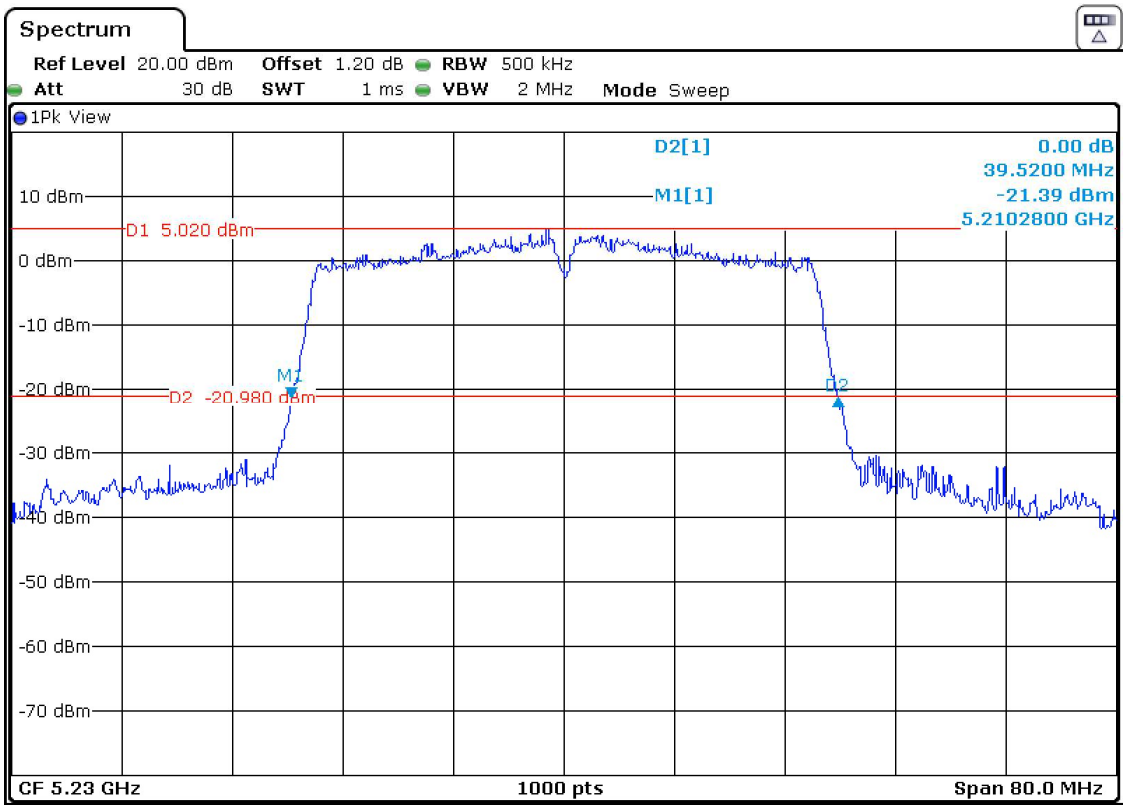
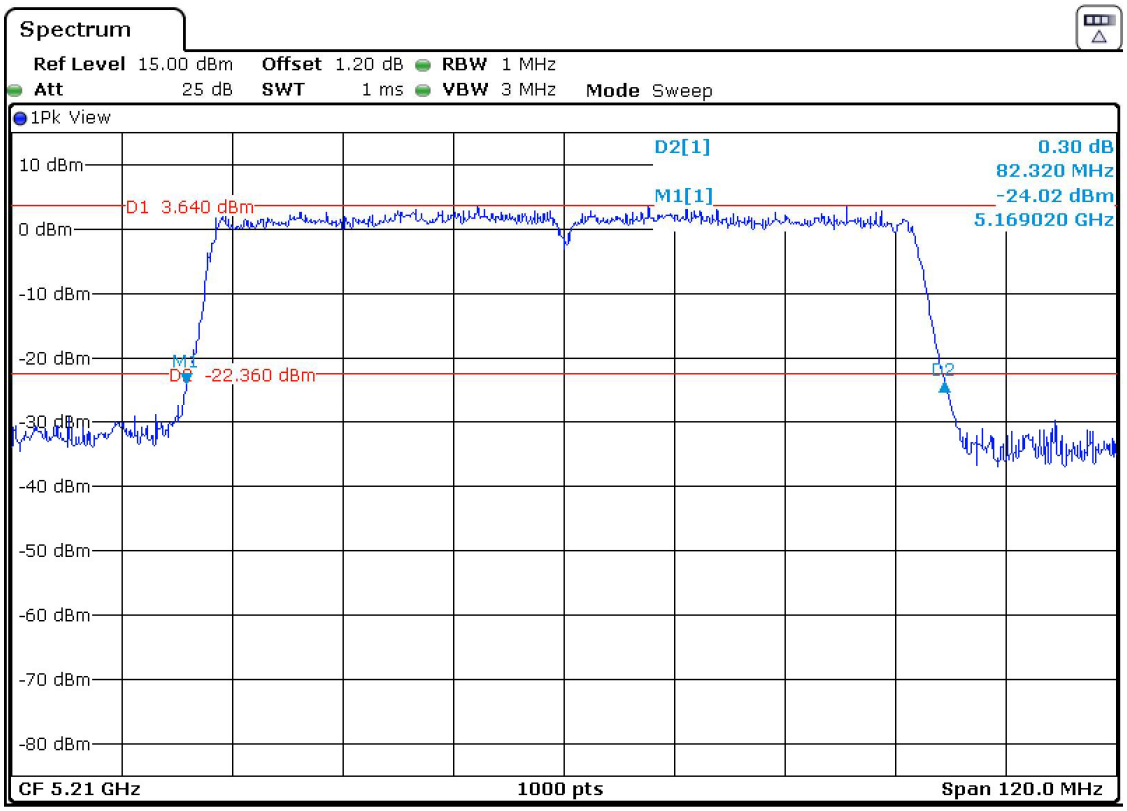
- High Channel 46 (5230 MHz):



Mode 802.11 ac80 (VHT80):

- Single Channel 42 (5210 MHz):



U-NII-3 (5725-5850 MHz)

Mode 802.11 a20:

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
26 dB Emission Bandwidth (MHz)	21.56	21.44	21.48
Measurement uncertainty (kHz)	<±40.04		

Mode 802.11 n20 (HT20):

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
26 dB Emission Bandwidth (MHz)	21.84	21.68	21.84
Measurement uncertainty (kHz)	<±40.04		

Mode 802.11 ac20 (VHT20):

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
26 dB Emission Bandwidth (MHz)	21.72	21.68	21.68
Measurement uncertainty (kHz)	<±40.04		

Mode 802.11 n40 (HT40):

Channels	Low Channel 151 (5755 MHz)	High Channel 159 (5795 MHz)
26 dB Emission Bandwidth (MHz)	39.76	39.68
Measurement uncertainty (kHz)	<±70.07	

Mode 802.11 ac40 (VHT40):

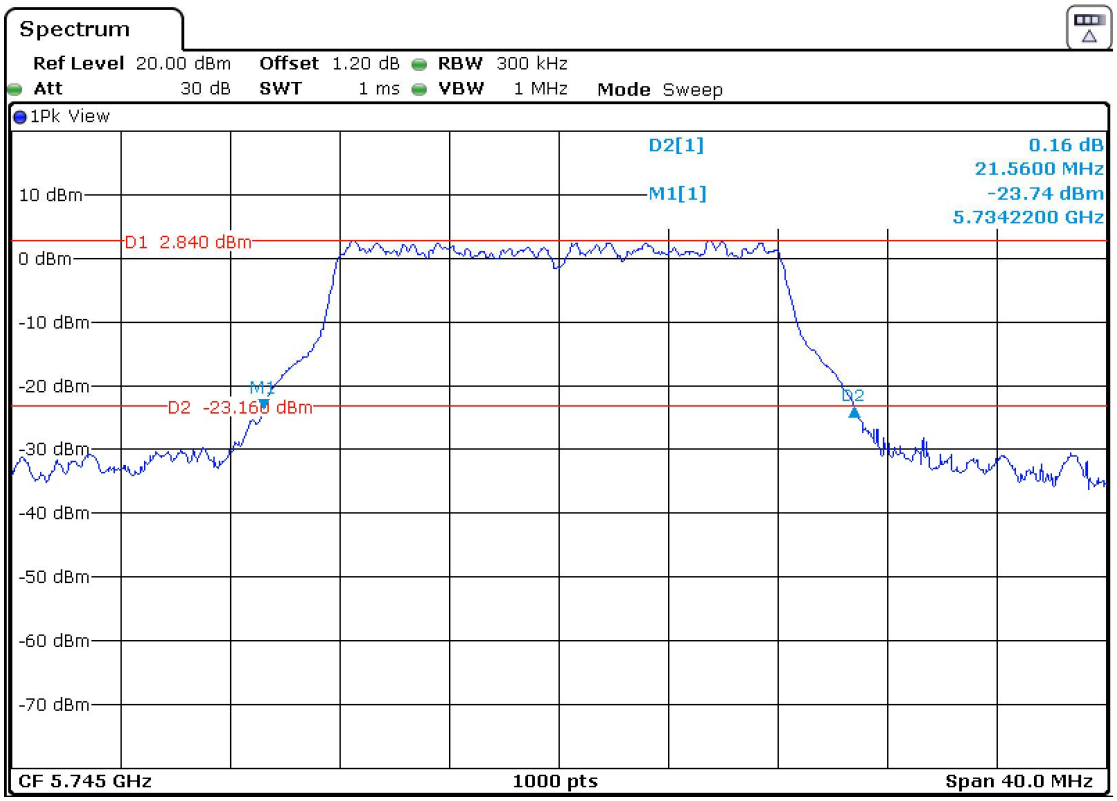
Channels	Low Channel 151 (5755 MHz)	High Channel 159 (5795 MHz)
26 dB Emission Bandwidth (MHz)	39.92	39.52
Measurement uncertainty (kHz)	<±70.07	

Mode 802.11 ac80 (VHT80):

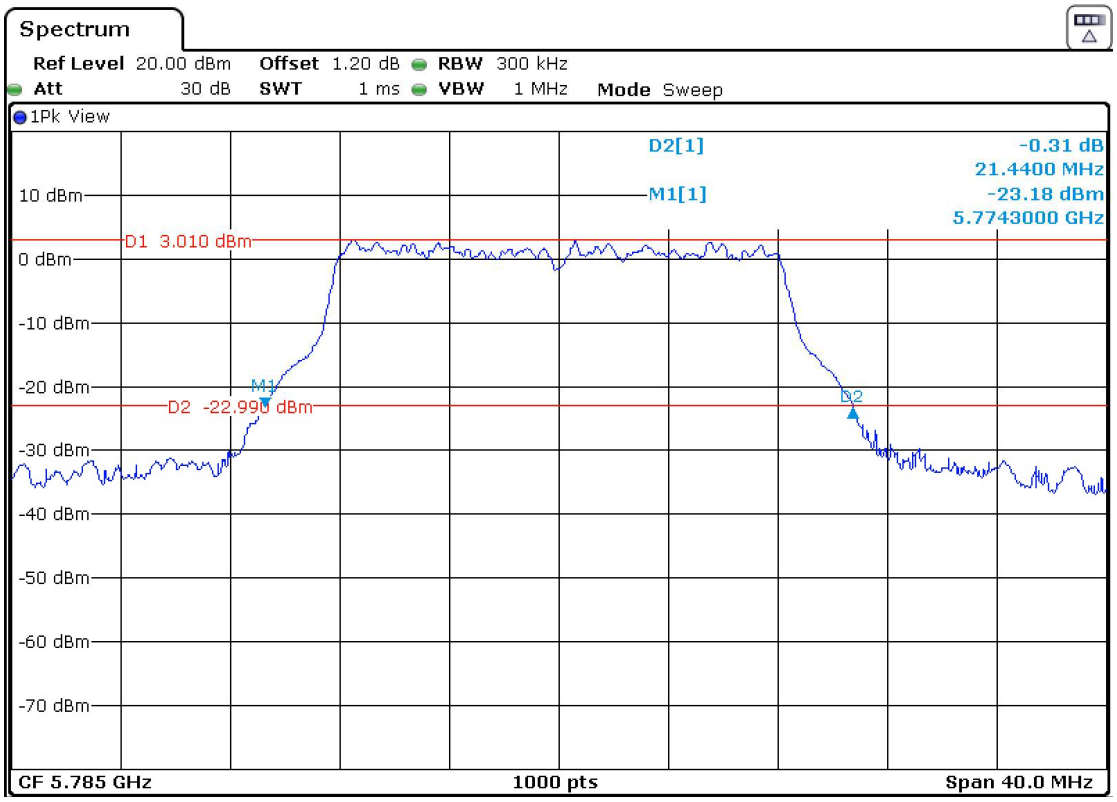
Channel	Single Channel 155 (5775 MHz)
26 dB Emission Bandwidth (MHz)	81.84
Measurement uncertainty (kHz)	<±110.11

Mode 802.11 a20:

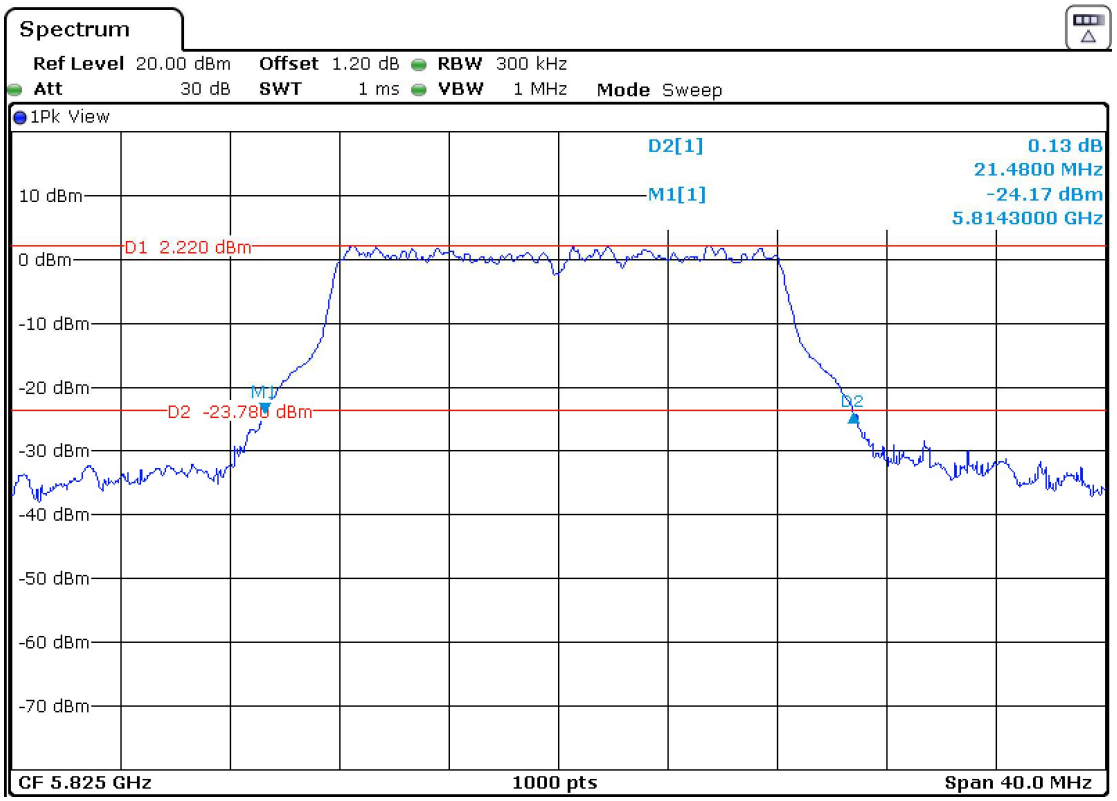
- Low Channel 149 (5745 MHz):



- Middle Channel 157 (5785 MHz):

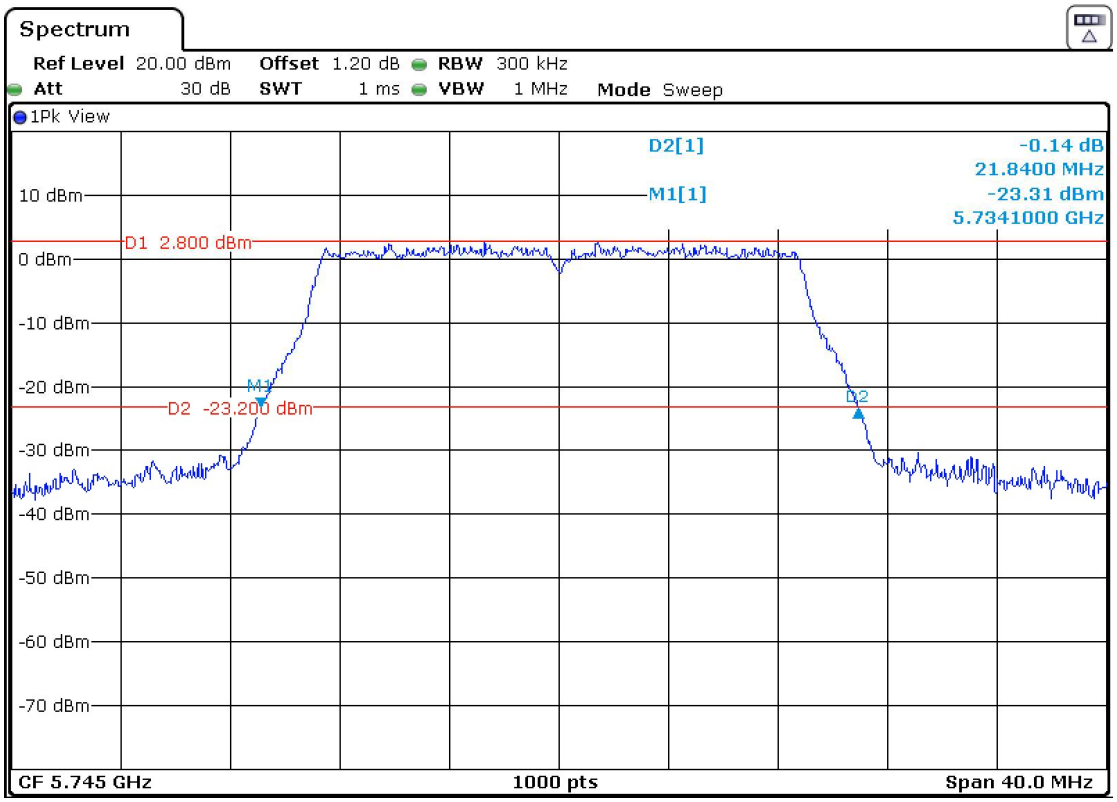


- High Channel 165 (5825 MHz):

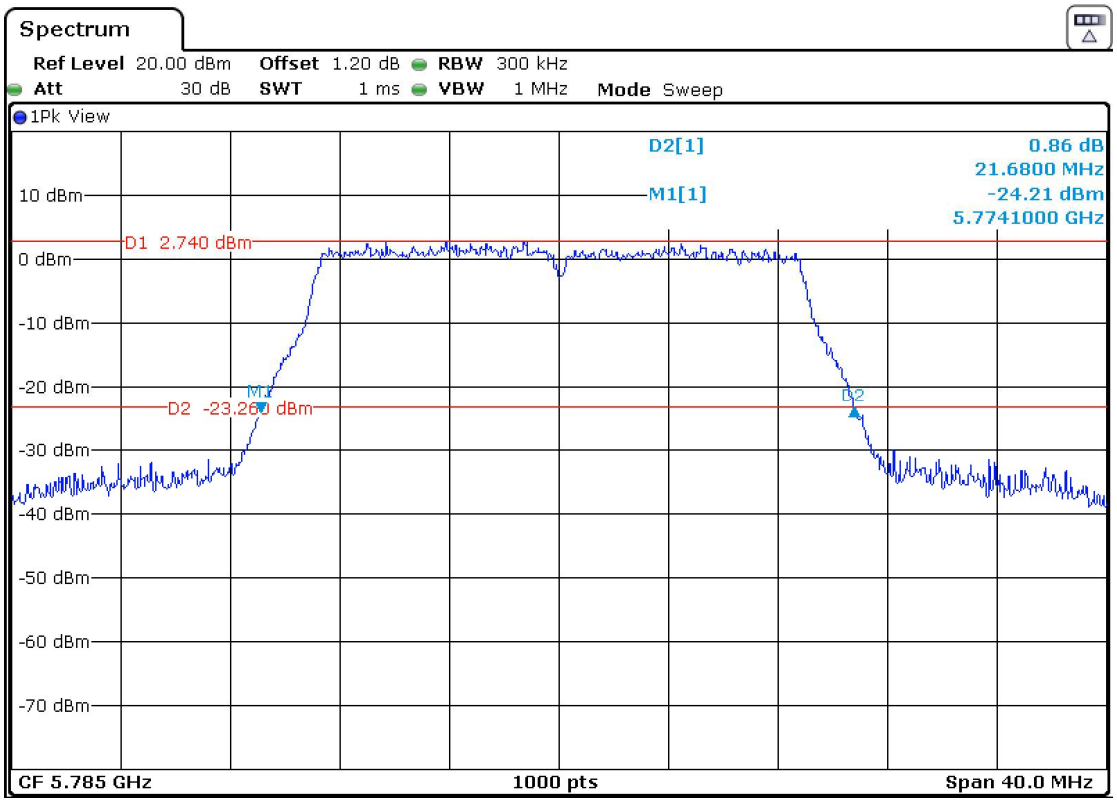


Mode 802.11 n20 (HT20):

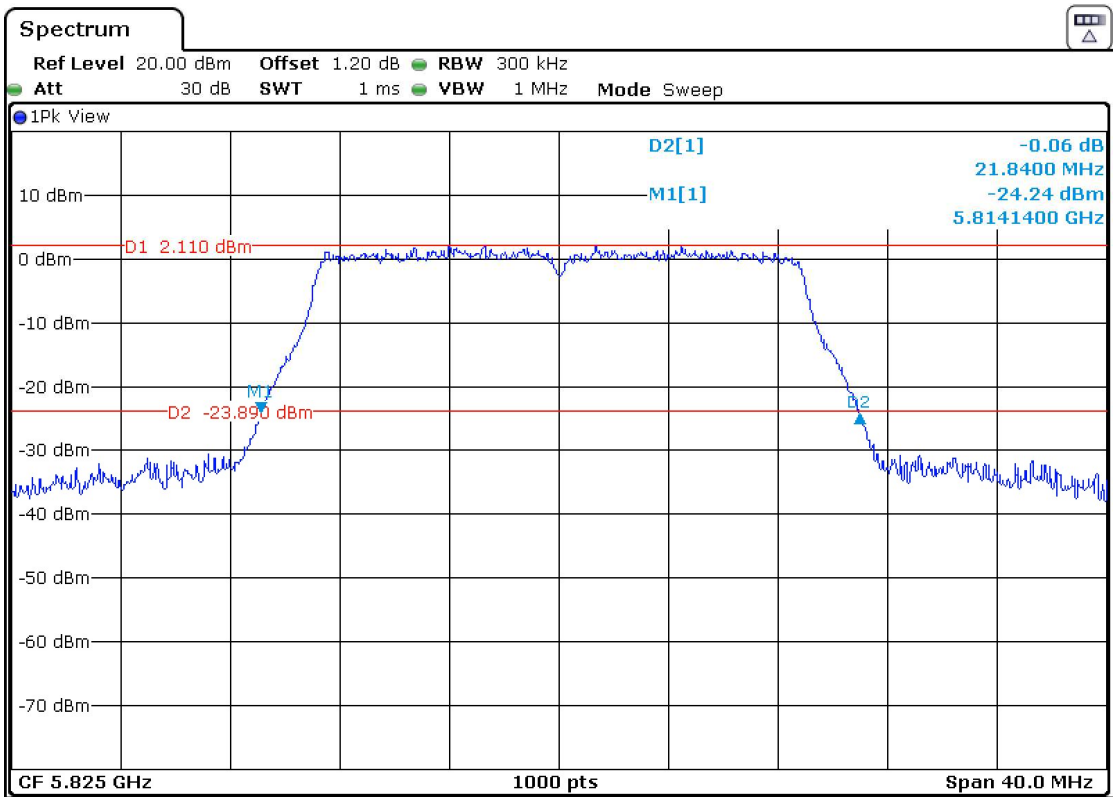
- Low Channel 149 (5745 MHz):



- Middle Channel 157 (5785 MHz):

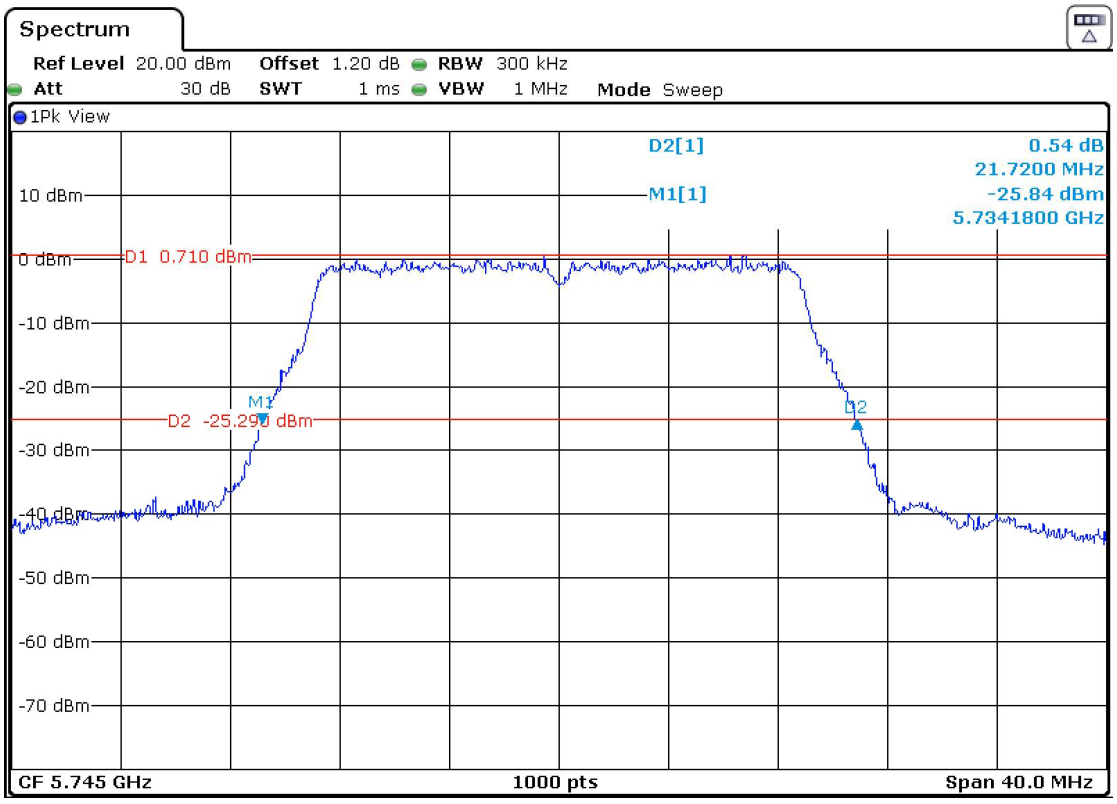


- High Channel 165 (5825 MHz):

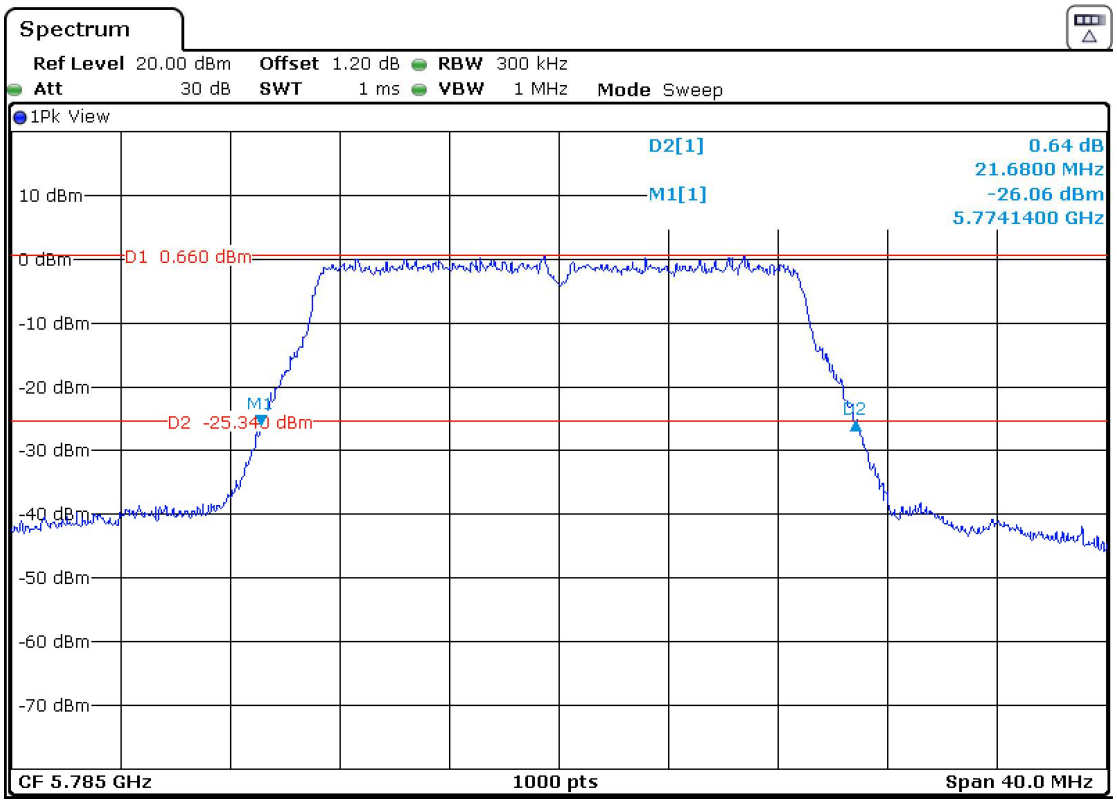


Mode 802.11 ac20 (VHT20):

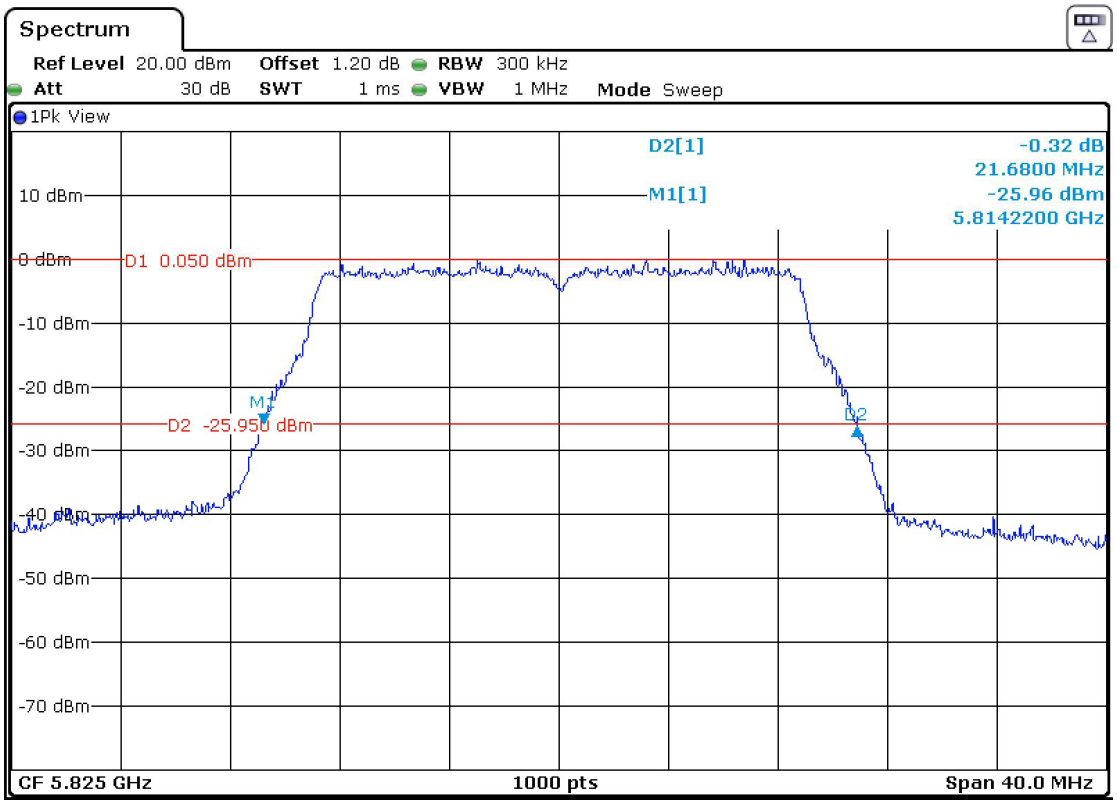
- Low Channel 149 (5745 MHz):



- Middle Channel 157 (5785 MHz):

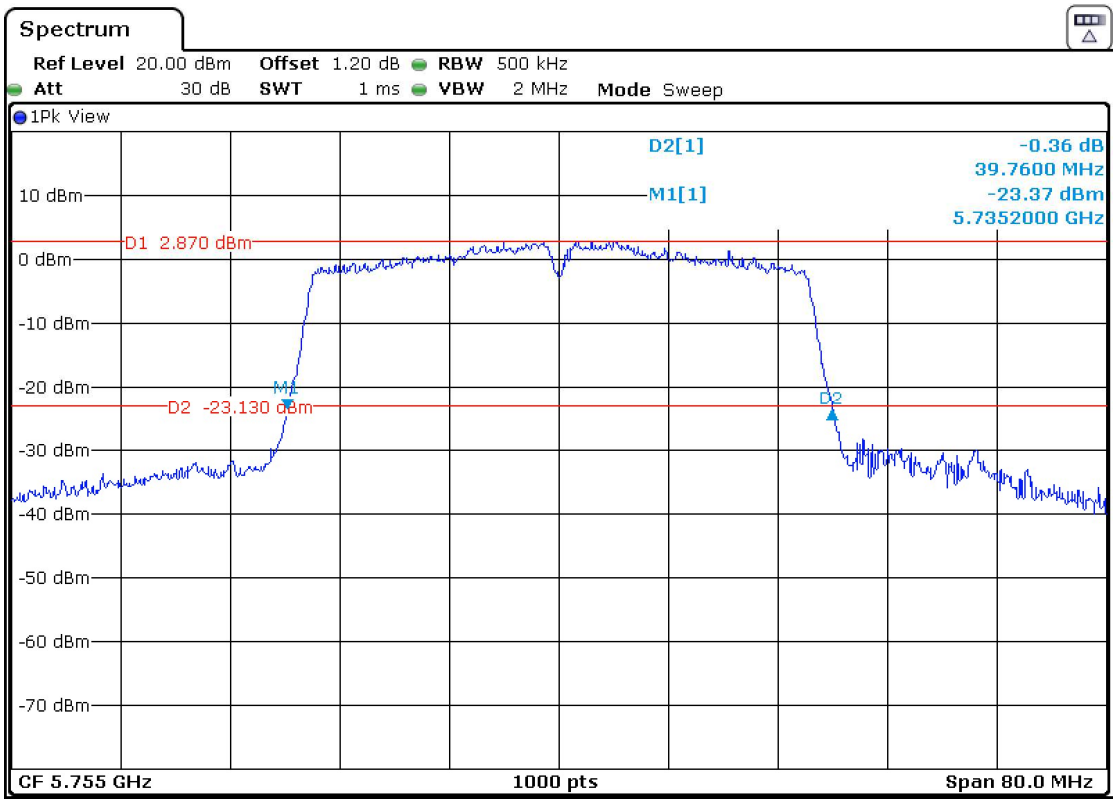


- High Channel 165 (5825 MHz):

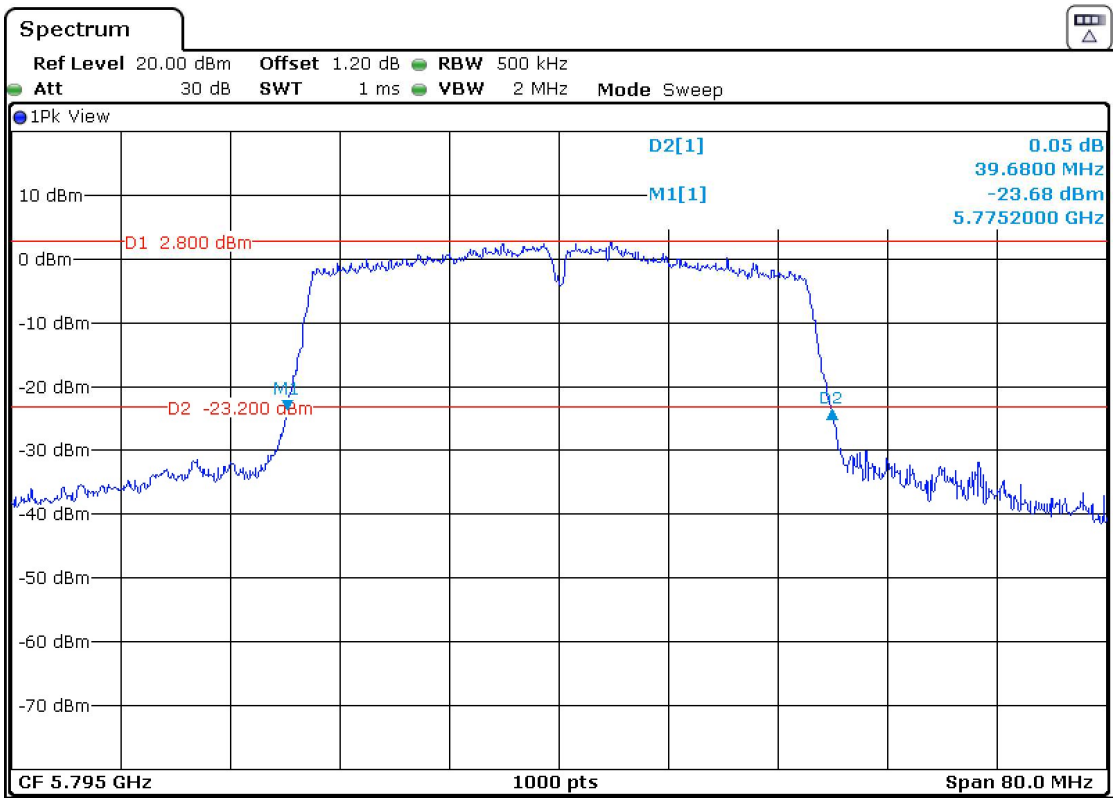


Mode 802.11 n40 (HT40):

- Low Channel 151 (5755 MHz):

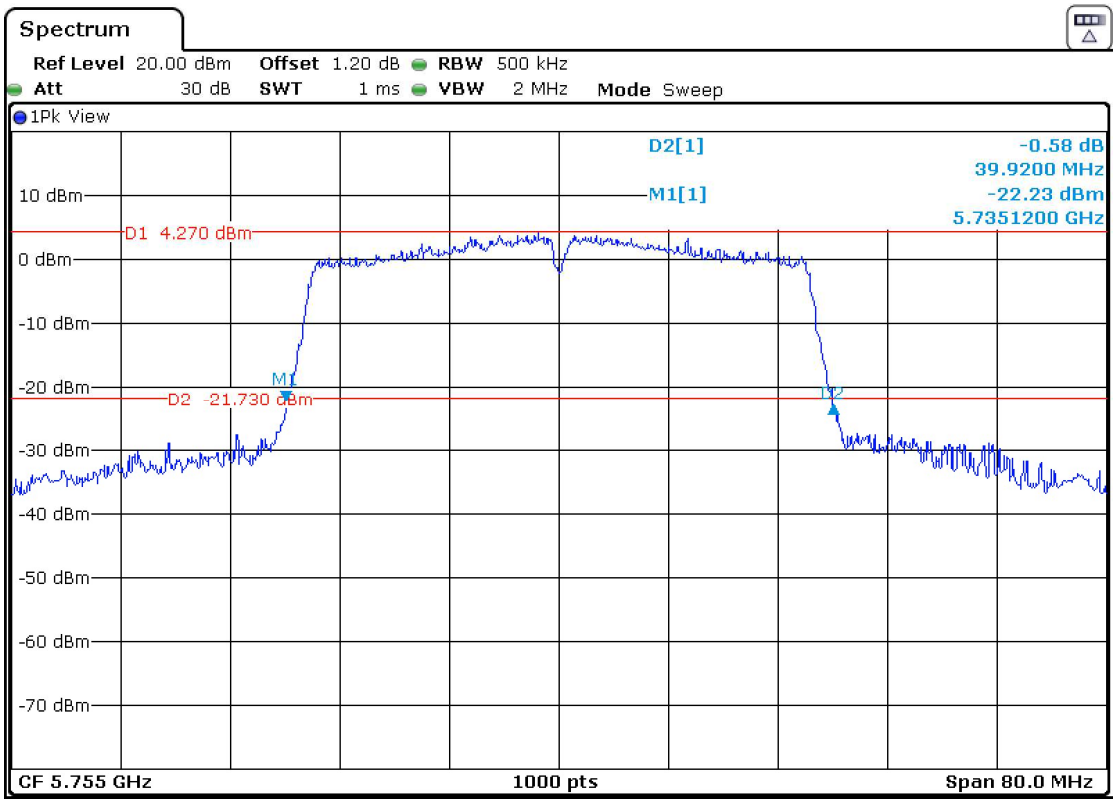


- High Channel 159 (5795 MHz):

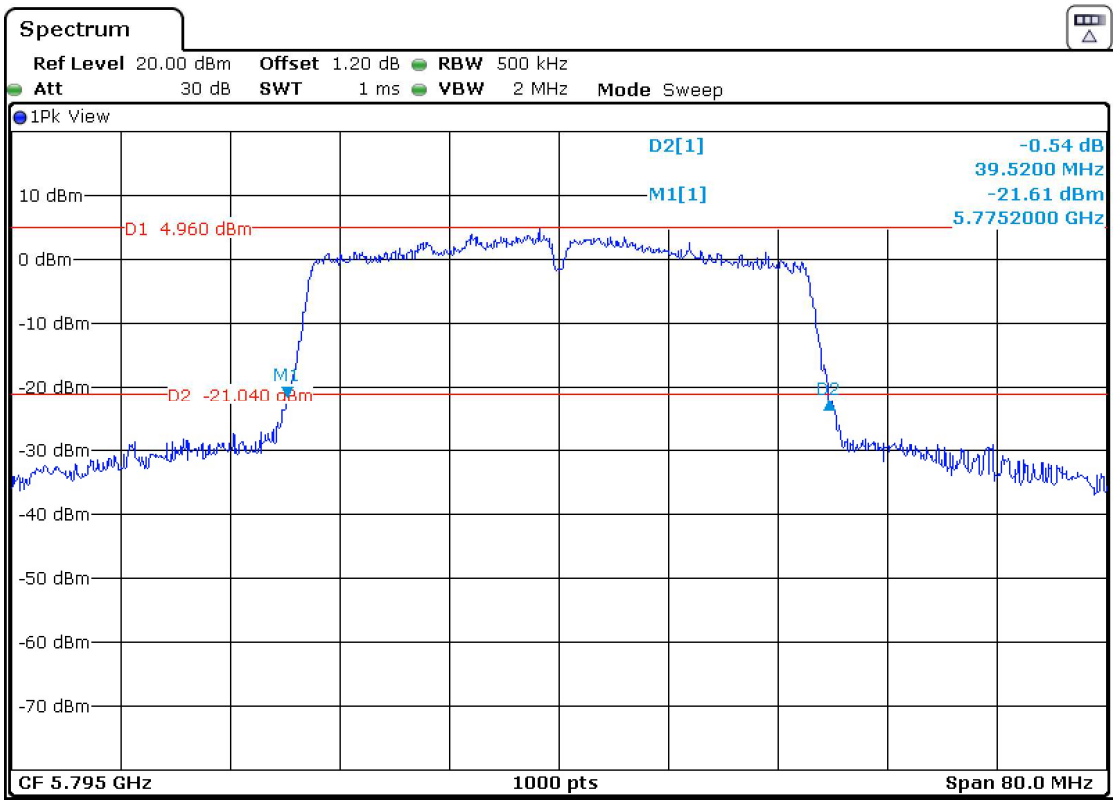


Mode 802.11 ac40 (VHT40):

- Low Channel 151 (5755 MHz):

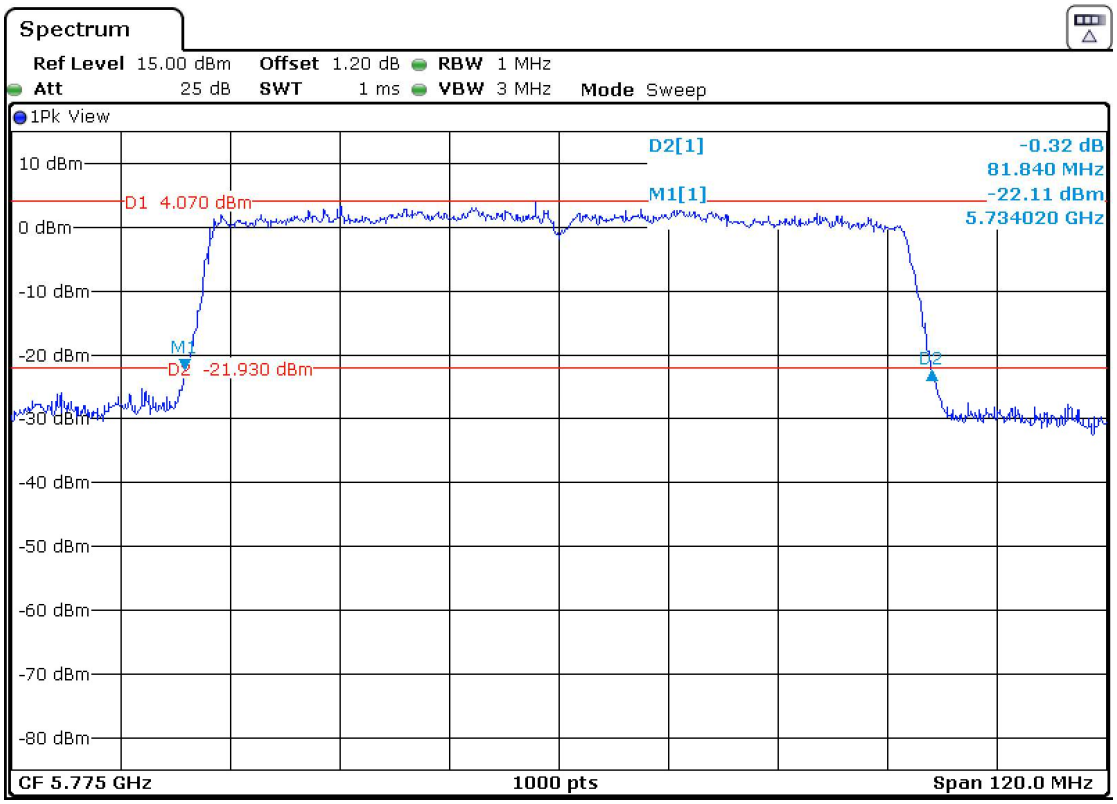


- High Channel 159 (5795 MHz):



Mode 802.11 ac80 (VHT80):

- Single Channel 155 (5775 MHz):



Appendix B: Tests results for the U-NII-1 Band 5.15 – 5.25 GHz

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TEST CONDITIONS

POWER SUPPLY (V):

V nonimal:	12 Vdc.
Type of Power Supply:	External power supply (Car Battery).
Type of Antenna:	External antenna.
Maximum Declared Antenna Gain:	-5.4 dBi (Antenna gain plus antenna cable loss).

Technology Tested:	WLAN (IEEE 802.11 a,n,ac) / U-NII-1	
Modes:	802.11a20: 6, 9, 12, 18, 24, 36, 48 & 54 Mbps	
	802.11n HT20: MCS0 to MCS23	
	802.11n HT40: MCS0 to MCS23	
	802.11ac VHT20: MCS0 to MCS9	
	802.11ac VHT40: MCS0 to MCS9	
	802.11ac VHT80: MCS0 to MCS9	
Setting of cores / ports:	One port.	
Beamforming:	No.	
Frequency Range:	5150 MHz to 5250 MHz	
Channel Spacing:	20 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Lowest: 36	5180
	Middle: 40	5200
	Highest: 48	5240
Channel Spacing:	40 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Lowest: 38	5190
	Highest: 46	5230
Channel Spacing:	80 MHz	
Transmit Channels	Middle: 42	5210

The test set-up was made in accordance to the general provisions of FCC Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017.

The EUT was tested in the following operating mode:

- Continuously transmitting with a modulated carrier at maximum power in all required channels using the supported data rates/modulations types.

The field strength at the band edges was evaluated for each mode on the lowest and highest channels at the rated power for the channel under test.
For all modes, the EUT was configured in test mode using a software application. The application was used to enable a continuous transmission and to select the test channels as required. The client supplied instructions to configure the EUT. The customer supplied a document containing the setup instructions.

The worst cases for testing were identified for output power and spurious levels at the band edges which were selected based on preliminary testing that correspond to next data rates:

- 802.11a20: 6 Mbits
- 802.11n HT20: MCS0
- 802.11n HT40: MCS0
- 802.11ac VHT20: MCS0
- 802.11ac VHT40: MCS0
- 802.11ac VHT80: MCS0

WIFI FCC:

tx_test.sh -a wlan0 stop

a20 - Core0

tx_test.sh -a wlan0 36 0 -d x -r 6 20 –c US

tx_test.sh -a wlan0 40 0 -d x -r 6 20 -c US

tx_test.sh -a wlan0 48 0 -d x -r 6 20 -c US

n20 - Core0

tx_test.sh -a wlan0 36 0 -d x -h 0 20 -c US

tx_test.sh -a wlan0 40 0 -d x -h 0 20 -c US

tx_test.sh -a wlan0 48 0 -d x -h 0 20 -c US

ac20 - Core0

tx_test.sh -a wlan0 36 0 -d x -v 0 20 -c US

tx_test.sh -a wlan0 40 0 -d x -v 0 20 -c US

tx_test.sh -a wlan0 48 0 -d x -v 0 20 -c US

n40 - Core0

tx_test.sh -a wlan0 40 0 -d x -h 0 40 -c US

tx_test.sh -a wlan0 48 0 -d x -h 0 40 -c US

ac40 - Core0

tx_test.sh -a wlan0 40 0 -d x -v 0 40 -c US

tx_test.sh -a wlan0 48 0 -d x -v 0 40 -c US

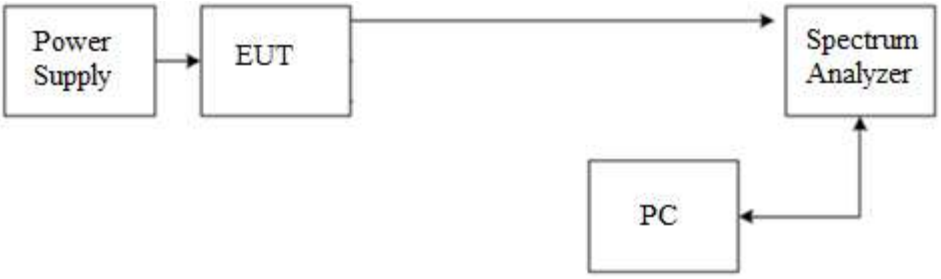
ac80 - Core0

tx_test.sh -a wlan0 40 0 -d x -v 0 80 -c US

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and connected to the spectrum analyzer using a low loss RF cable. The reading in the spectrum analyzer is corrected taking into account the internal and external RF cable loss.

For all modes:



The DC supply voltage is applied using an external power supply.

RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 1 m for the frequency range 1 GHz-40 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

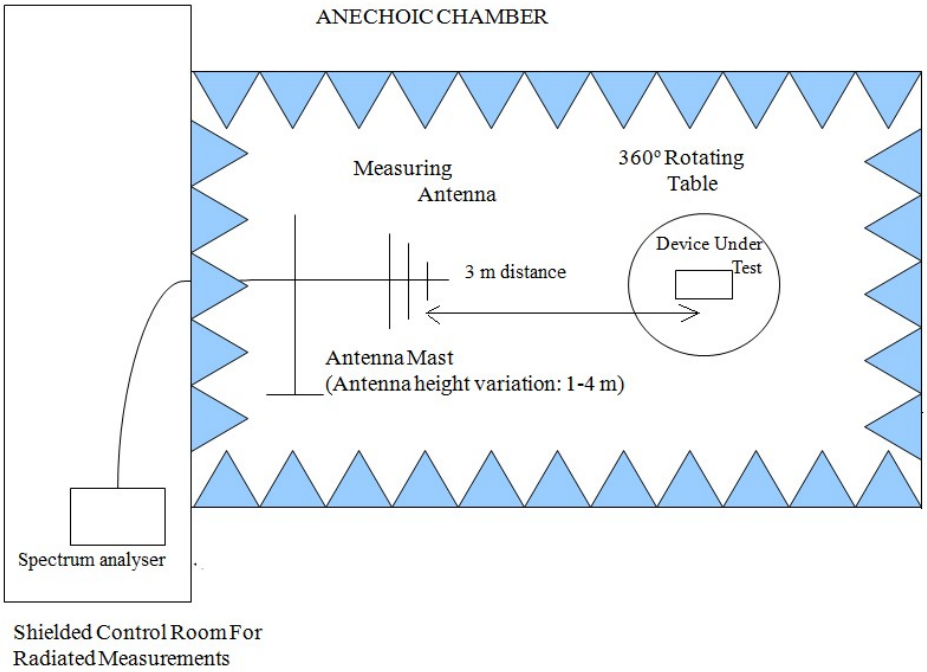
For radiated emissions in the range 1 GHz-40 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The EUT was placed at a height of 80 cm above the reference ground plane in the center of the chamber turntable to perform the measurements below 1GHz and the EUT was placed at a height of 1.5 meters above the test chamber floor in the center of the chamber turntable to perform the measurements above 1GHz. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

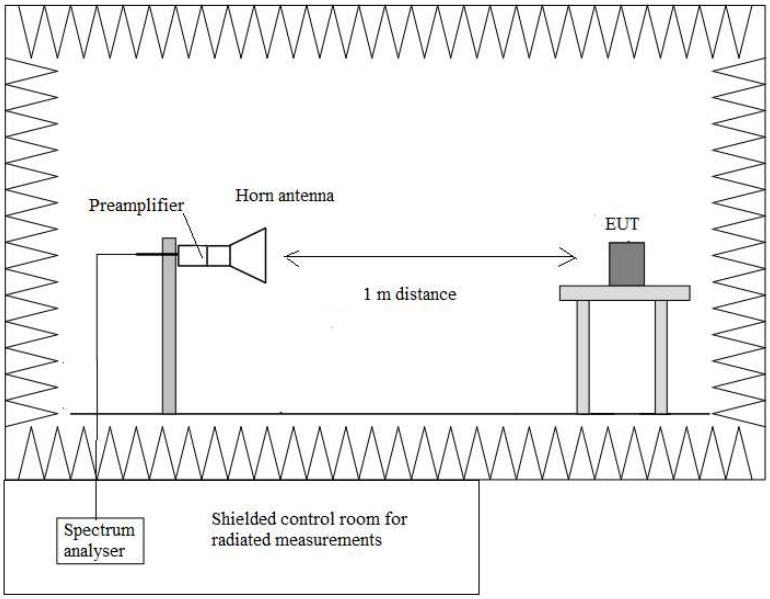
Measurements were made in both horizontal and vertical planes of polarization.

The final measured value, for the given emission, in the tables below incorporates the calibrated antenna factor and cable loss.

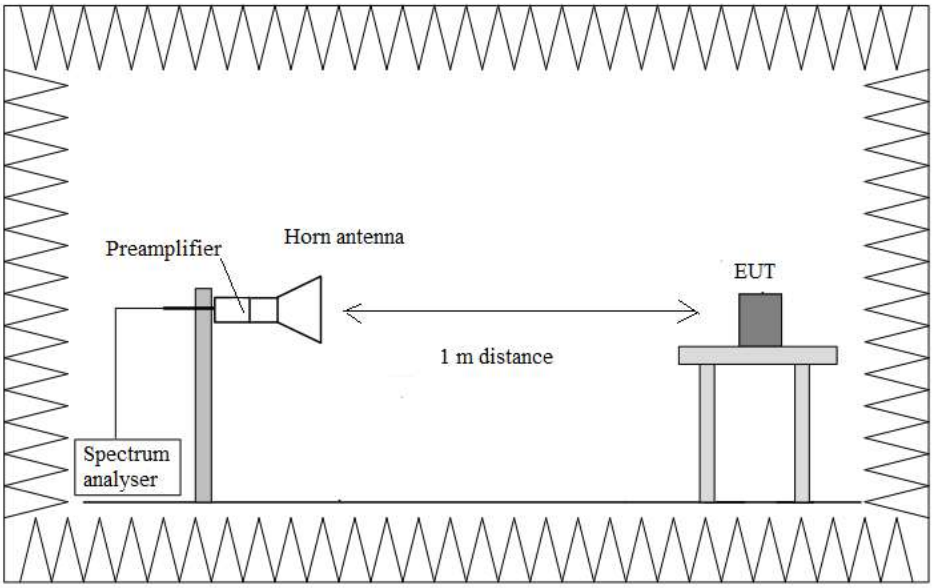
Radiated measurements setup f < 1 GHz.



Radiated measurements setup f > 1 GHz up to 18 GHz.



Radiated measurements setup f > 18 GHz up to 40 GHz.



FCC 15.407 (a)(1)(ii) / RSS-247 6.2.1.1 Transmitter Maximum Conducted Output Power

SPECIFICATION:

FCC 15.407: For client devices in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW (24 dBm) provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

RSS-247: The maximum e.i.r.p. shall not exceed 200 mW (23 dBm) or 10 + 10 log10 B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.

RESULTS:

The maximum conducted output power was measured using the channel power integration method according to point E) 2) b) (Method SA-1) of 789033 D02 General UNII Test Procedures New Rules v02r01 when the duty cycle is >98% and the channel power integration method according to point E) 2) d) (Method SA-2) of 789033 D02 General UNII Test Procedures New Rules v02r01 when the duty cycle is <98%.

For data rates where the EUT was transmitting at <98% duty cycle, the duty calculated in Appendix A was added to the measured power in order to calculate the total average power during the actual transmission time.

The e.i.r.p. levels are calculated by adding the declared maximum antenna gain (dBi).

For all modes of operation, the antenna gain is less than 6 dBi.

Maximum Declared Antenna Gain: -5.4 dBi

Mode 802.11 a20

	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
Max. Conducted Power (dBm)	7.42	6.81	6.84
Maximum EIRP power (dBm)	6.814504971	6.204504971	6.234504971
Duty Cycle Correction Factor (dB)	4.794504971		
Max. Conducted Power Corrected (dBm)	12.21450497	11.60450497	11.63450497
Measurement uncertainty (dB)	<±1.20		

Mode 802.11 n20 (HT20)

	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
Max. Conducted Power (dBm)	6.24	5.92	6.09
Maximum EIRP power (dBm)	5.893842073	5.573842073	5.743842073
Duty Cycle Correction Factor (dB)	5.053842073		
Max. Conducted Power Corrected (dBm)	11.29384207	10.97384207	11.14384207
Measurement uncertainty (dB)	<±1.20		

Mode 802.11 ac20 (VHT20)

	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
Max. Conducted Power (dBm)	5.09	4.79	5.02
Maximum EIRP power (dBm)	10.5430588	10.2430588	10.4730588
Duty Cycle Correction Factor (dB)	5.453058804		
Max. Conducted Power Corrected (dBm)	10.5430588	10.2430588	10.4730588
Measurement uncertainty (dB)	<±1.20		

Mode 802.11 n40 (HT40)

	Low Channel 38 (5190 MHz)	High Channel 46 (5230 MHz)
Max. Conducted Power (dBm)	2.58	2.51
Maximum EIRP power (dBm)	9.433971971	9.363971971
Duty Cycle Correction Factor (dB)	6.853971971	
Max. Conducted Power Corrected (dBm)	9.433971971	9.363971971
Measurement uncertainty (dB)	<±1.20	

Mode 802.11 ac40 (VHT40)

	Low Channel 38 (5190 MHz)	High Channel 46 (5230 MHz)
Max. Conducted Power (dBm)	2.41	2.56
Maximum EIRP power (dBm)	9.708603764	9.858603764
Duty Cycle Correction Factor (dB)	7.298603764	
Max. Conducted Power Corrected (dBm)	9.708603764	9.858603764
Measurement uncertainty (dB)	<±1.20	

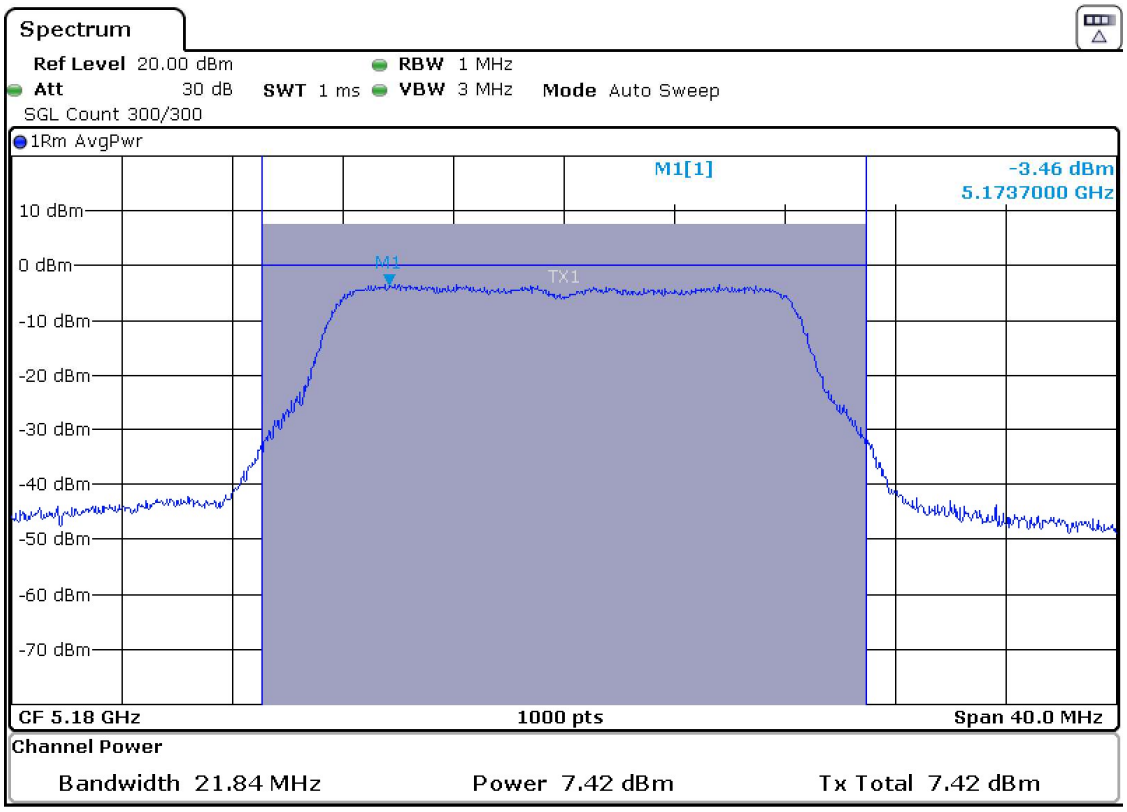
Mode 802.11 ac80 (VHT80)

	Single Channel 42 (5210 MHz)
Max. Conducted Power (dBm)	1.55
Maximum EIRP power (dBm)	10.35784669
Duty Cycle Correction Factor (dB)	8.807846692
Max. Conducted Power Corrected (dBm)	10.35784669
Measurement uncertainty (dB)	<±1.20

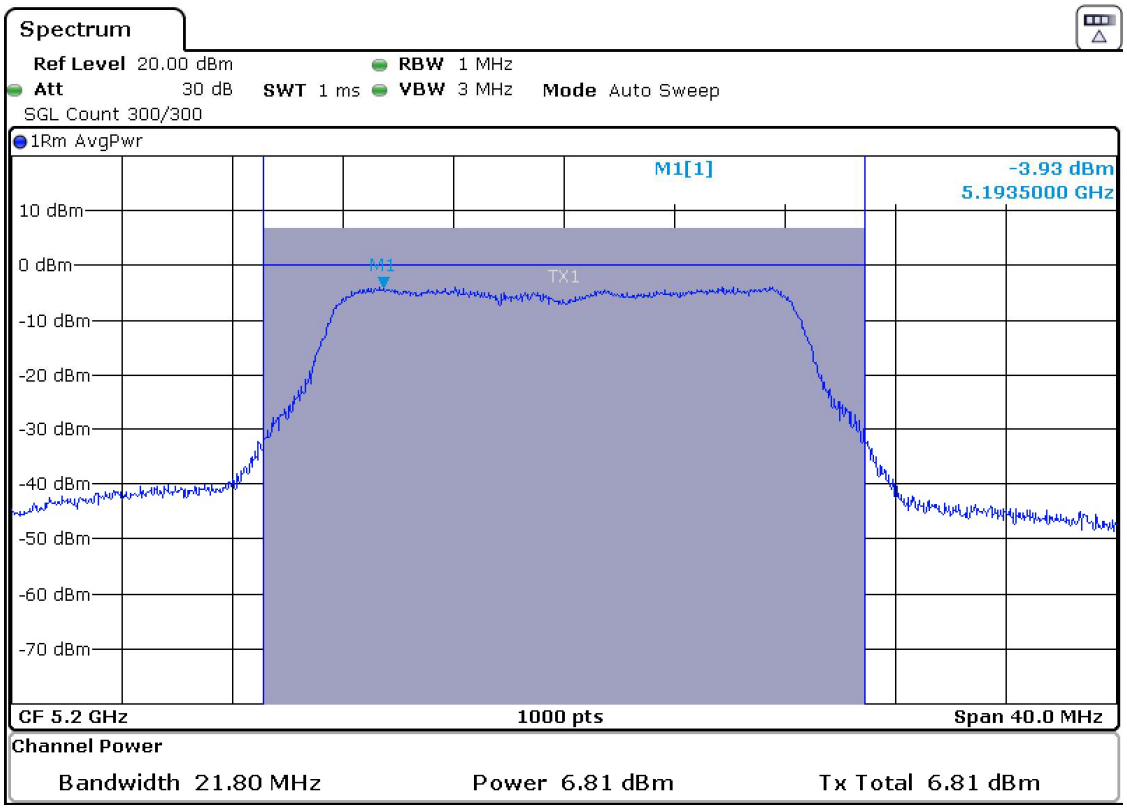
Verdict: PASS

Mode 802.11 a20

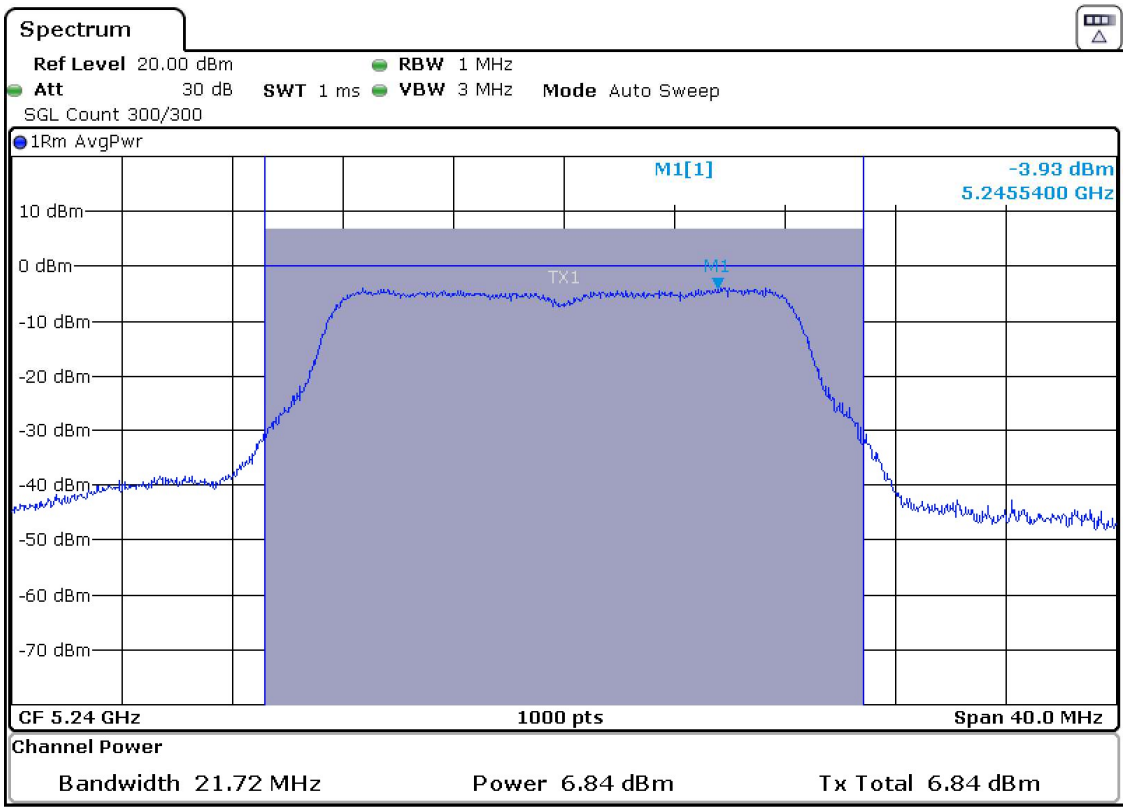
- Low Channel 36:



- Middle Channel 40:

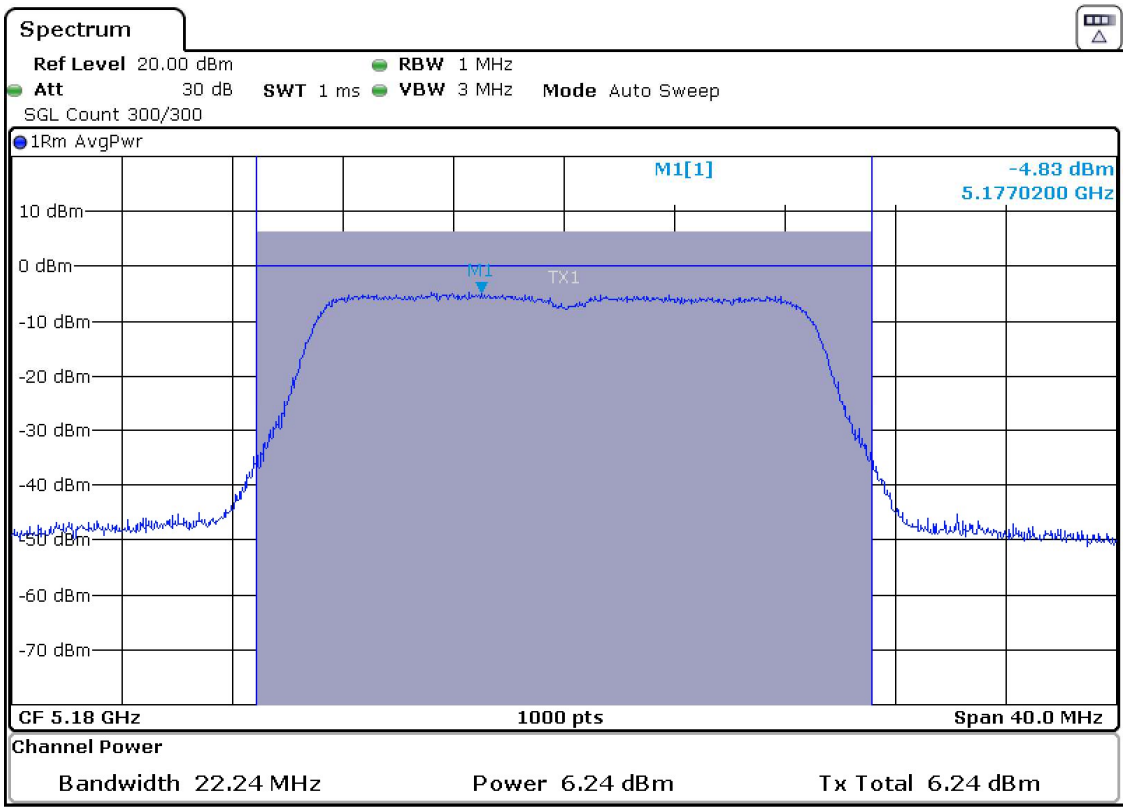


- High Channel 48:

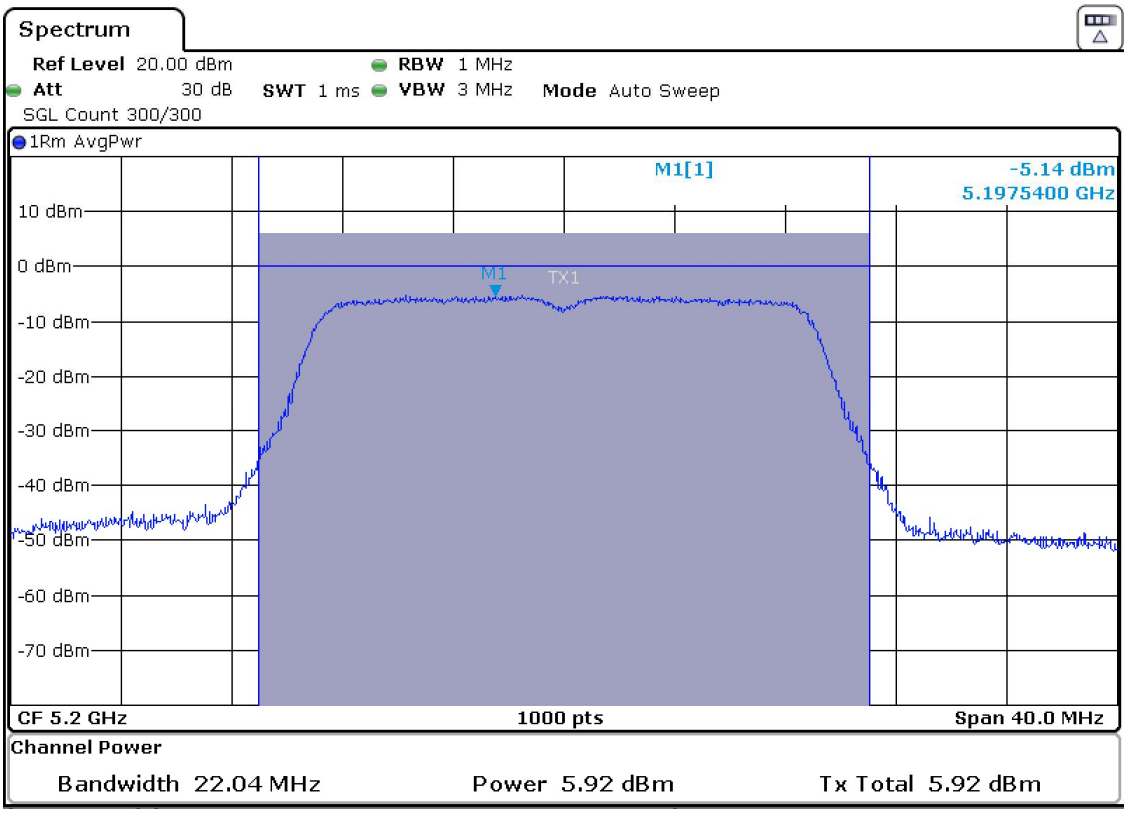


Mode 802.11 n20 (HT20)

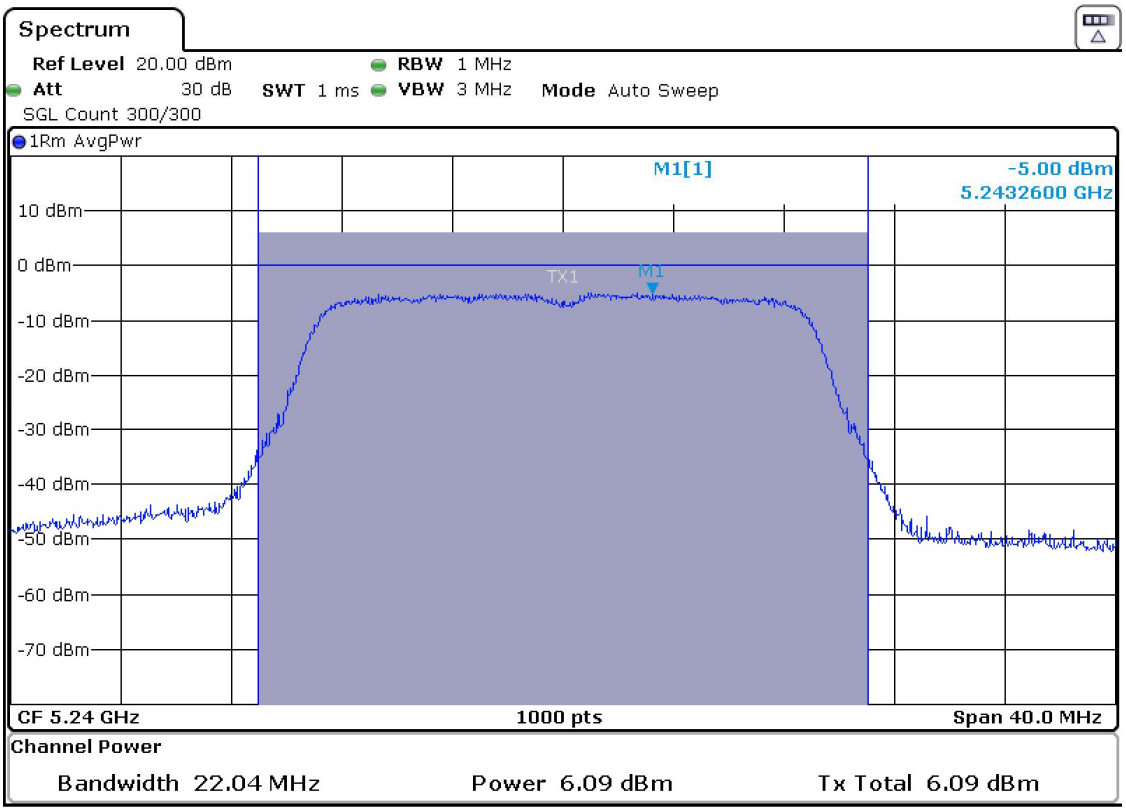
- Low Channel 36:



- Middle Channel 40:

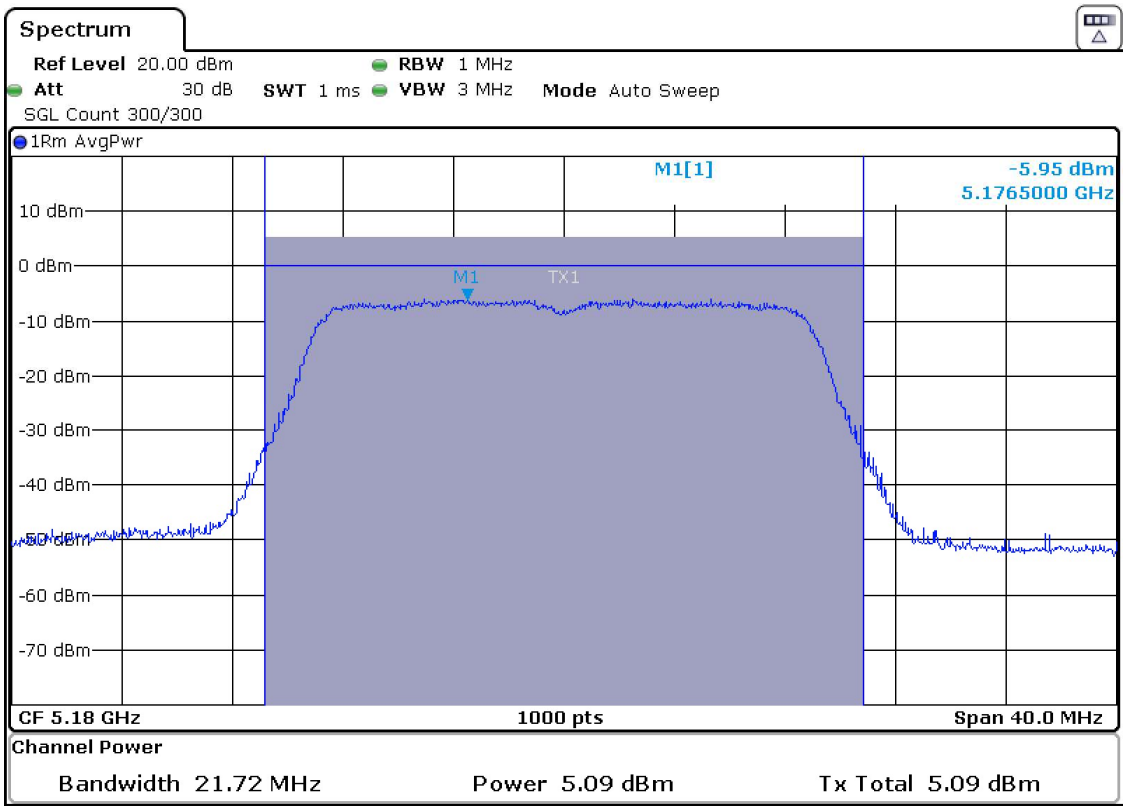


- High Channel 48:

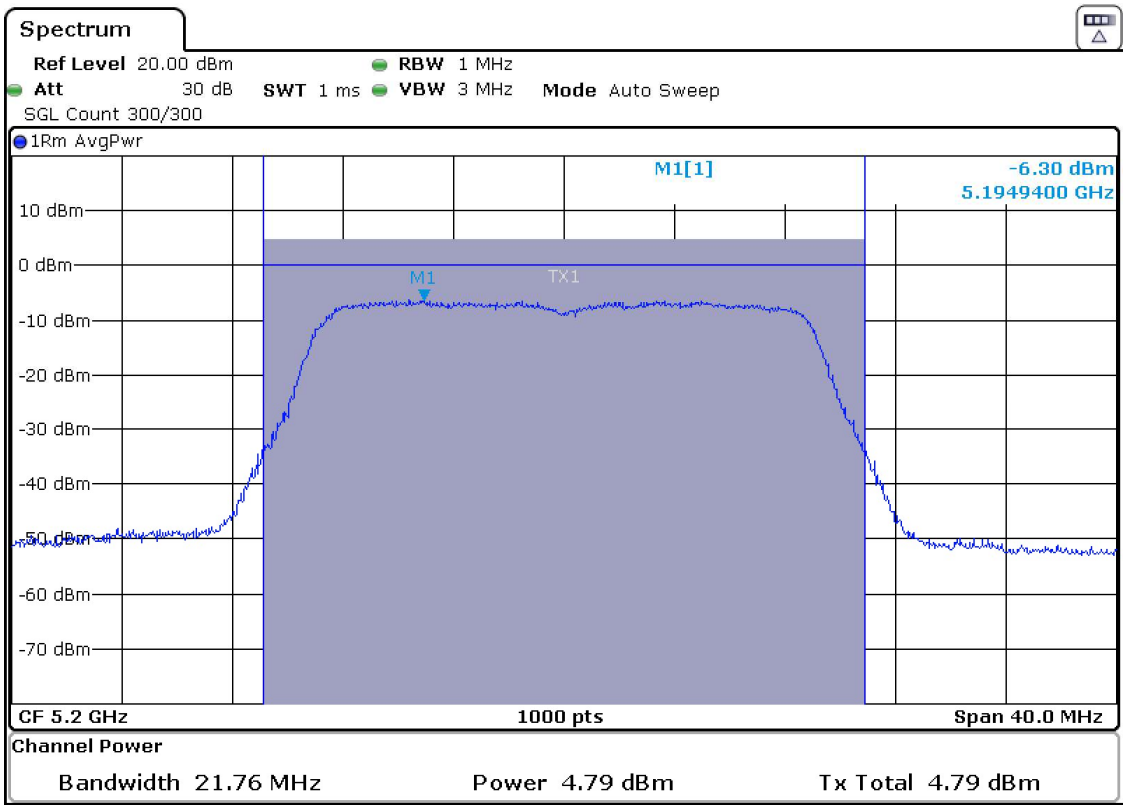
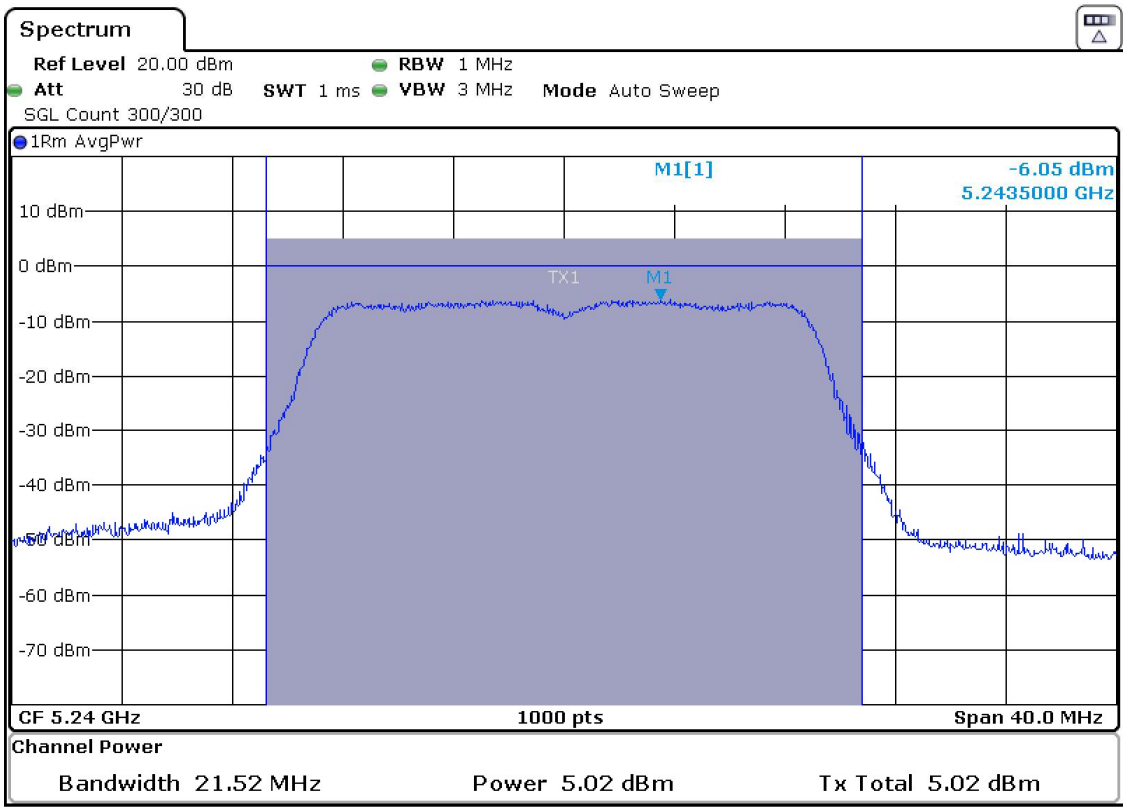


Mode 802.11 ac20 (VHT20)

- Low Channel 36:



- Middle Channel 40:



- High Channel 48: