS0	6.08	0.32	6.40
	U-NII 3			-0.93		-0.61
11n_HT40	U-NII 2C	5 710	MCS0	6.06	0.61	6.67
	U-NII 3			-5.94		-5.33
11ac_VHT80	U-NII 2C	5 690	MCS0	5.76	1.16	6.92
	U-NII 3			-9.08		-7.92

Mode	Band	Limit					
		Frequency (MHz)	Fixed Limit (dB m)	26 dB BW (MHz)	11+10LogB (dB m)	Antenna Gain (dB i)	Limit (dB m)
11a	U-NII 2C	5 720	23.98	15.593	22.93	2.75	22.93
	U-NII 3					-0.80	30
11n_HT20	U-NII 2C	5 720	23.98	15.825	22.99	2.75	22.99
	U-NII 3					-0.80	30
11n_HT40	U-NII 2C	5 710	23.98	35.140	26.46	2.75	23.98
	U-NII 3					-0.80	30
11ac_VHT80	U-NII 2C	5 690	23.98	75.980	29.81	2.75	23.98
	U-NII 3					-0.80	30

Remark;

1. Average Power Result (dB m) = Average Power (dB m) + Duty Cycle Correction Factor (dB)

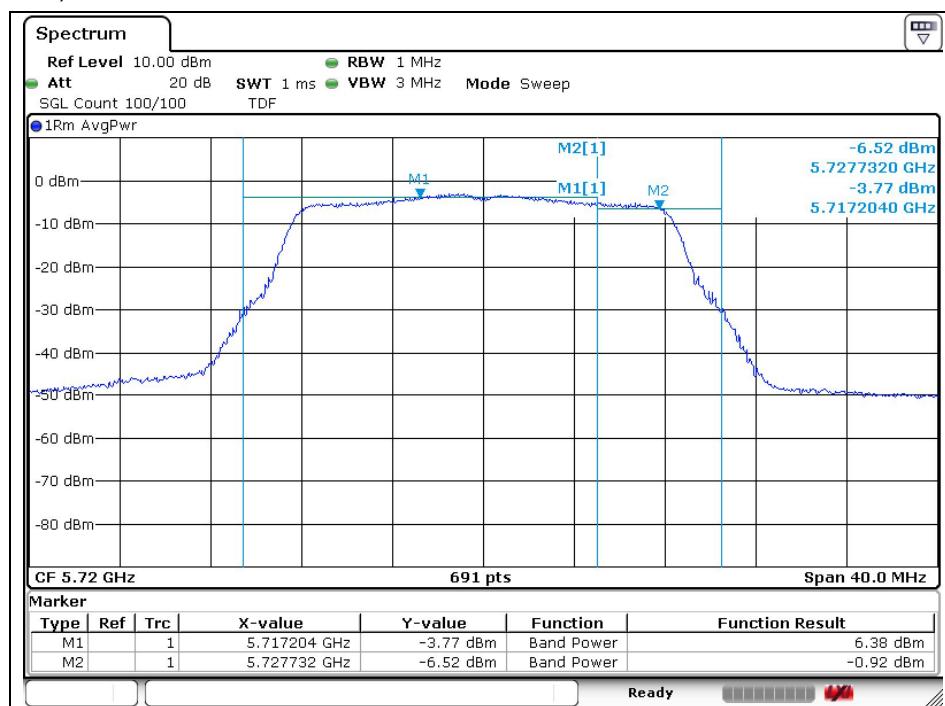
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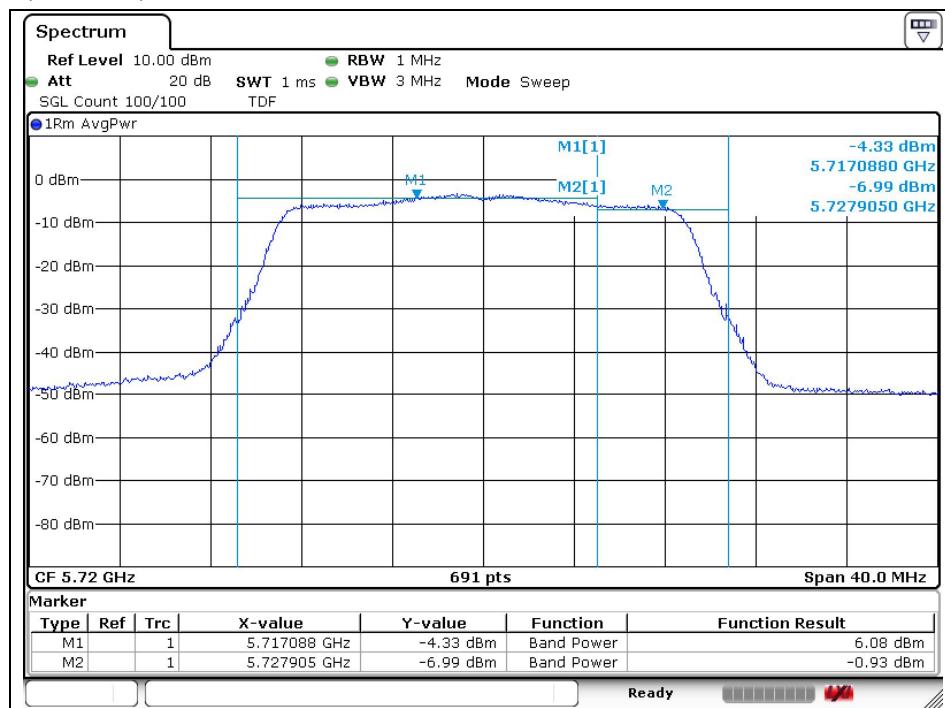
- Test plots

Band-crossing channels

802.11a (5 720 MHz)



802.11n-HT20 (5 720 MHz)



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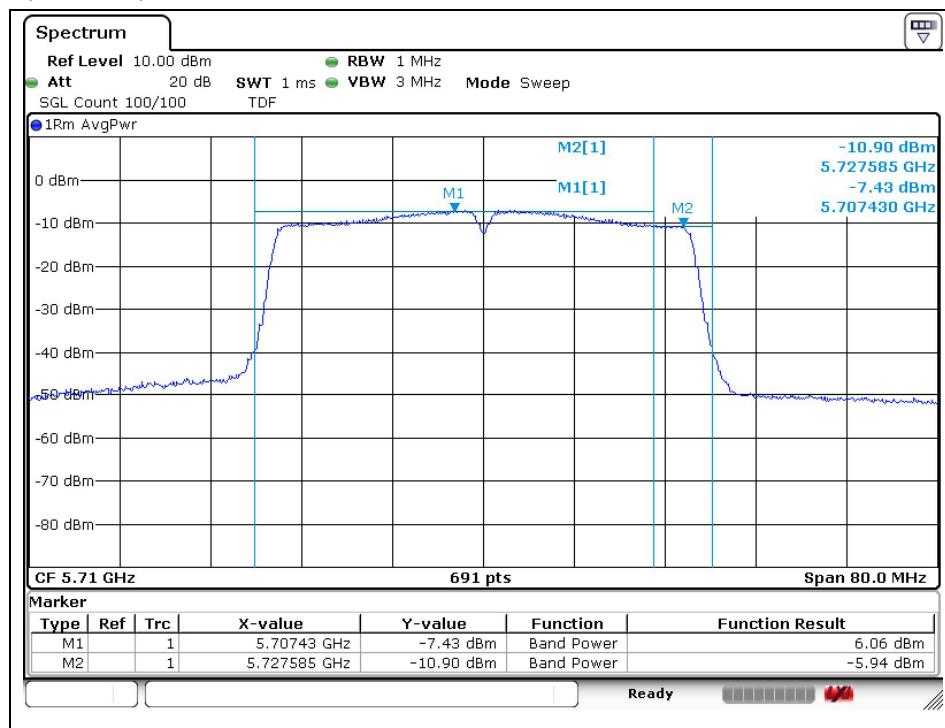
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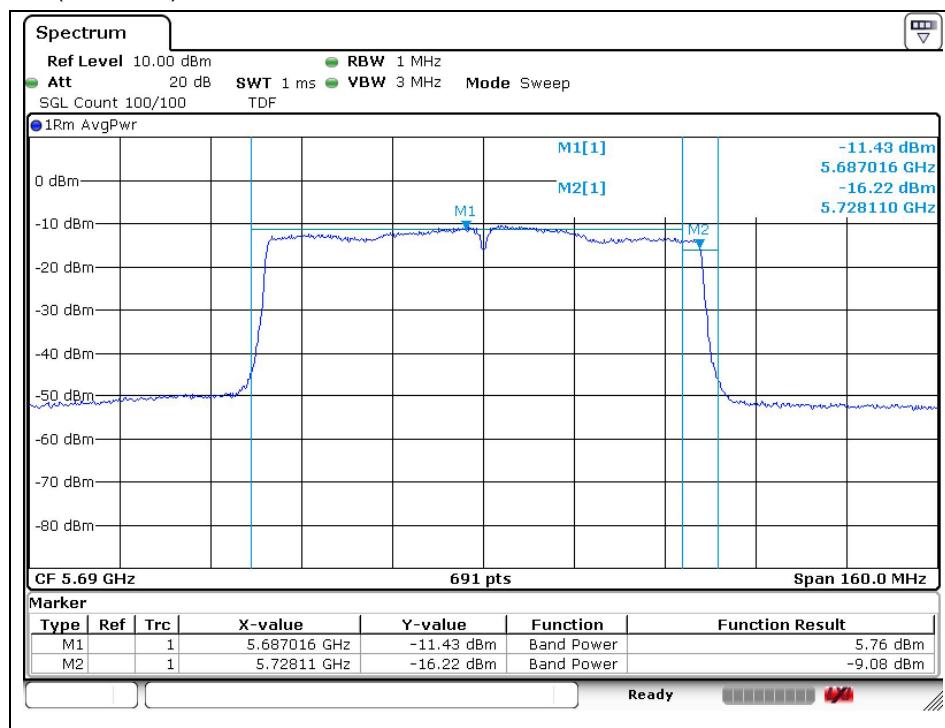
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802.11n_HT40 (5 710 MHz)



802.11ac_VHT80 (5 690 MHz)



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A4(210 mm x 297 mm)

6. Peak Power Spectral Density

6.1. Test Setup



6.2. Limit

6.2.1 FCC

According to 15.407(a)(1)(iv)

For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dB i. In addition, the maximum power spectral density shall not exceed 11 dB m in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dB i are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dB i.

According to 15.407(a)(2)

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dB m + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dB m in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dB i are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dB i.

According to 15.407(a)(3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dB m in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dB i are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dB i. However, fixed point-to point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dB i without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

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A4(210 mm x 297 mm)

6.2.2 IC

According to RSS-247 Issue 2,

6.2.1.1 Frequency band 5 150-5 250 MHz

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or $1.76 + 10\log_{10}B$, dBm, whichever is less. Devices shall implement transmitter power control (TPC) in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

For other devices, the maximum e.i.r.p. shall not exceed 200 mW or $10 + 10\log_{10}B$, dBm, whichever power is less. B is the 99 % emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

6.2.2.1 Frequency band 5 250-5 350 MHz

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or $1.76 + 10\log_{10}B$, dBm, whichever is less. Devices shall implement TPC in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

Devices, other than devices installed in vehicles, shall comply with the following:

- a) The maximum conducted output power shall not exceed 250 mW or $11 + 10\log_{10}B$, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band;
- b) The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10\log_{10}B$, dBm, whichever is less. B is the 99 % emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

6.2.3.1 Frequency band 5 470-5 600 MHz and 5 650-5 725 MHz

The maximum conducted output power shall not exceed 250 mW or $11 + 10\log_{10}B$, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10\log_{10}B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

6.2.4.1 Frequency band 5 725-5 850 MHz

For equipment operating in the band 5 725-5 850 MHz, the minimum 6 dB bandwidth shall be at least 500 kHz. The maximum conducted output power shall not exceed 1 W. The output power spectral density shall not exceed 30 dB m in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dB i are used, both the maximum conducted output power and the output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dB i. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dB i without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint³ systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

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6.3. 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.

1. This measurement settings are specified in section F of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, "Compute power...". (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
3. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
4. Make the following adjustments to the peak value of the spectrum, if applicable:
 - a) If Method SA-2 or SA-2 Alternative was used, add $10 \log(1/x)$, where x is the duty cycle, to the peak of the spectrum.
 - b) If Method SA-3 Alternative was used and the linear mode was used in step II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
5. The result is the Maximum PSD over 1 MHz reference bandwidth.
6. For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:
 - a) Set RBW $\geq 1/T$, where T is defined in section II.B.1.a).
 - b) Set VBW ≥ 3 RBW.
 - c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10\log(500 \text{ kHz}/\text{RBW})$ to the measured result, whereas RBW (< 500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
 - d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add $10\log(1 \text{ MHz}/\text{RBW})$ to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
 - e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.
7. 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.

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6.4. Test result

Ambient temperature : (23 ± 1) °C
 Relative humidity : 47 % R.H.

Test mode: 11a

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Measured PPSD (dB m)	Duty Cycle Correction Factor (dB)	Final PPSD (dB m)	Limit (dB m/1 MHz)
U-NII 1	5 180	36	6	-2.02	0.30	-1.72	11
	5 220	44		-2.32		-2.02	
	5 240	48		-2.33		-2.03	
U-NII 2A	5 260	52		-2.31		-2.01	
	5 300	60		-2.17		-1.87	
	5 320	64		-2.49		-2.19	
U-NII 2C	5 500	100		-2.84		-2.54	
	5 580	116		-2.81		-2.51	
	5 700	140		-3.03		-2.73	
Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Measured PPSD (dB m)	Duty Cycle Correction Factor (dB)	Final PPSD (dB m)	Limit (dB m/500 kHz)
U-NII 3	5 745	149	6	-5.64	0.30	-5.34	30
	5 785	157		-5.71		-5.41	
	5 825	165		-5.34		-5.04	

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Final PPSD (dB m)	Antenna Gain (dB i)	E.I.R.P. PPSD (dB m)	IC Limit (dB m/1 MHz)
U-NII 1	5 180	36	6	-1.72	2.75	1.03	10
	5 220	44		-2.02		0.73	
	5 240	48		-2.03		0.72	

Remark:

1. Final PPSD (dB m) = Measured PPSD (dB m) + Duty Cycle Correction Factor (dB)
2. E.I.R.P. PPSD (dB m) = Final PPSD (dB m) + Antenna Gain (dB i)

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Test mode: 11n-HT20

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Measured PPSD (dB m)	Duty Cycle Correction Factor (dB)	Final PPSD (dB m)	Limit (dB m/1 MHz)
U-NII 1	5 180	36	MCS0	-2.58	0.32	-2.26	11
	5 220	44		-2.53		-2.21	
	5 240	48		-2.67		-2.35	
U-NII 2A	5 260	52		-2.50		-2.18	
	5 300	60		-2.72		-2.40	
	5 320	64		-2.71		-2.39	
U-NII 2C	5 500	100	MCS0	-3.27	0.32	-2.95	11
	5 580	116		-3.06		-2.74	
	5 700	140		-3.36		-3.04	
Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Measured PPSD (dB m)	Duty Cycle Correction Factor (dB)	Final PPSD (dB m)	Limit (dB m/500 kHz)
U-NII 3	5 745	149	MCS0	-5.82	0.32	-5.50	30
	5 785	157		-5.85		-5.53	
	5 825	165		-5.69		-5.37	

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Final PPSD (dB m)	Antenna Gain (dB i)	E.I.R.P. PPSD (dB m)	IC Limit (dB m/1 MHz)
U-NII 1	5 180	36	MCS0	-2.26	2.75	0.49	10
	5 220	44		-2.21		0.54	
	5 240	48		-2.35		0.40	

Remark:

1. Final PPSD (dB m) = Measured PPSD (dB m) + Duty Cycle Correction Factor (dB)
2. E.I.R.P. PPSD (dB m) = Final PPSD (dB m) + Antenna Gain (dB i)

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A4(210 mm x 297 mm)

Test mode: 11n_HT40

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Measured PPSD (dB m)	Duty Cycle Correction Factor (dB)	Final PPSD (dB m)	Limit (dB m/1 MHz)
U-NII 1	5 190	38	MCS0	-10.24	0.61	-9.63	11
	5 230	40		-10.16		-9.55	
U-NII 2A	5 270	54	MCS0	-5.61	0.61	-5.00	11
	5 310	62		-6.33		-5.72	
U-NII 2C	5 510	102	MCS0	-6.41	0.61	-5.80	11
	5 550	110		-6.56		-5.95	
	5 670	134		-6.94		-6.33	
Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Measured PPSD (dB m)	Duty Cycle Correction Factor (dB)	Final PPSD (dB m)	Limit (dB m/500 kHz)
U-NII 3	5 755	151	MCS0	-9.40	0.61	-8.79	30
	5 795	159		-9.63		-9.02	

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Final PPSD (dB m)	Antenna Gain (dB i)	E.I.R.P. PPSD (dB m)	IC Limit (dB m/1 MHz)
U-NII 1	5 190	38	MCS0	-9.63	2.75	-6.88	10
	5 230	40		-9.55		-6.80	

Remark:

1. Final PPSD (dB m) = Measured PPSD (dB m) + Duty Cycle Correction Factor (dB)
2. E.I.R.P. PPSD (dB m) = Final PPSD (dB m) + Antenna Gain (dB i)

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RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

Test mode: 11ac_VHT80

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Measured PPSD (dB m)	Duty Cycle Correction Factor (dB)	Final PPSD (dB m)	Limit (dB m/1 MHz)
U-NII 1	5 210	42	MCS0	-13.30	1.16	-12.14	11
U-NII 2A	5 290	58		-10.43		-9.27	
U-NII 2C	5 530	106		-9.71		-8.55	
Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Measured PPSD (dB m)	Duty Cycle Correction Factor (dB)	Final PPSD (dB m)	Limit (dB m/500 kHz)
U-NII 3	5 775	155	MCS0	-12.79	1.16	-11.63	30

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Final PPSD (dB m)	Antenna Gain (dB i)	E.I.R.P. PPSD (dB m)	IC Limit (dB m/1 MHz)
U-NII 1	5 210	42	MCS0	-12.14	2.75	-9.39	10

Remark:

1. Final PPSD (dB m) = Measured PPSD (dB m) + Duty Cycle Correction Factor (dB)
2. E.I.R.P. PPSD (dB m) = Final PPSD (dB m) + Antenna Gain (dB i)

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A4(210 mm x 297 mm)

Band-crossing channels

Mode	Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Measured PPSD (dB m)	Duty Cycle Correction Factor (dB)	Final PPSD (dB m)	Limit (dB m/1 MHz or dB m/500 kHz)
11a	U-NII 2C	5 720	144	6	-2.97	0.30	-2.67	11
	U-NII 3	5 720	144		-8.06		-7.76	30
11n_HT20	U-NII 2C	5 720	144	MCS0	-3.25	0.32	-2.93	11
	U-NII 3	5 720	144		-8.30		-7.98	30
11n_HT40	U-NII 2C	5 710	142	MCS0	-6.53	0.61	-5.92	11
	U-NII 3	5 710	142		-13.01		-12.40	30
11ac_VHT80	U-NII 2C	5 690	138	MCS0	-9.87	1.16	-8.71	11
	U-NII 3	5 690	138		-16.34		-15.18	30

Remark:

1. Final PPSD (dB m) = Measured PPSD (dB m) + Duty Cycle Correction Factor (dB)

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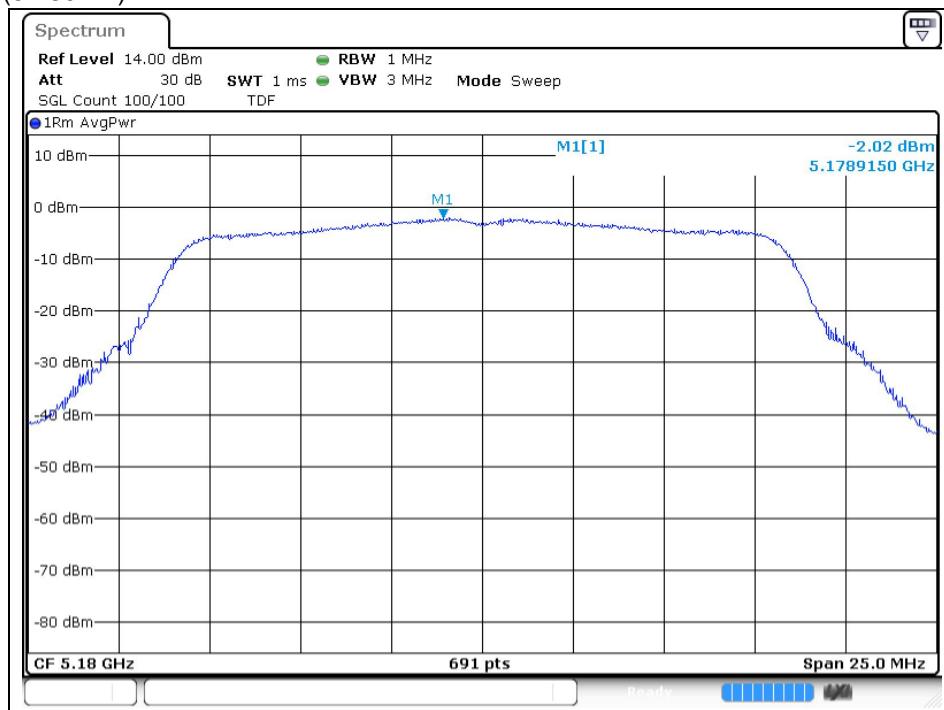
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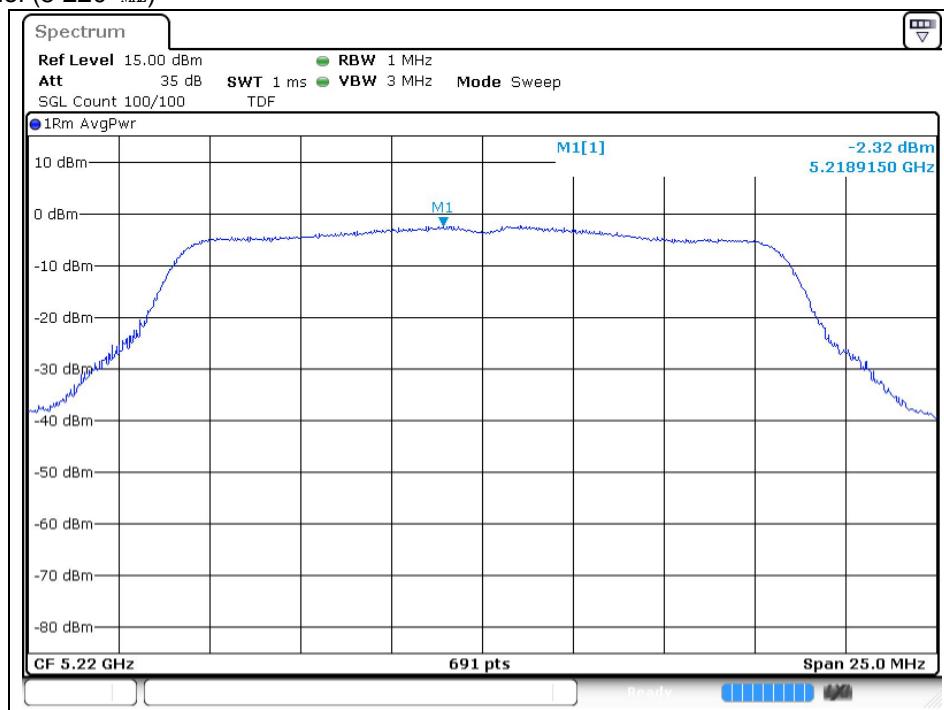
A4(210 mm x 297 mm)

- Test plots**802.11a (Band 1)**

Low Channel (5 180 MHz)



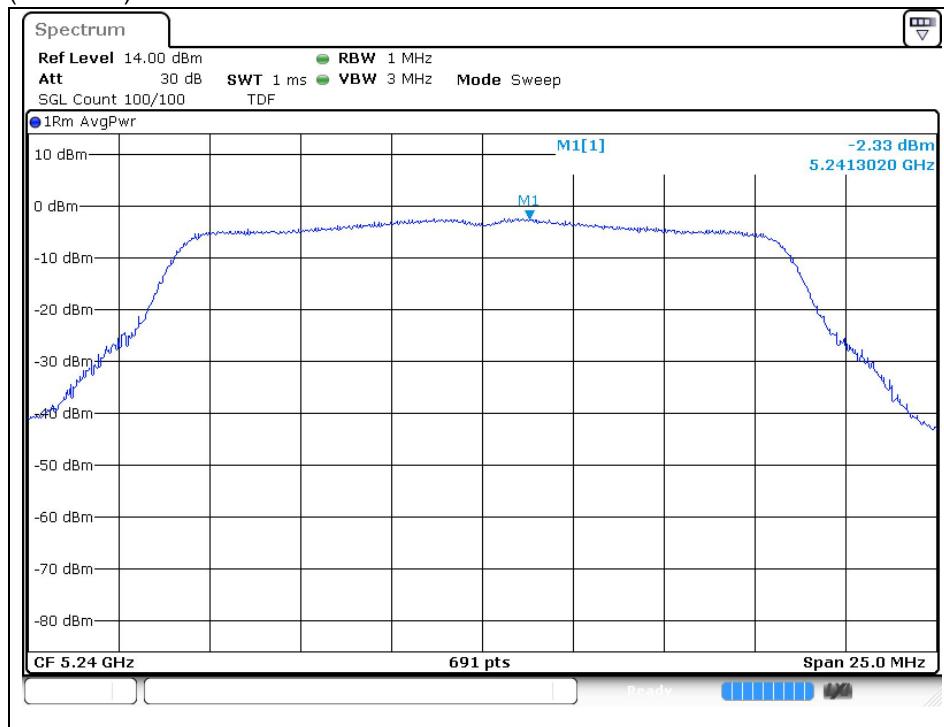
Middle Channel (5 220 MHz)



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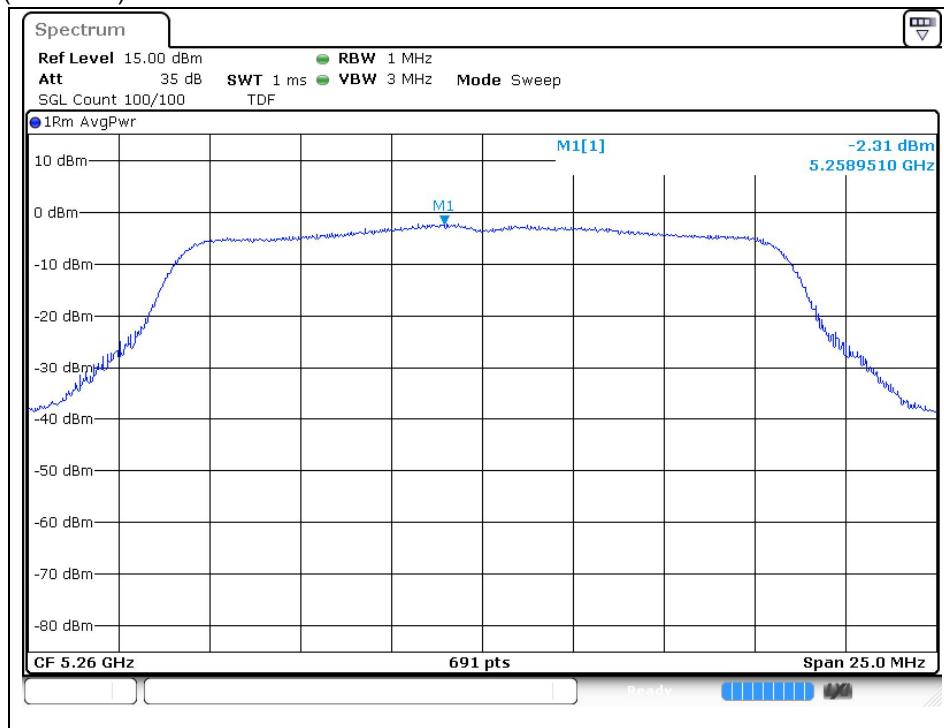
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High Channel (5.240 MHz)



802.11a (Band 2A)

Low Channel (5.260 MHz)



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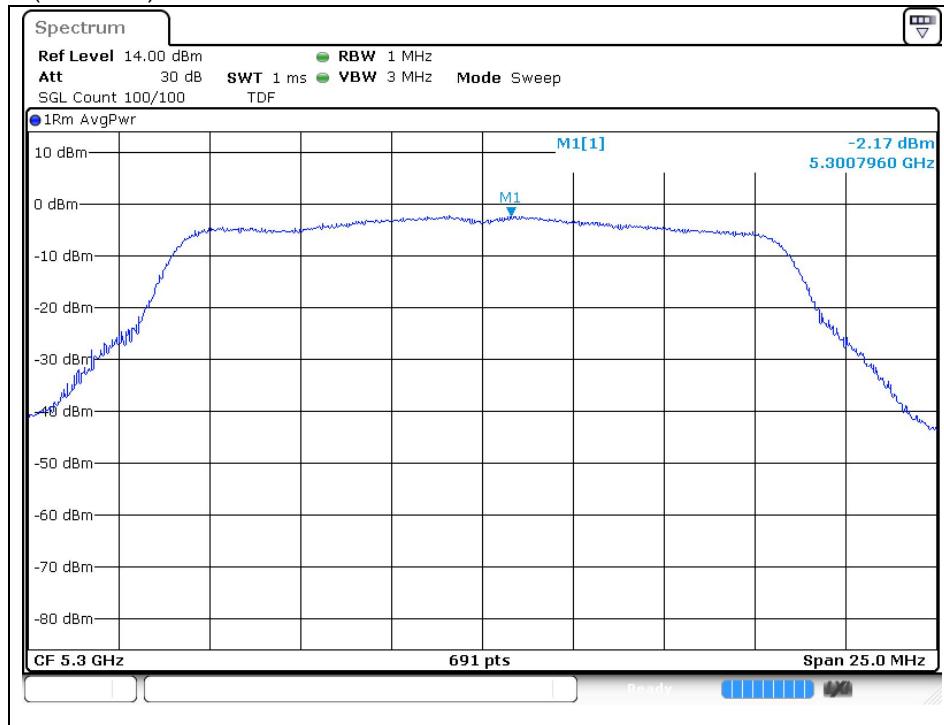
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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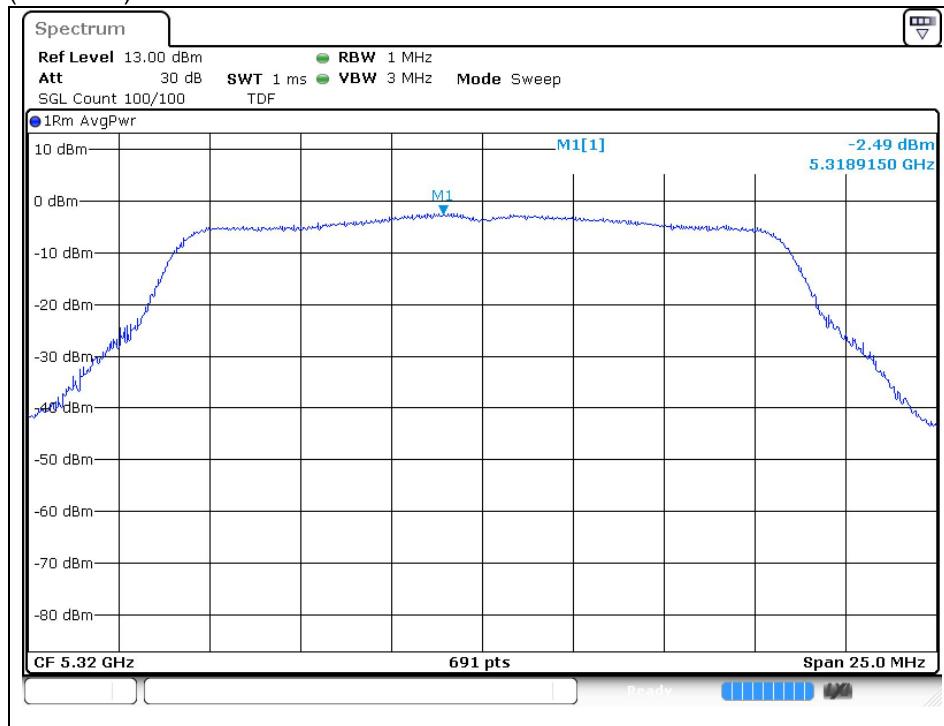
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A4(210 mm x 297 mm)

Middle Channel (5 300 MHz)



High Channel (5 320 MHz)



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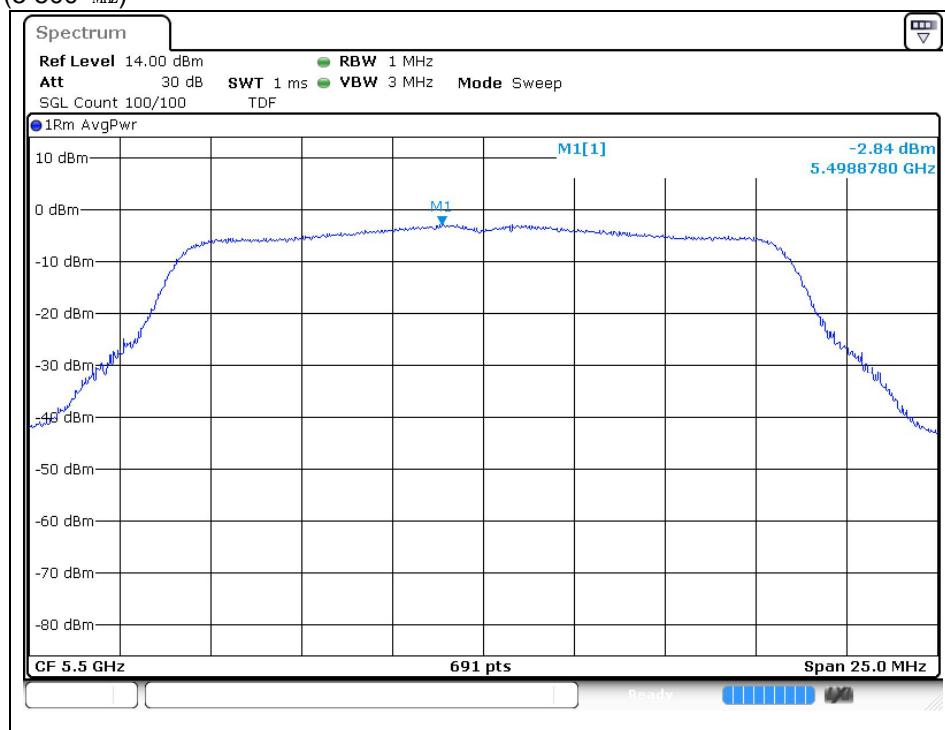
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Tel. +82 31 428 5700 / Fax. +82 31 427 2370

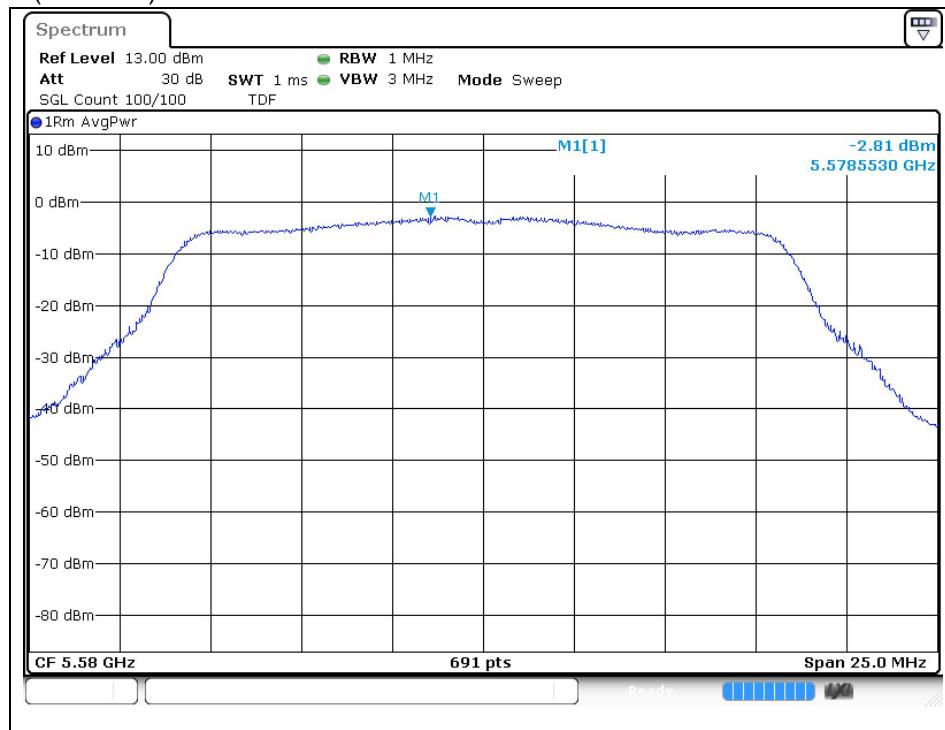
A4(210 mm x 297 mm)

802.11a (Band 2C)

Low Channel (5 500 MHz)



Middle Channel (5 580 MHz)



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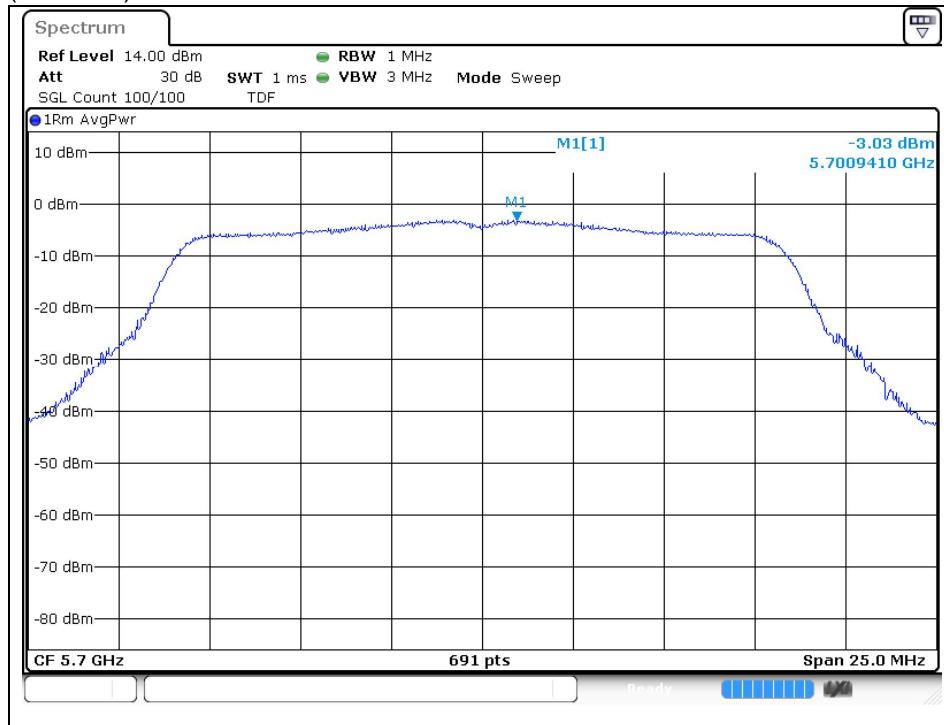
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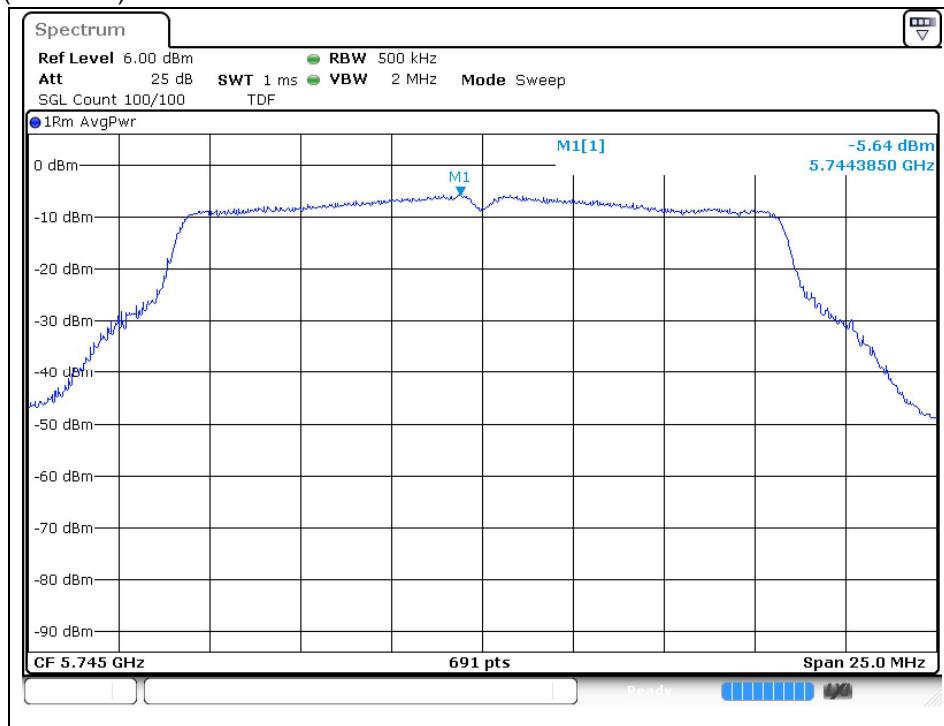
A4(210 mm x 297 mm)

High Channel (5 700 MHz)



802.11a (Band 3)

Low Channel (5 745 MHz)



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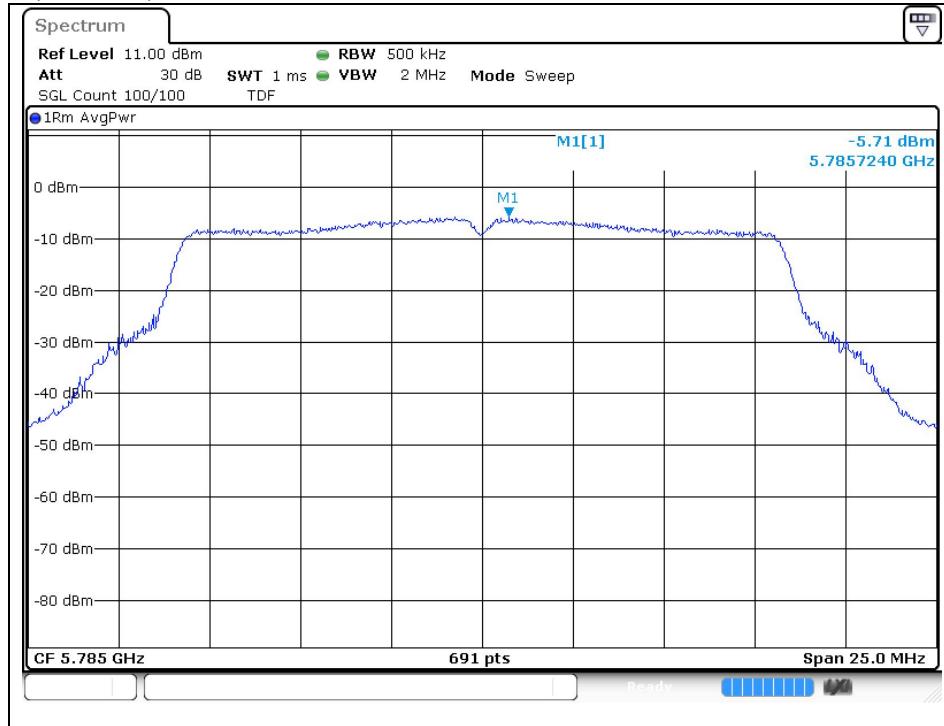
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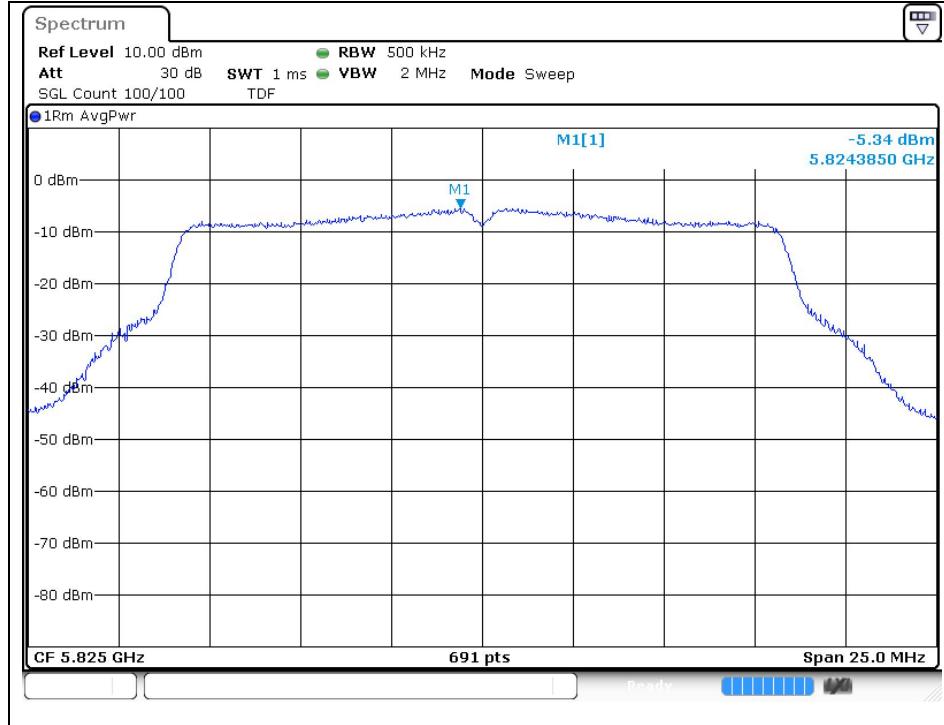
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A4(210 mm x 297 mm)

Middle Channel (5 785 MHz)



High Channel (5 825 MHz)



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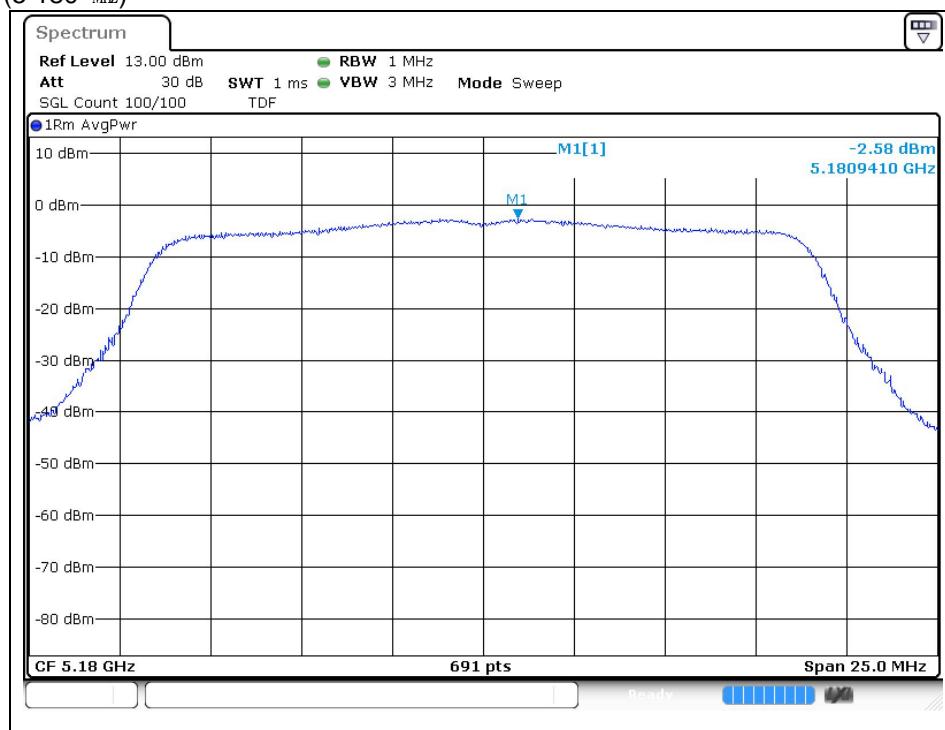
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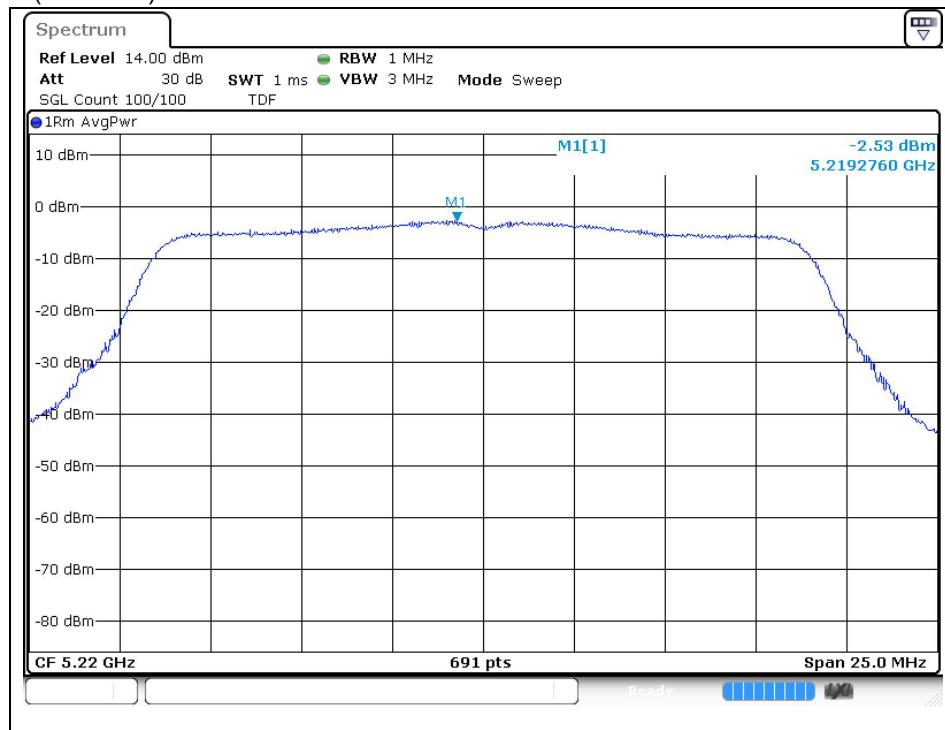
A4(210 mm x 297 mm)

802.11n_HT20 (Band 1)

Low Channel (5 180 MHz)



Middle Channel (5 220 MHz)



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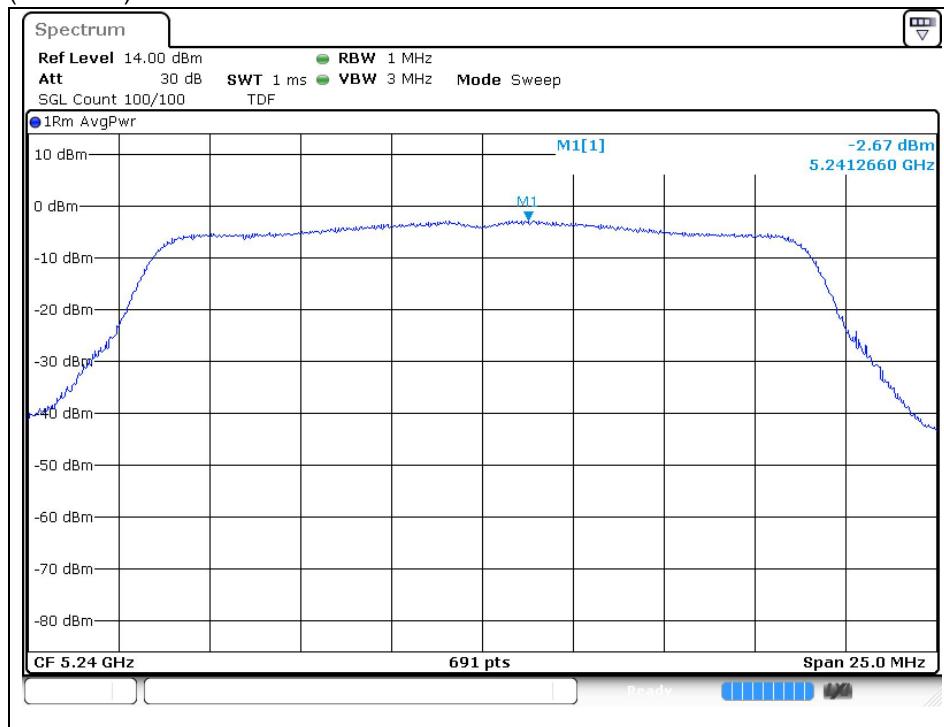
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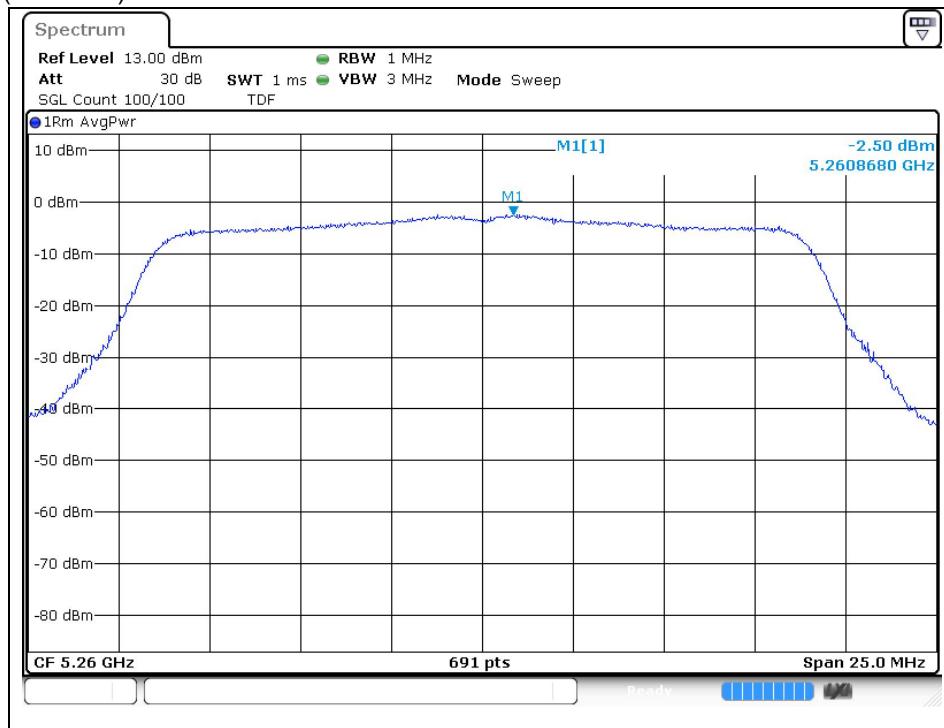
A4(210 mm x 297 mm)

High Channel (5.240 MHz)



802.11n_HT20 (Band 2A)

Low Channel (5.260 MHz)



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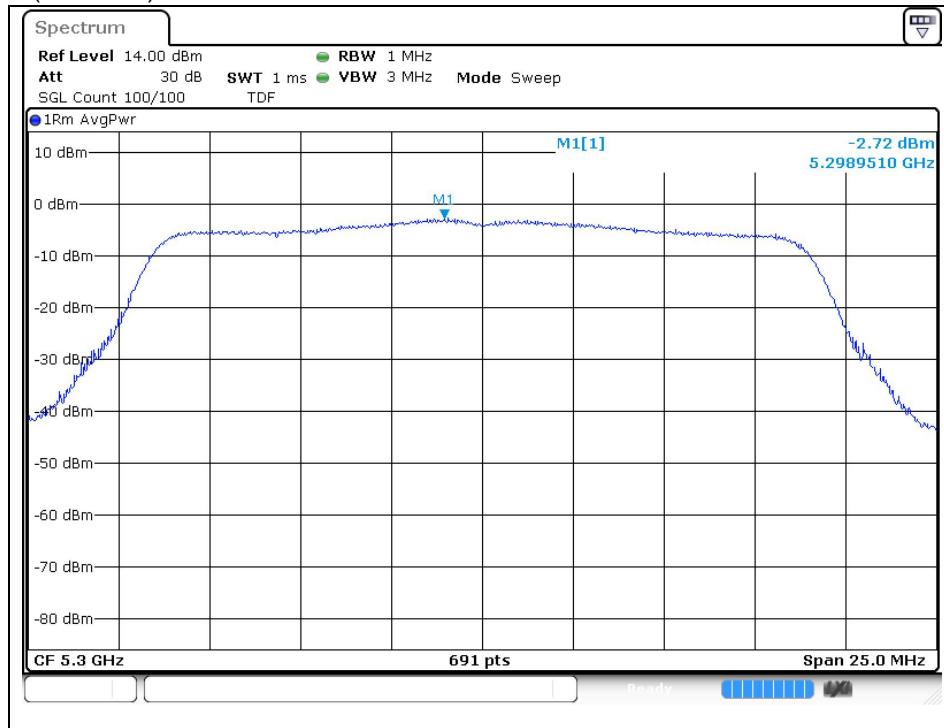
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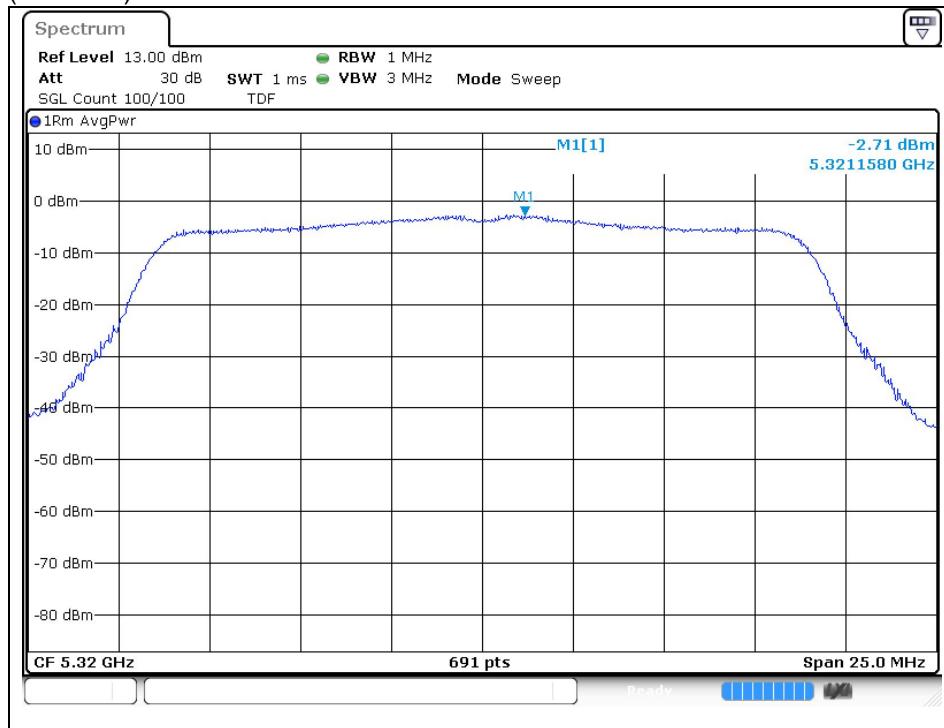
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A4(210 mm x 297 mm)

Middle Channel (5 300 MHz)



High Channel (5 320 MHz)



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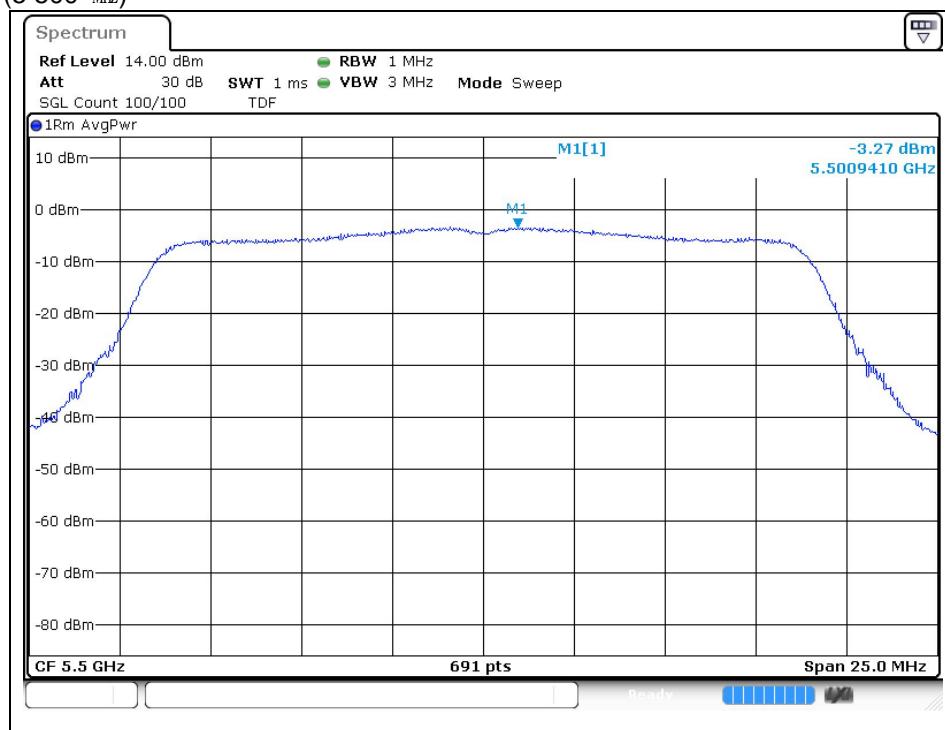
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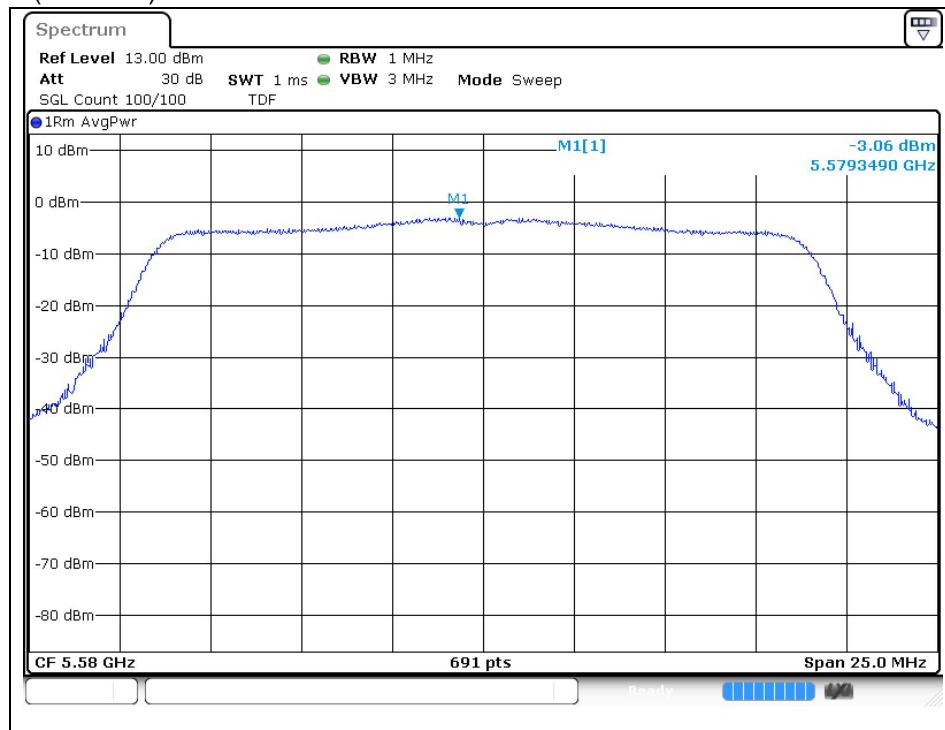
A4(210 mm x 297 mm)

802.11n_HT20 (Band 2C)

Low Channel (5 500 MHz)



Middle Channel (5 580 MHz)



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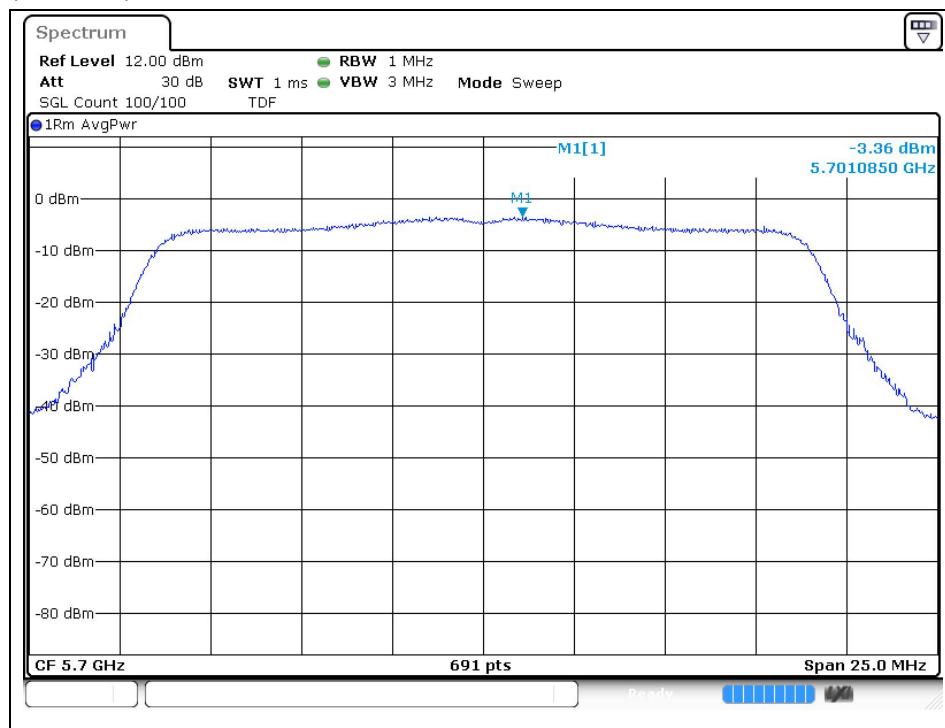
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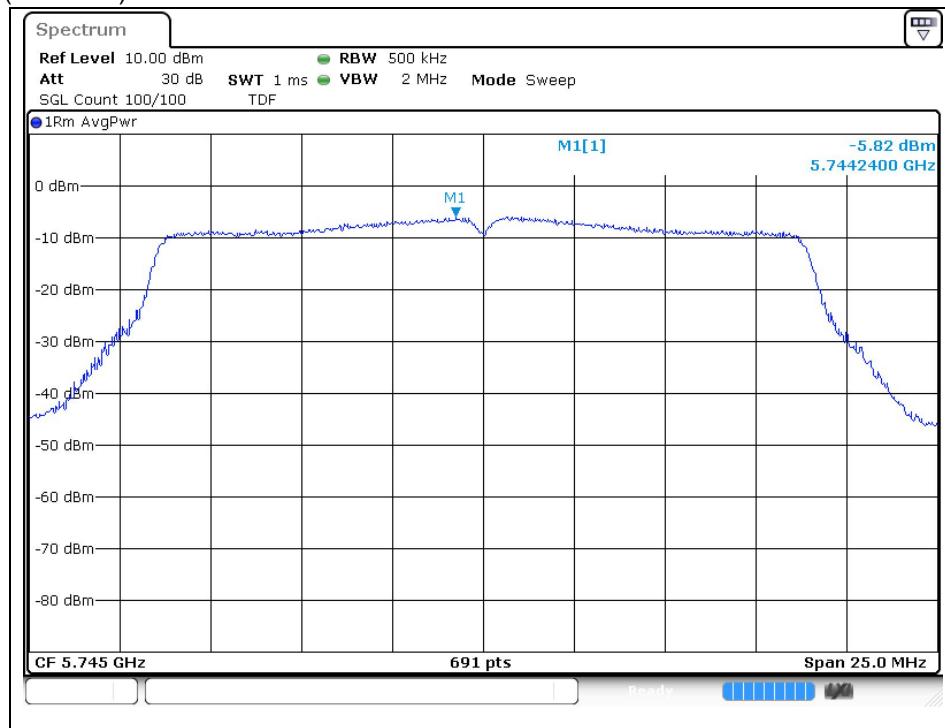
A4(210 mm x 297 mm)

High Channel (5 700 MHz)



802.11n_HT20 (Band 3)

Low Channel (5 745 MHz)



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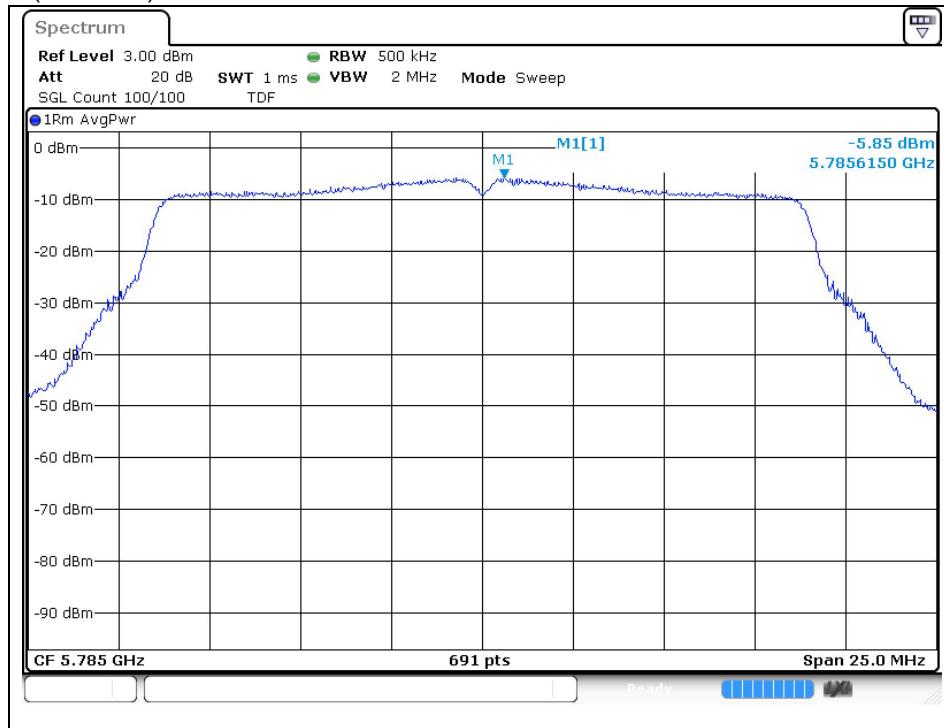
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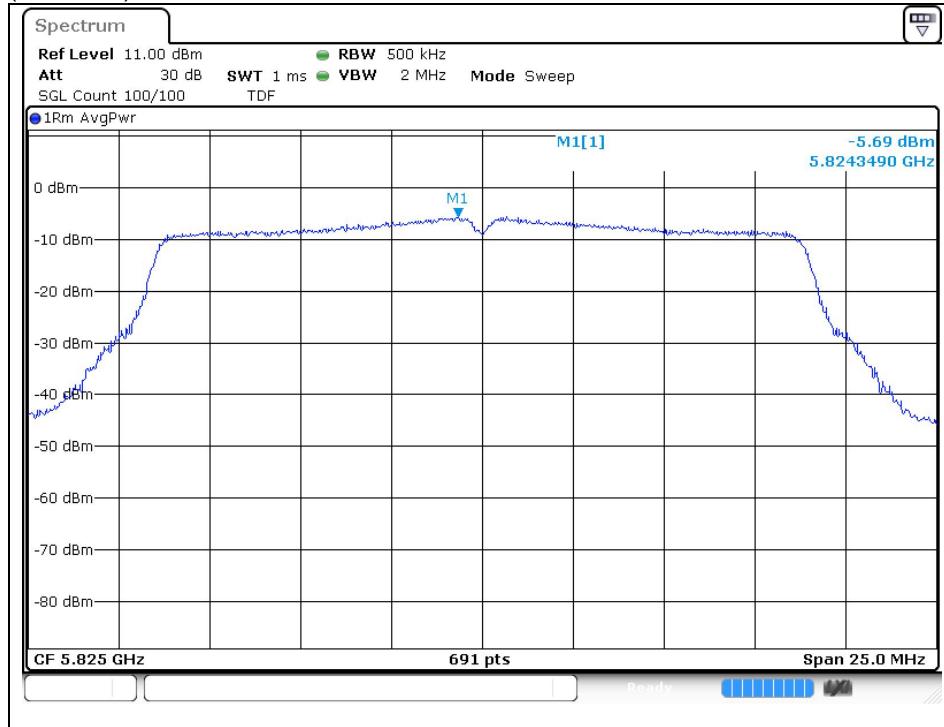
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A4(210 mm x 297 mm)

Middle Channel (5 785 MHz)



High Channel (5 825 MHz)



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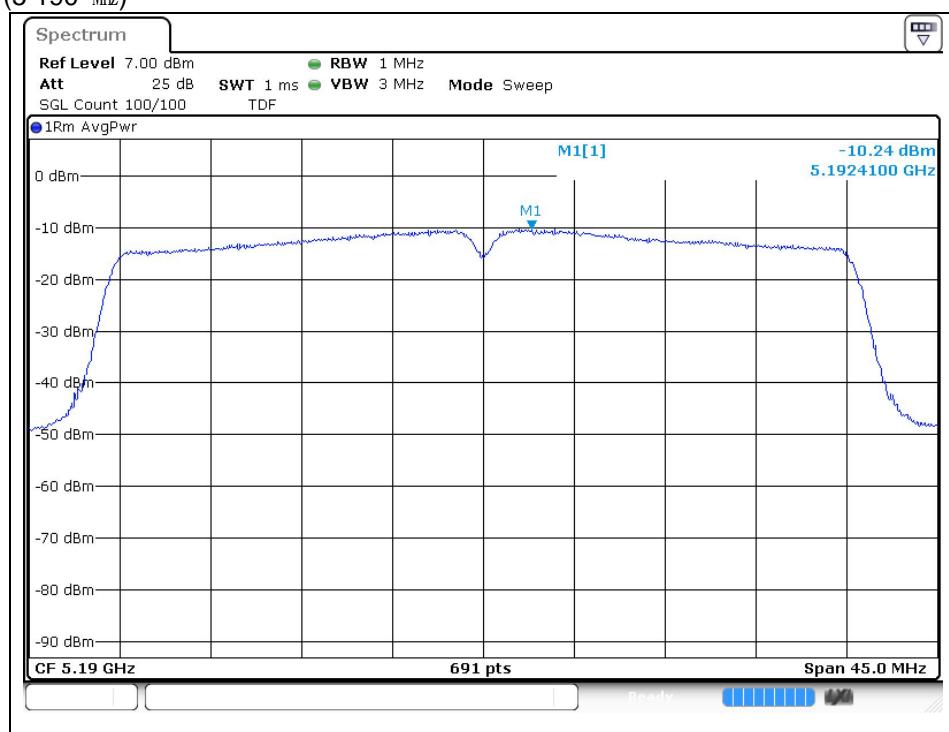
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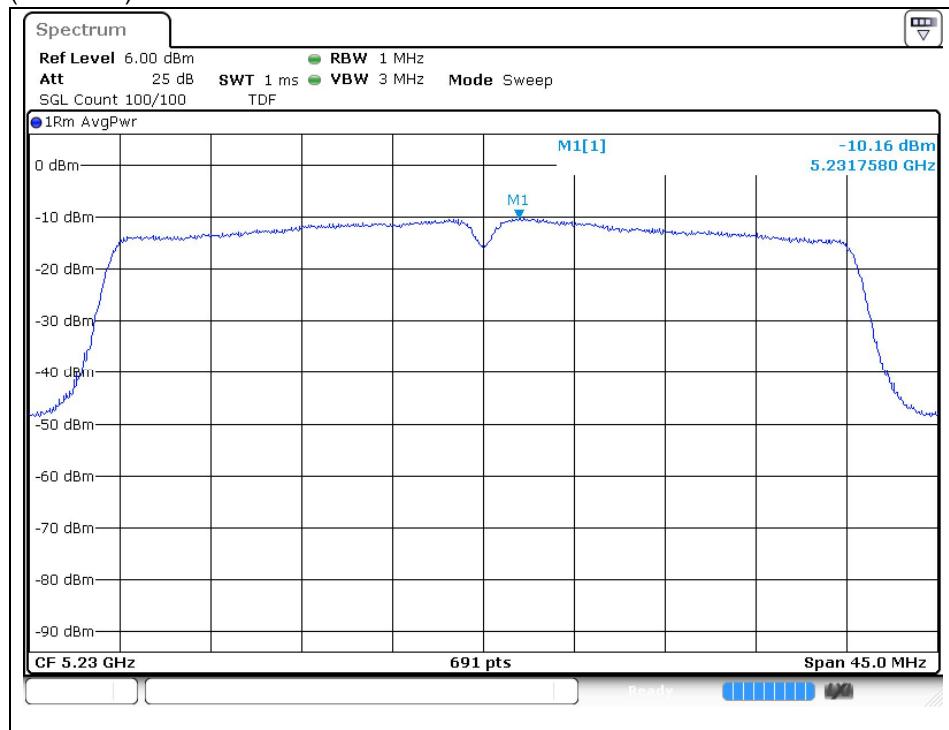
A4(210 mm x 297 mm)

802.11n_HT40 (Band 1)

Low Channel (5 190 MHz)



High Channel (5 230 MHz)



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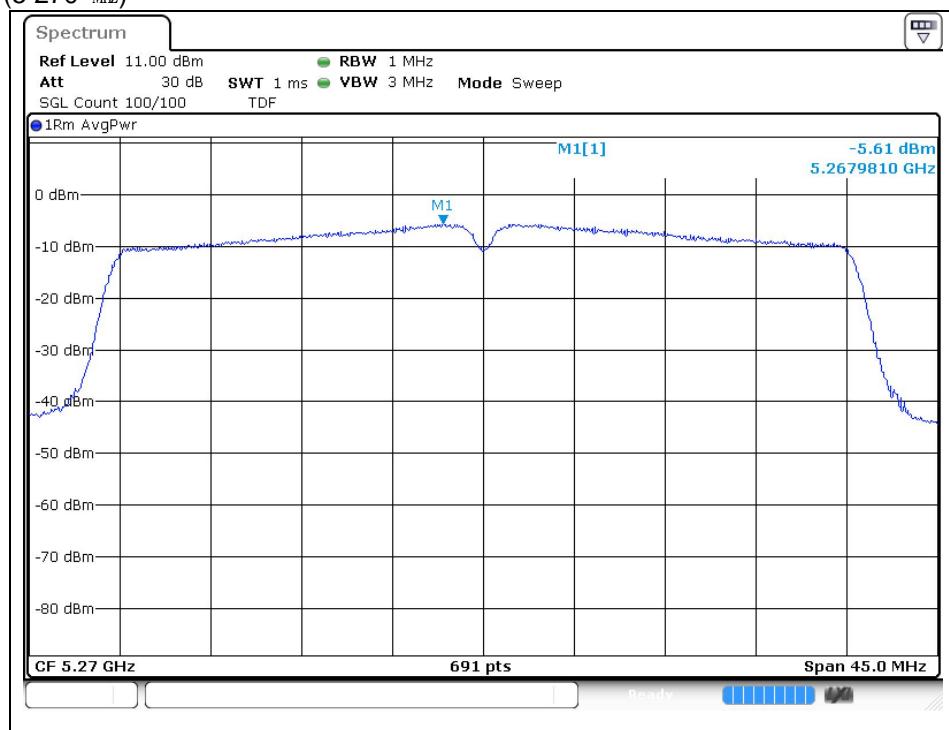
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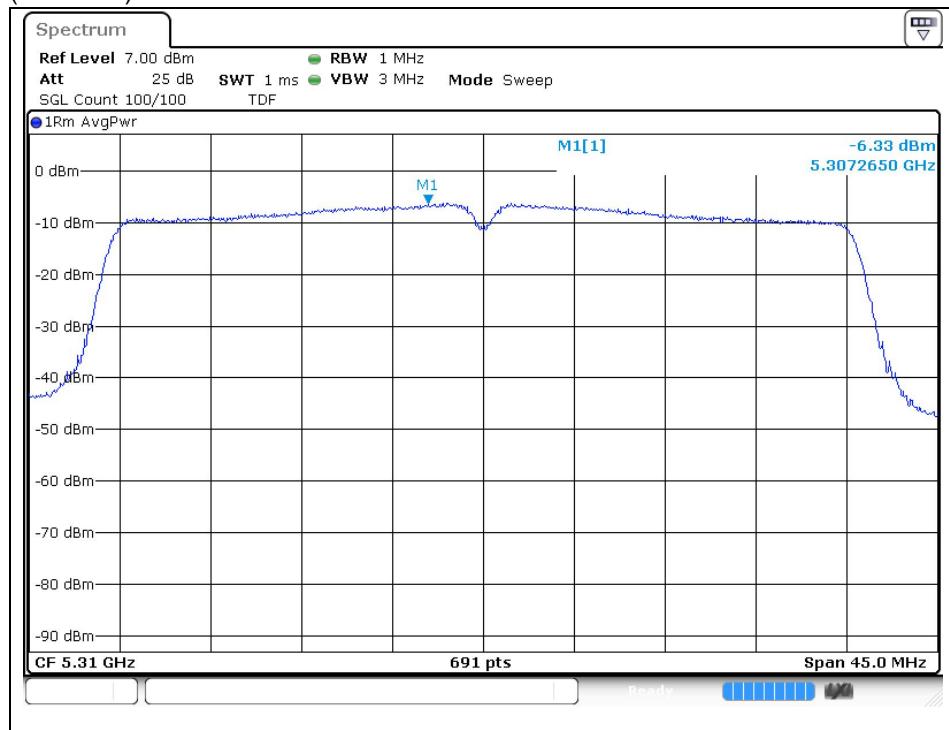
A4(210 mm x 297 mm)

802.11n_HT40 (Band 2A)

Low Channel (5 270 MHz)



High Channel (5 310 MHz)



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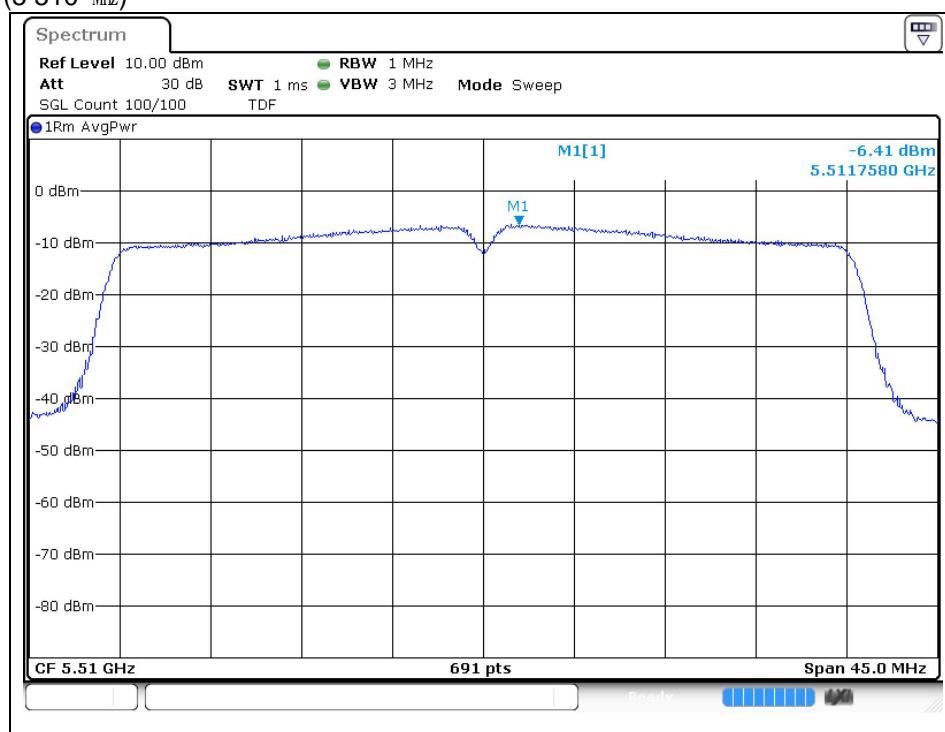
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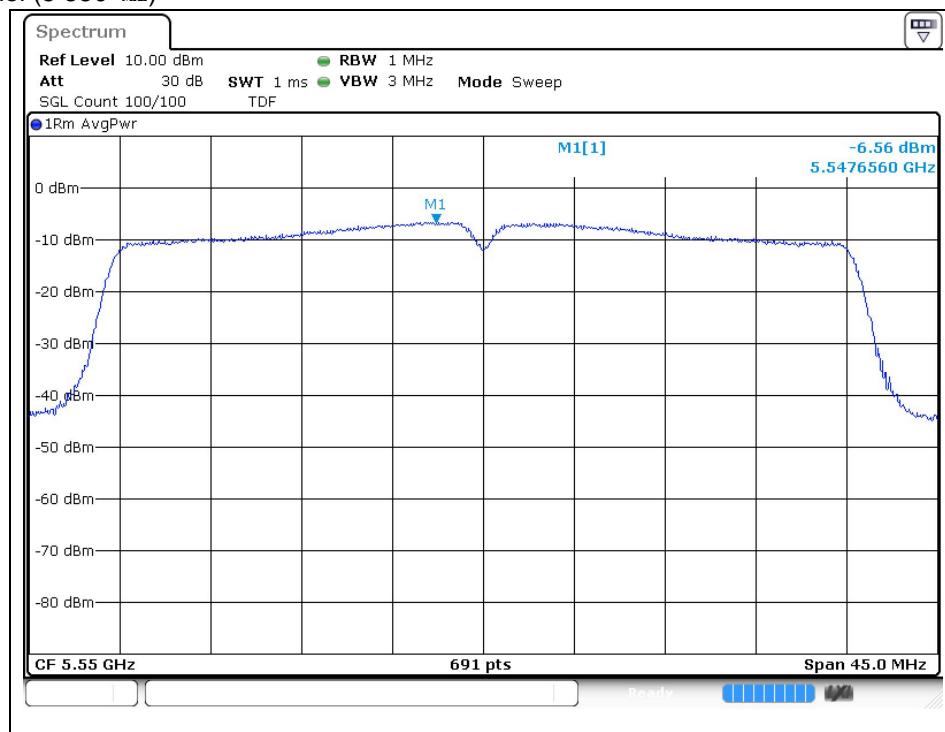
A4(210 mm x 297 mm)

802.11n_HT40 (Band 2C)

Low Channel (5 510 MHz)



Middle Channel (5 550 MHz)



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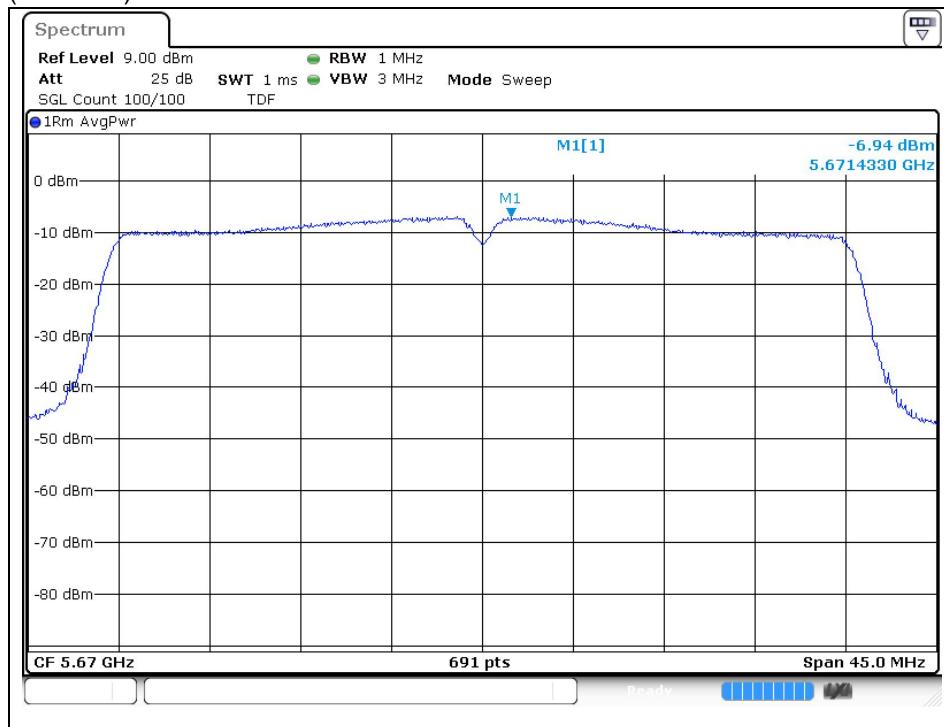
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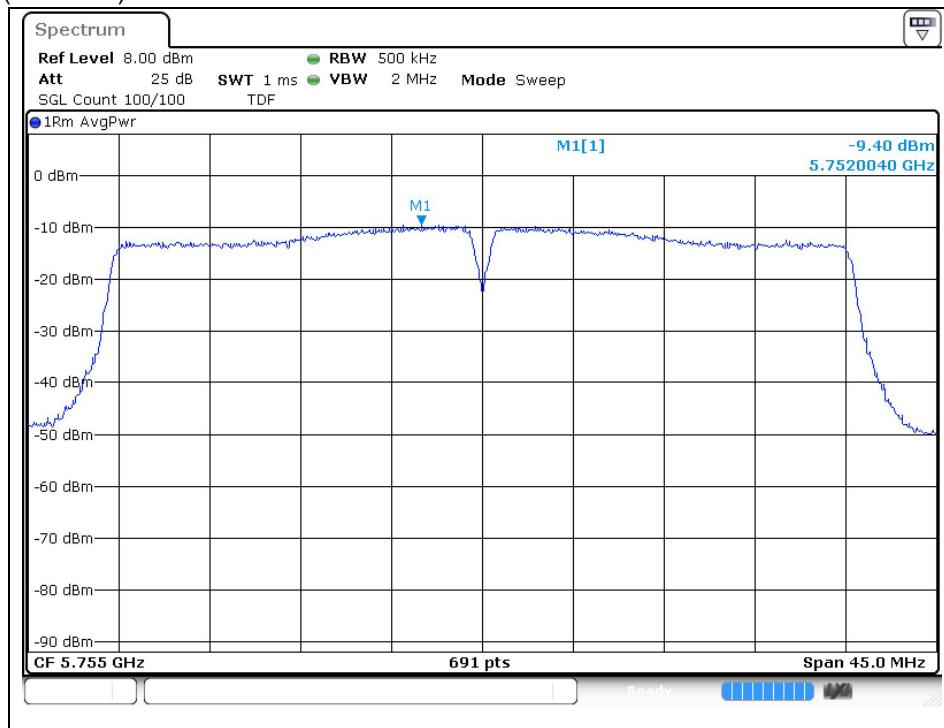
A4(210 mm x 297 mm)

High Channel (5 670 MHz)



802.11n_HT40 (Band 3)

Low Channel (5 755 MHz)



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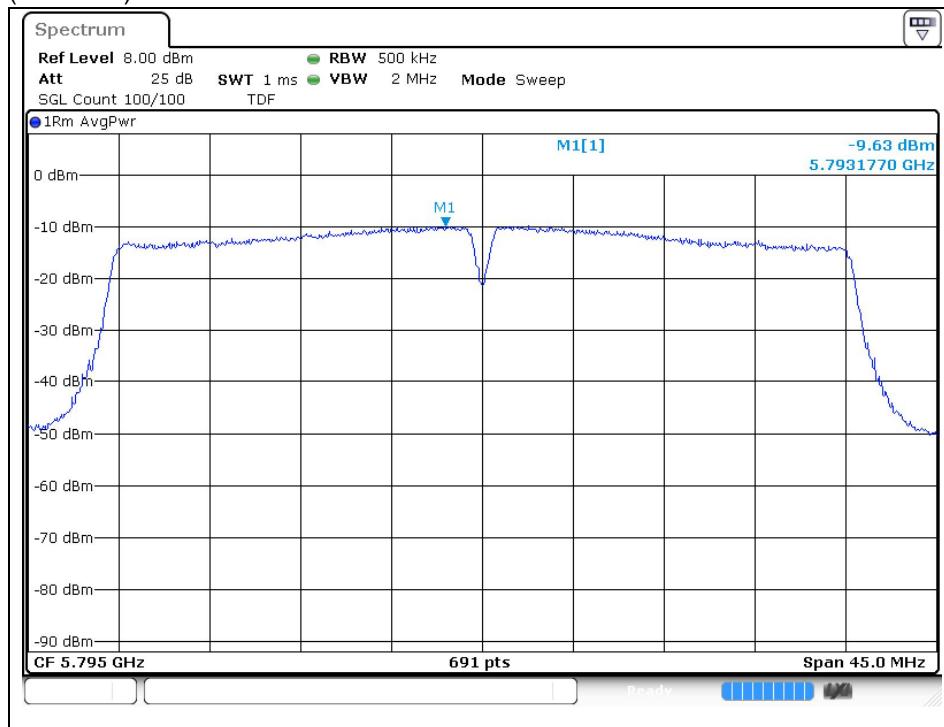
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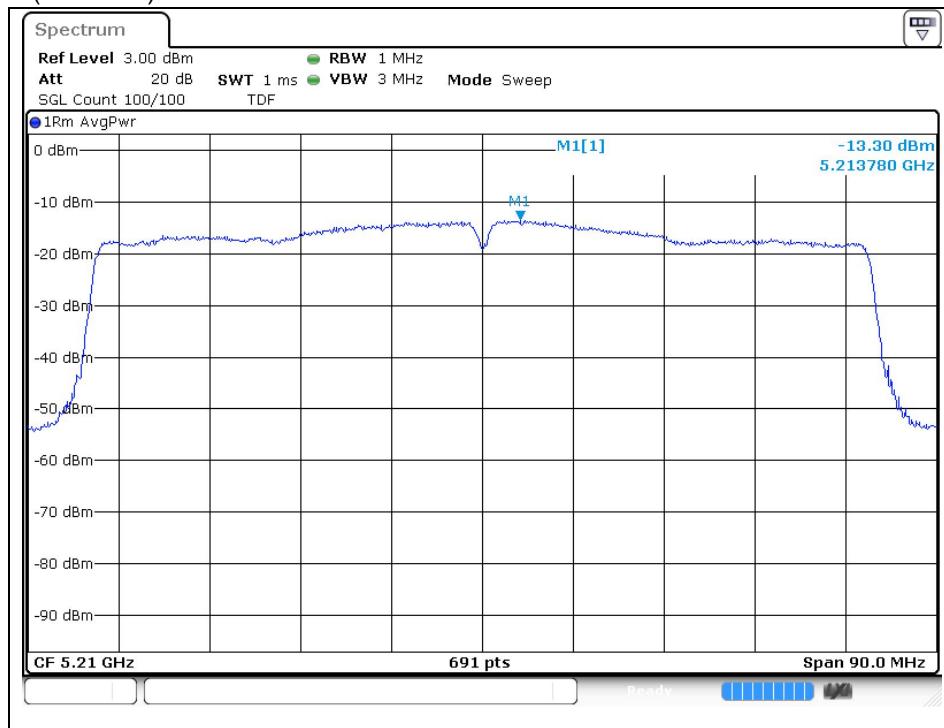
A4(210 mm x 297 mm)

High Channel (5 795 MHz)



802.11ac_VHT80 (Band 1)

Middle Channel (5 210 MHz)



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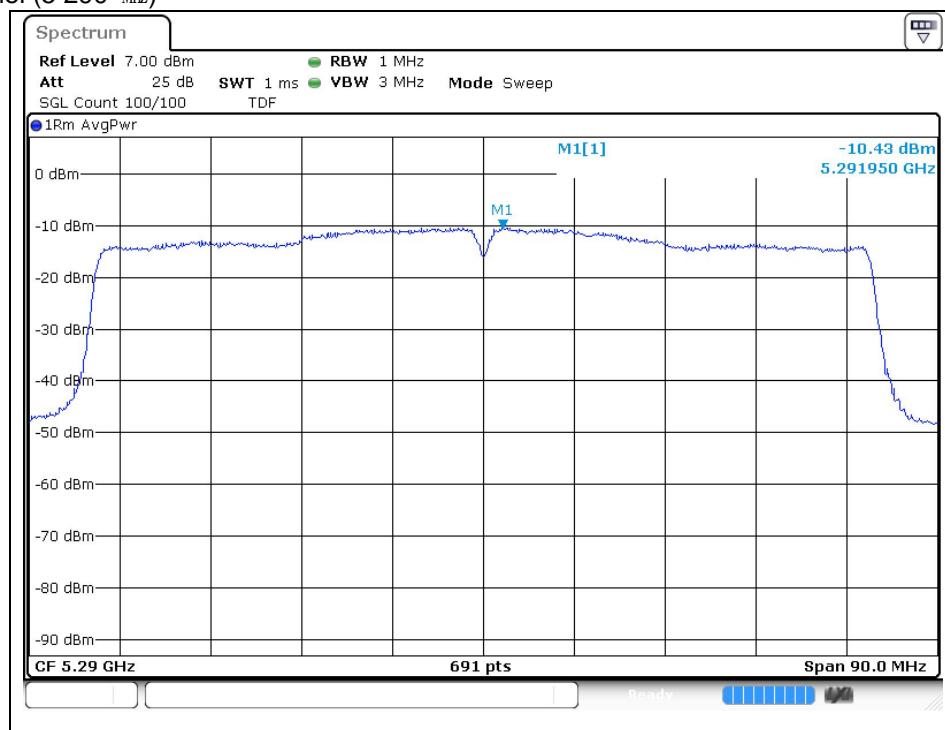
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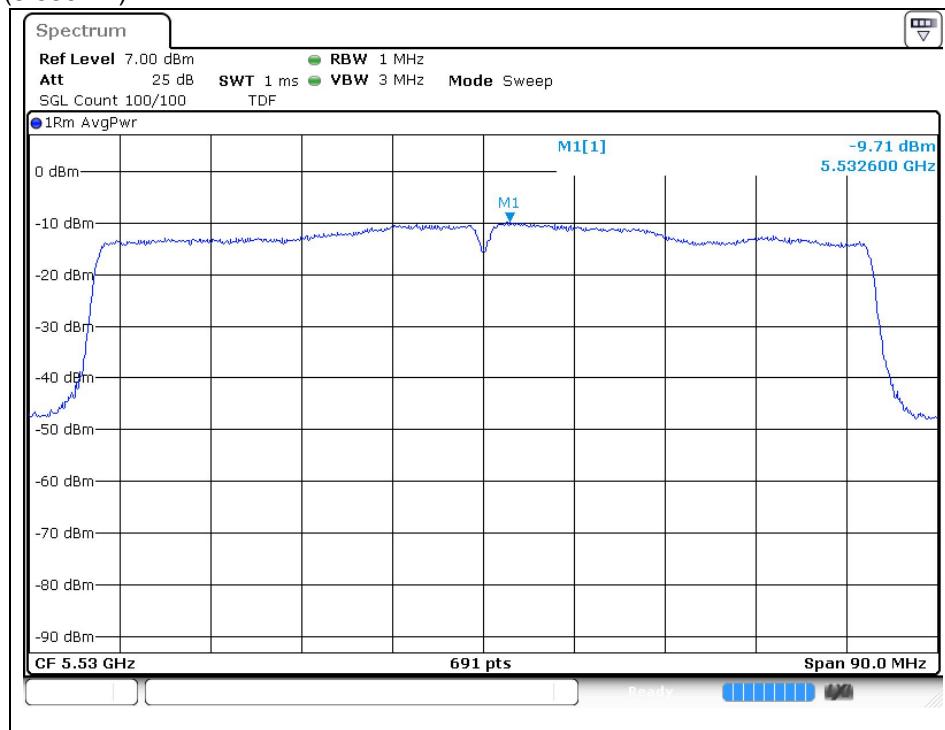
A4(210 mm x 297 mm)

802.11ac_VHT80 (Band 2A)

Middle Channel (5 290 MHz)

**802.11ac_VHT80 (Band 2C)**

Low Channel (5 530 MHz)



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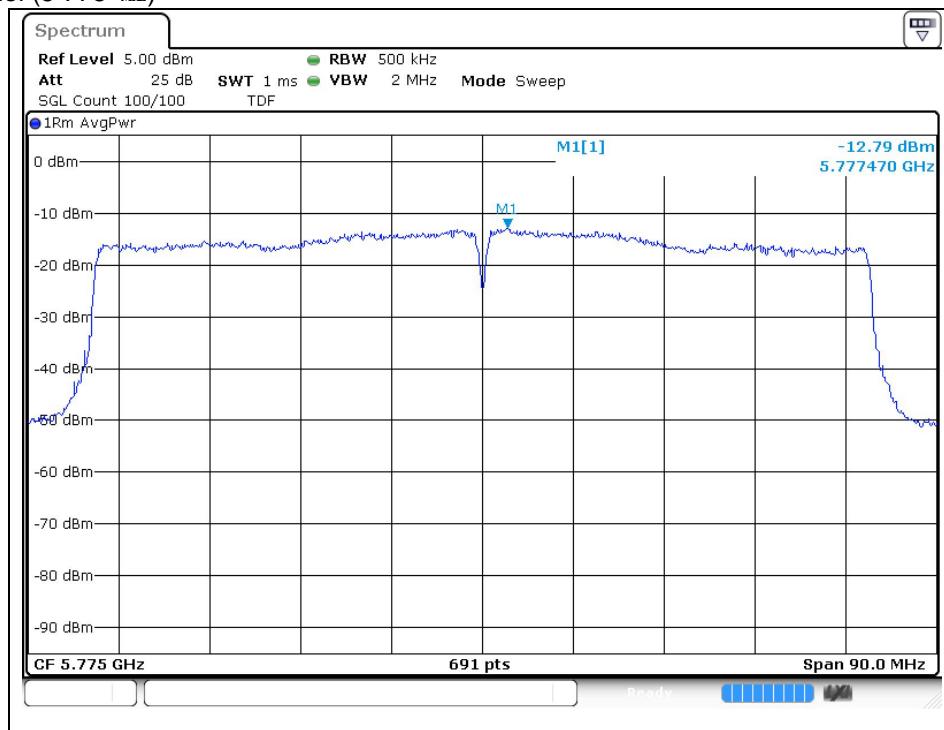
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A4(210 mm x 297 mm)

802.11ac_VHT80 (Band 3)

Middle Channel (5 775 MHz)



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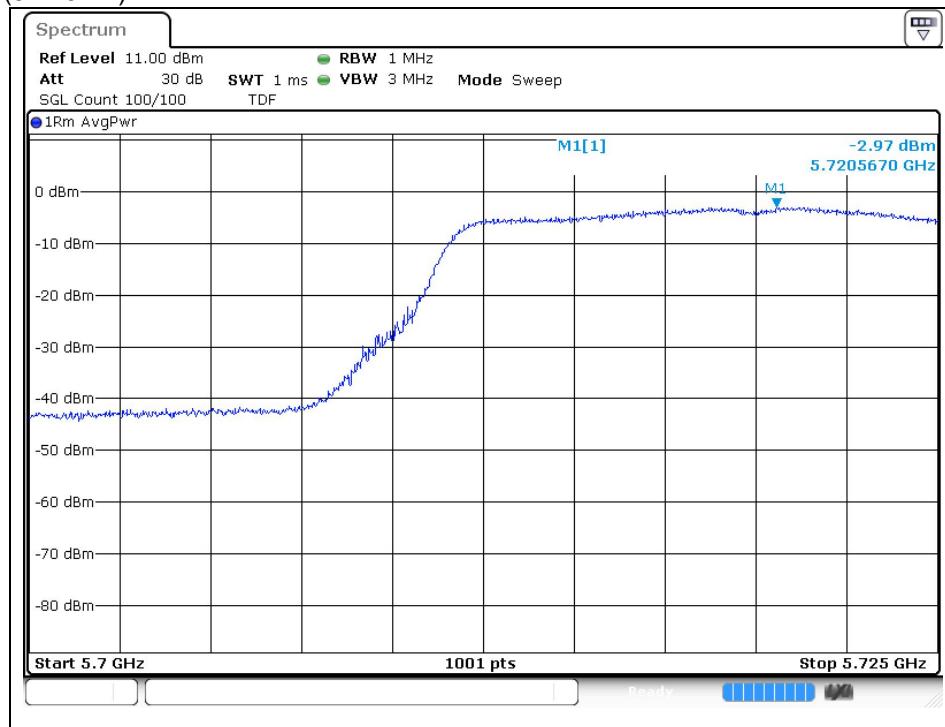
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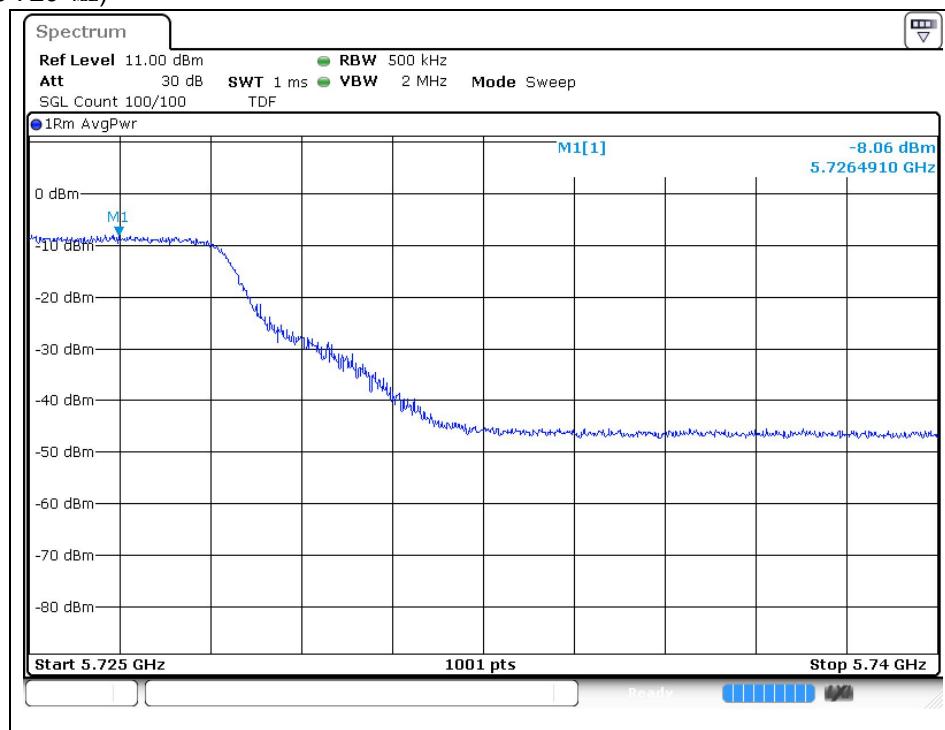
A4(210 mm x 297 mm)

Band-crossing channels

U-NII 2C 11a (5.720 GHz)



U-NII 3 11a (5.720 GHz)



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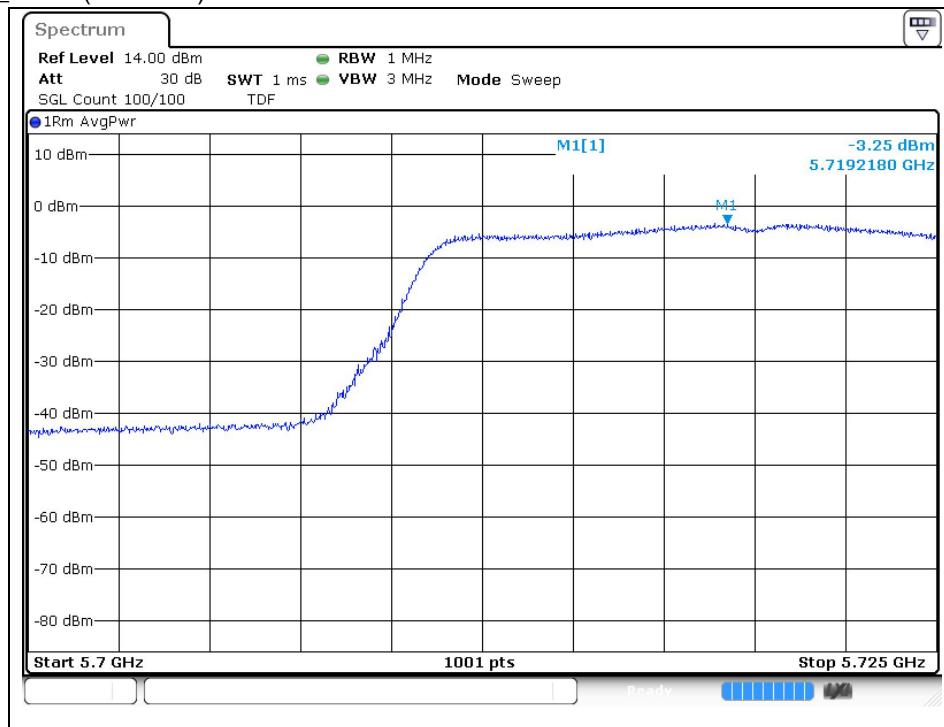
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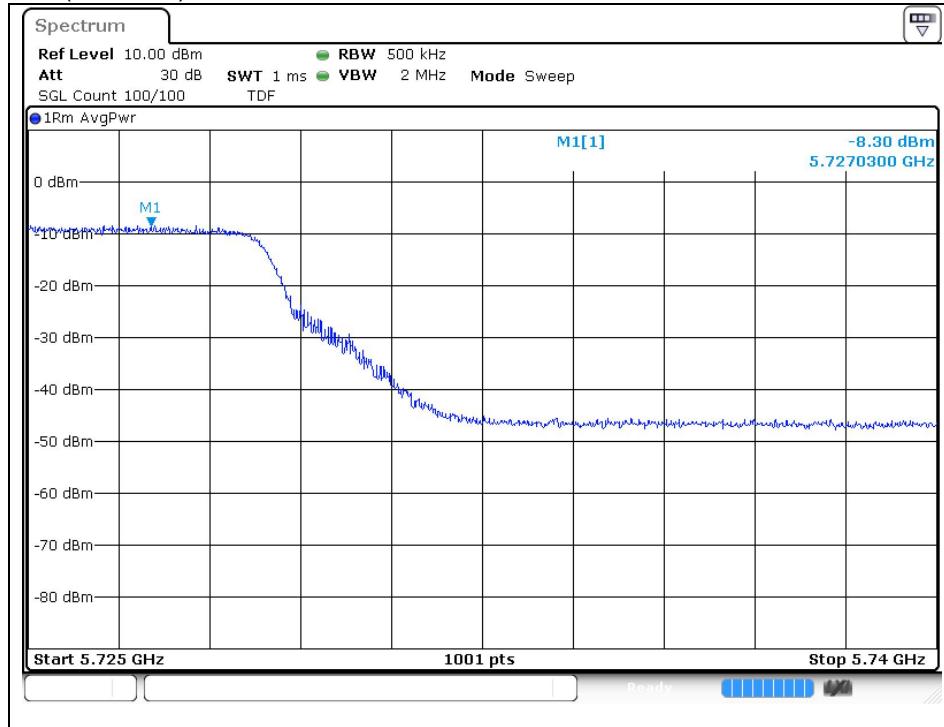
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A4(210 mm x 297 mm)

U-NII 2C 11n_HT20 (5 720 MHz)



U-NII 3 11n_HT20 (5 720 MHz)



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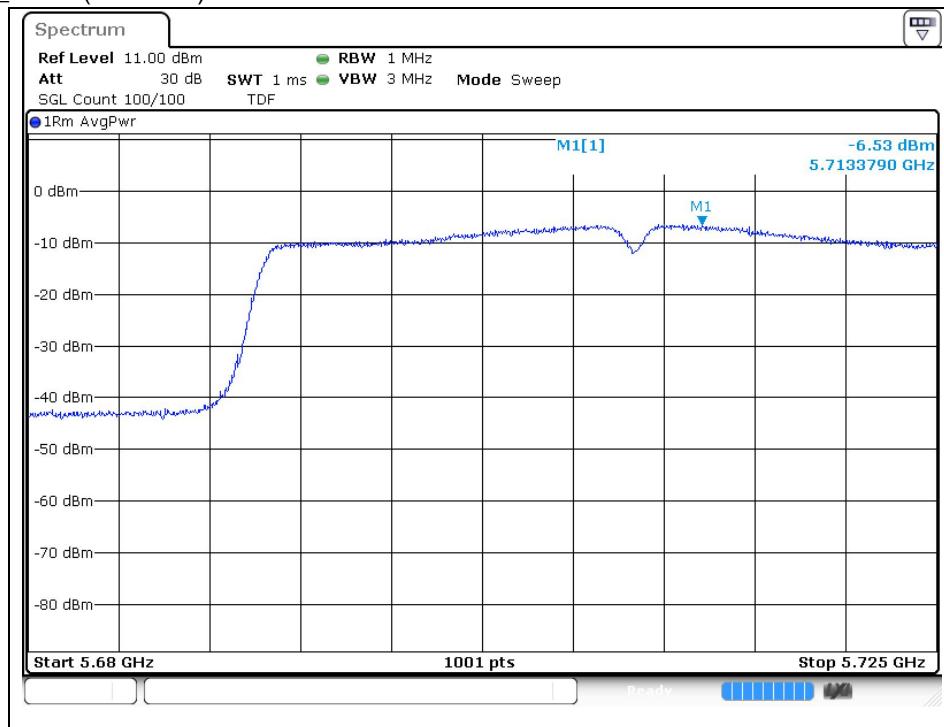
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RTT5041-19(2019.04.24)(1)

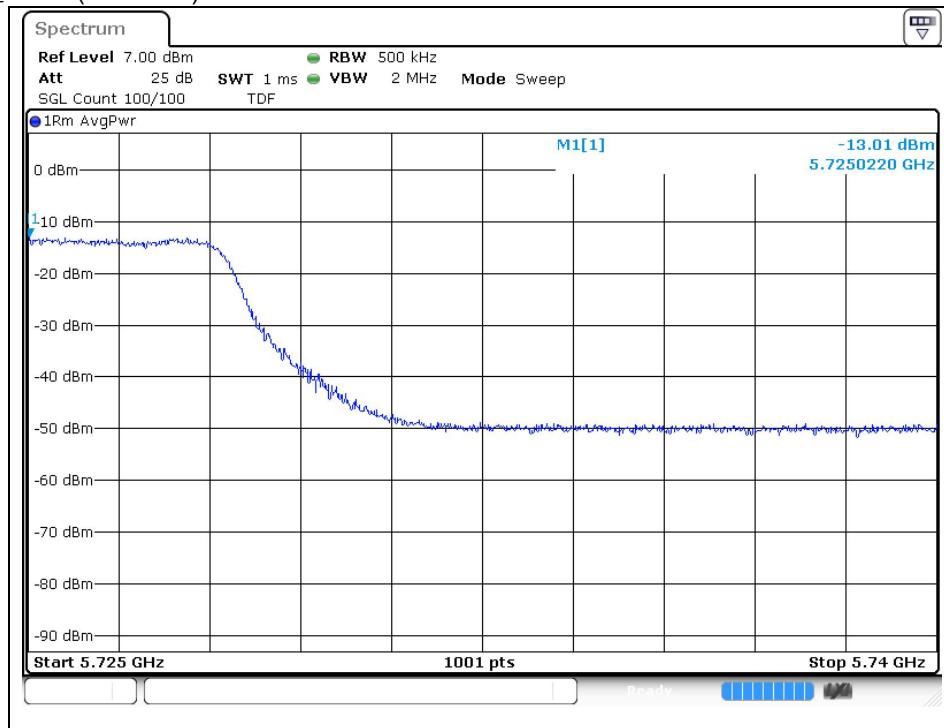
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A4(210 mm x 297 mm)

U-NII 2C 11n HT40 (5.710 GHz)



U-NII 3 11n HT40 (5.710 GHz)



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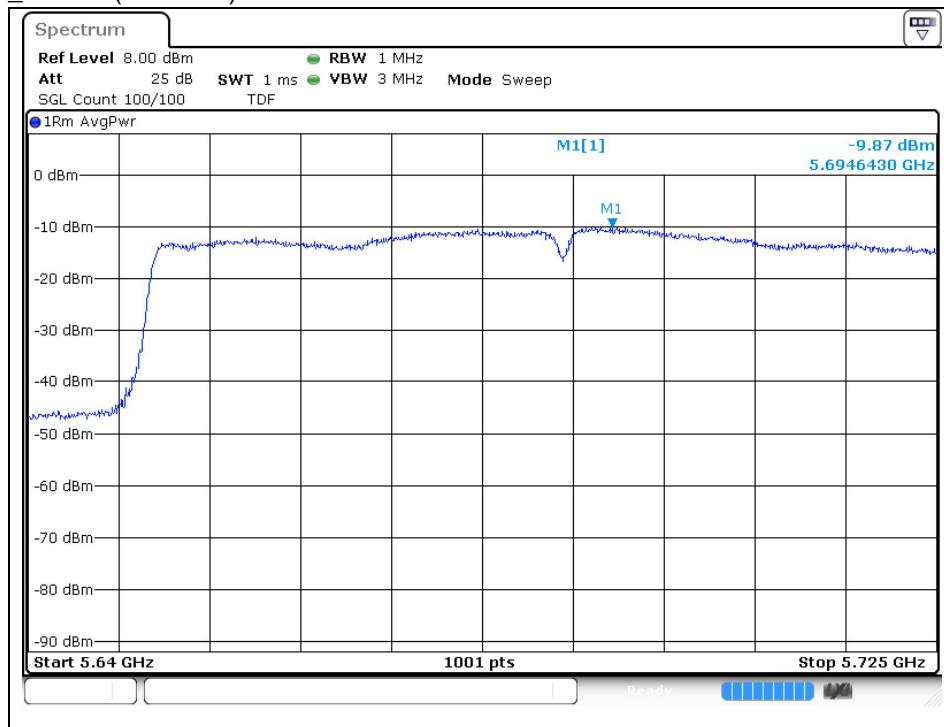
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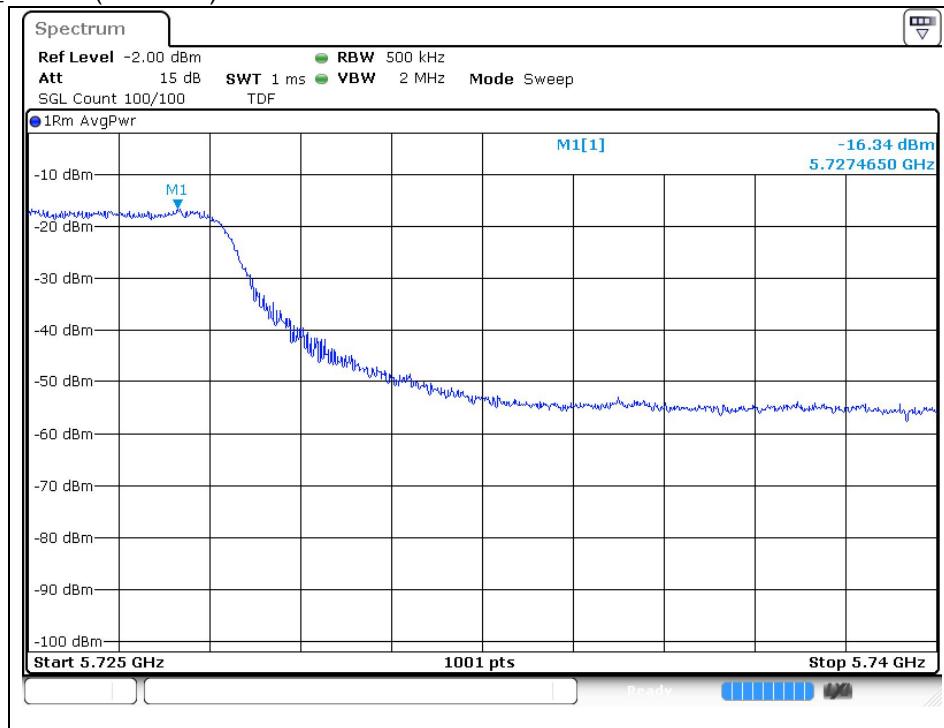
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A4(210 mm x 297 mm)

U-NII 2C 11ac VHT80 (5.690 MHz)



U-NII 3 11ac VHT80 (5.690 MHz)



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A4(210 mm x 297 mm)

7. Antenna Requirement

7.1. Standard Applicable

For intentional device, according to FCC 47 CFR 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. And according to FCC 47 CFR Section §15.407 (a) if transmitting antennas of directional gain greater than 6 dB i are used, the power shall be reduced by the amount in dB that the gain of the antenna exceeds 6 dB i.

7.2. Antenna Connected Construction

Antenna used in this product is PCB pattern antenna and peak max gain of antenna as below.

Band	5 150 MHz ~ 5 250 MHz	5 250 MHz ~ 5 350 MHz	5 470 MHz ~ 5 725 MHz	5 725 MHz ~ 5 850 MHz
Mode	11a/n_HT20, HT40, 11ac_VHT20, VHT40, VHT80			
Gain	2.75 dB i	2.75 dB i	-0.80 dB i	-1.24 dB i

- End of the Test Report -

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