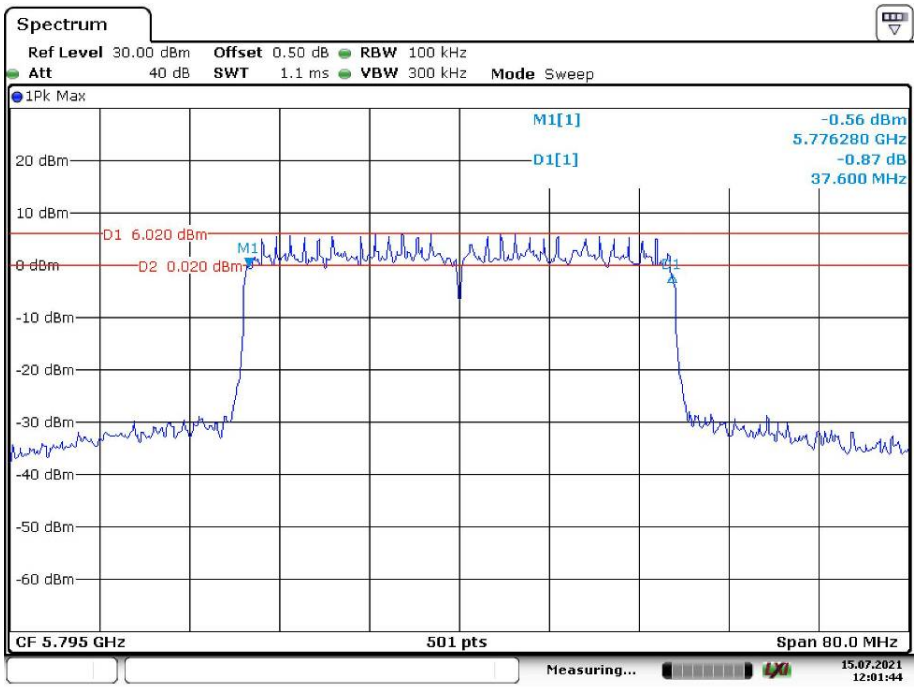
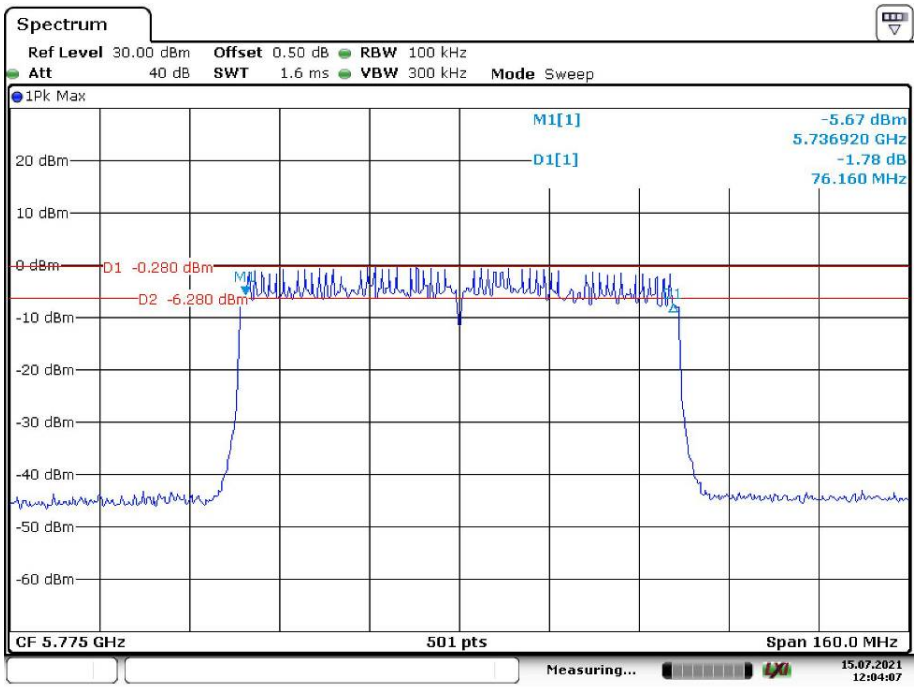
802.11 ax hew40 High Channel



Date: 15.JUL.2021 12:01:44

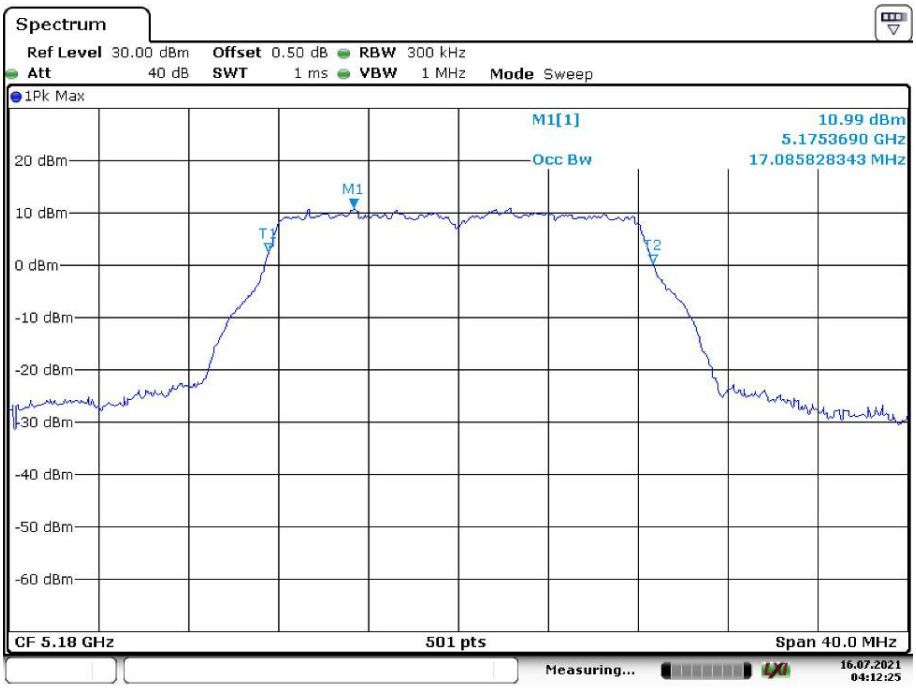
802.11 ax hew80 Middle Channel



Date: 15.JUL.2021 12:04:07

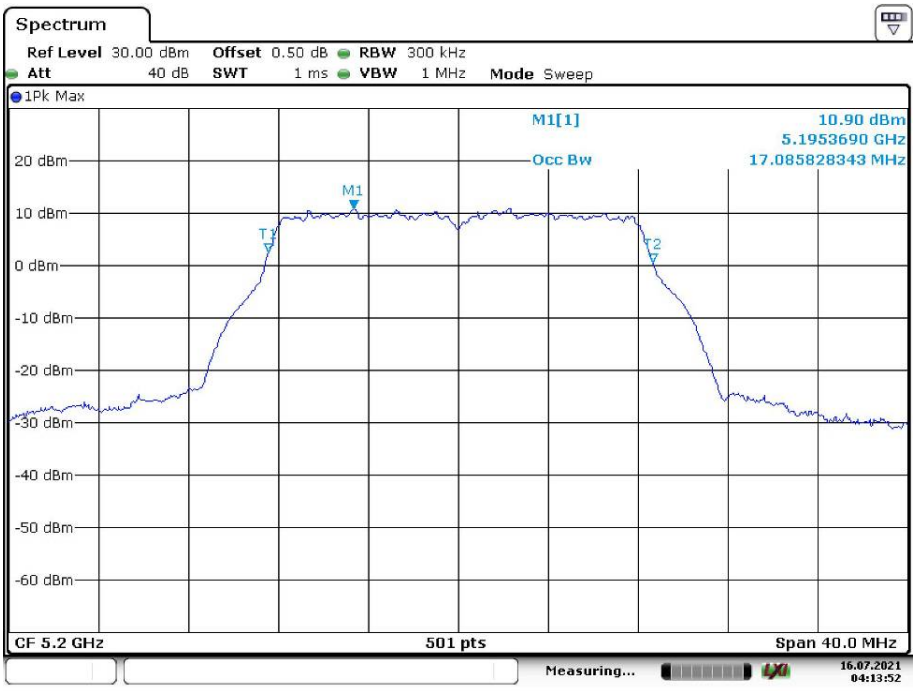
99% Occupied Bandwidth:
5150-5250 MHz:

802.11a Low Channel



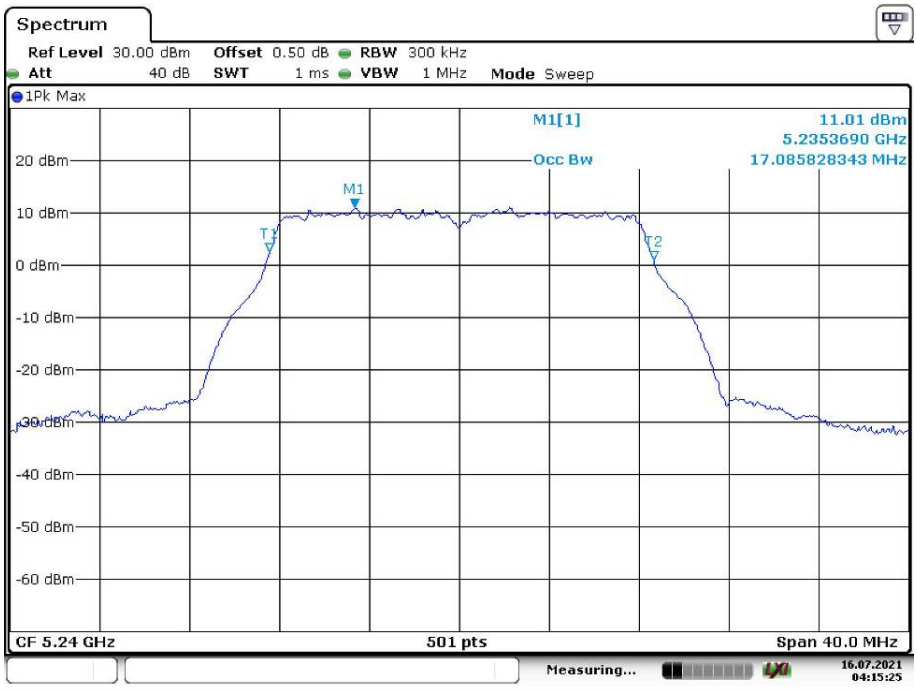
Date: 16.JUL.2021 04:12:26

802.11a Middle Channel



Date: 16.JUL.2021 04:13:53

802.11a High Channel



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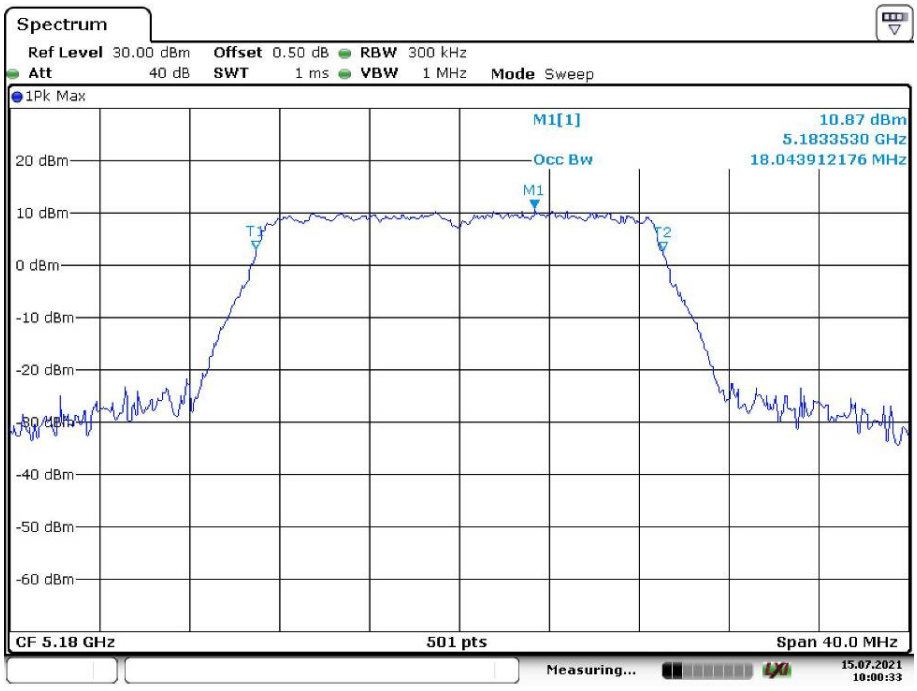
802.11n ht20 Low Channel



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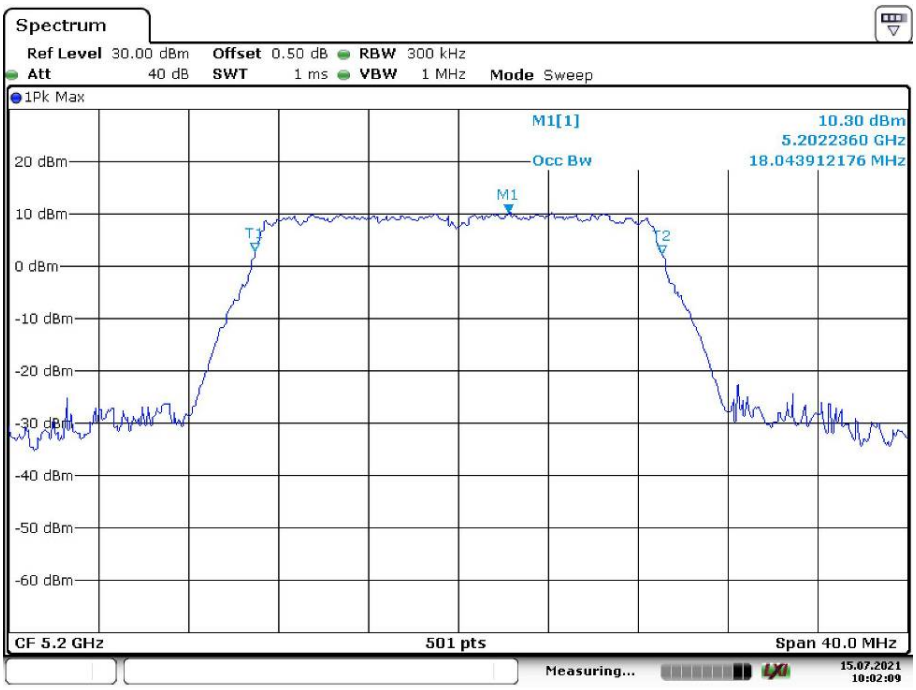
802.11n ht20 Middle Channel



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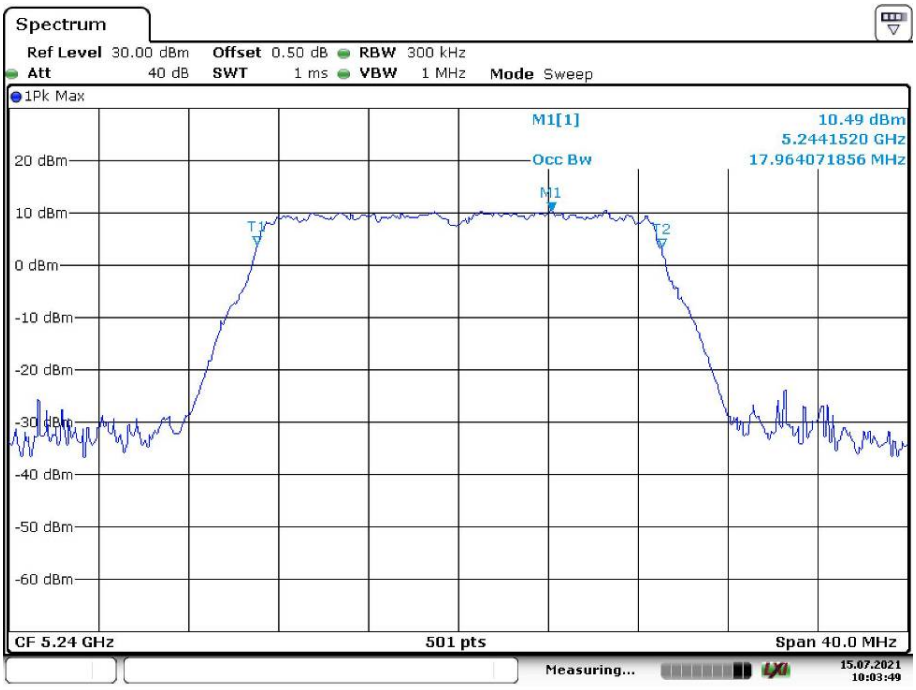
802.11n ht20 High Channel



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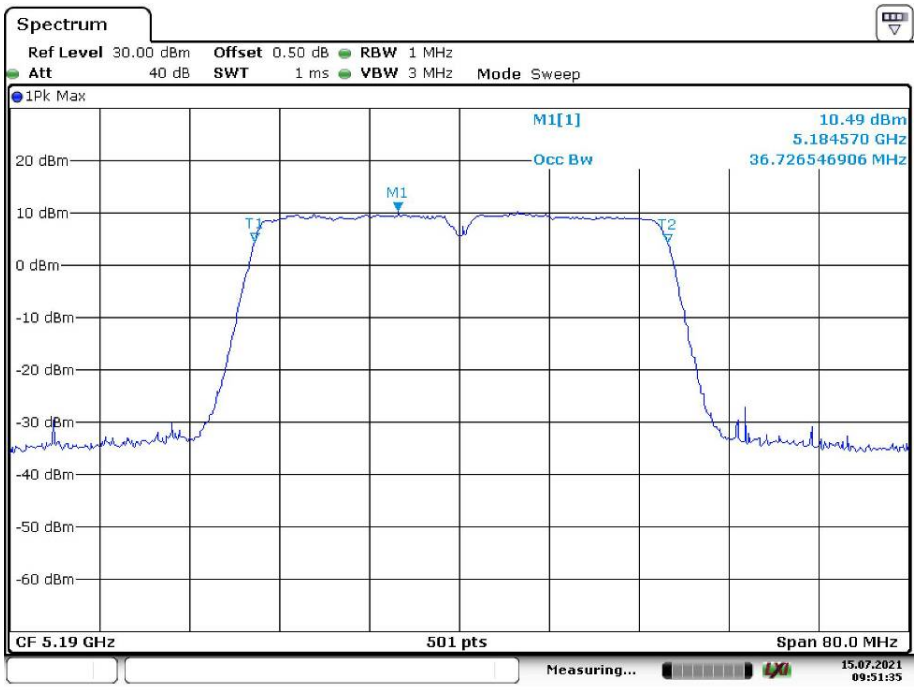
802.11n ht40 Low Channel



Date: 15.JUL.2021 09:51:35

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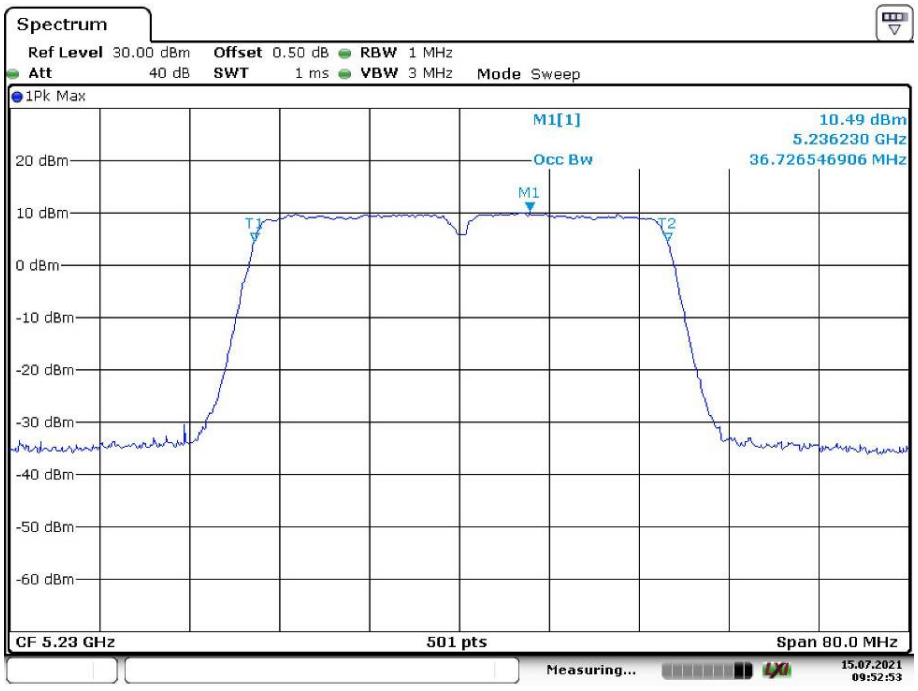

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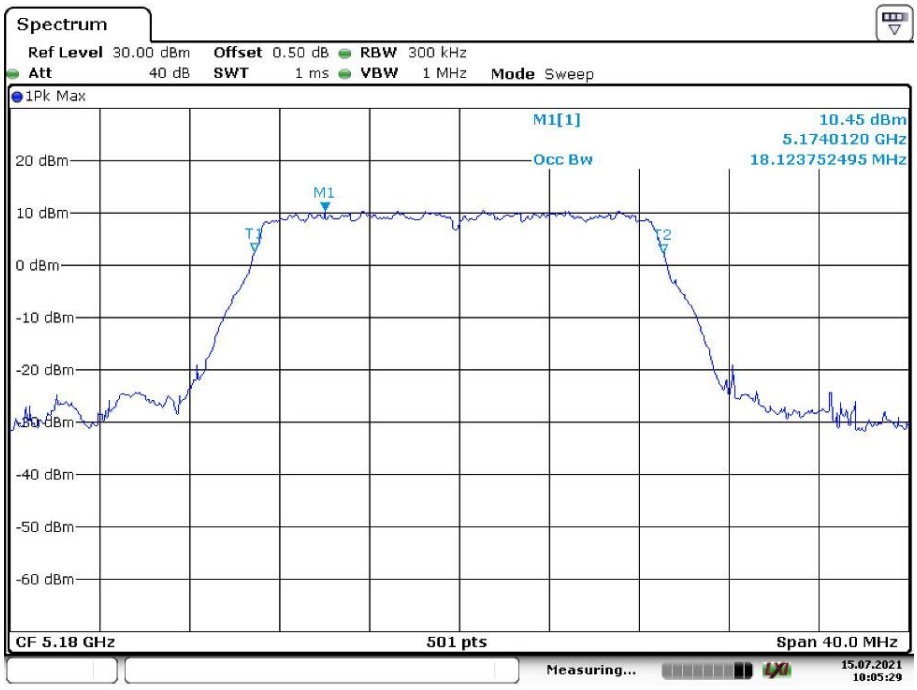
802.11ac vht20 Low Channel



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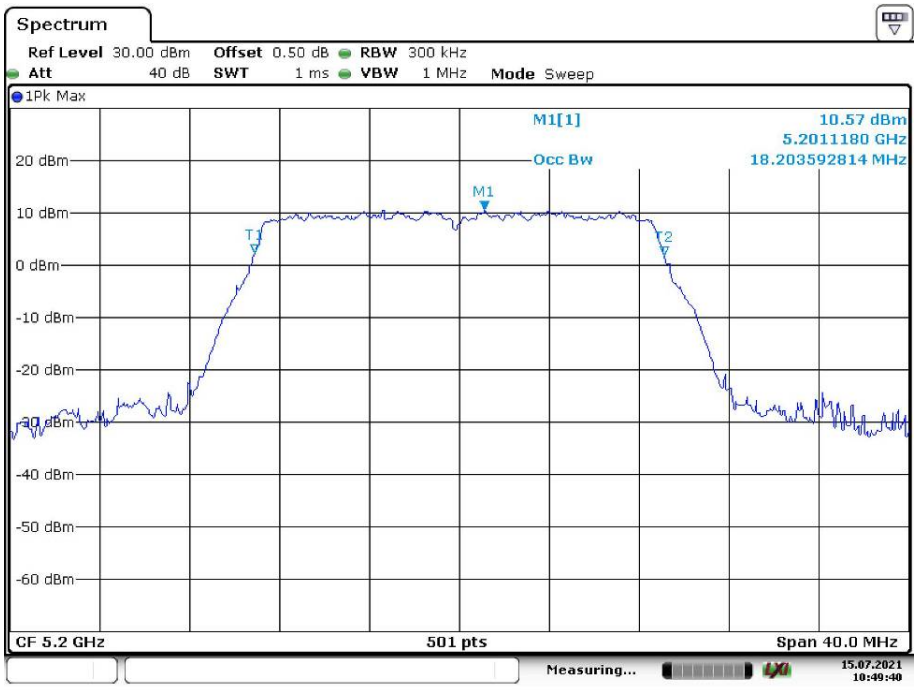
802.11ac vht20 Middle Channel



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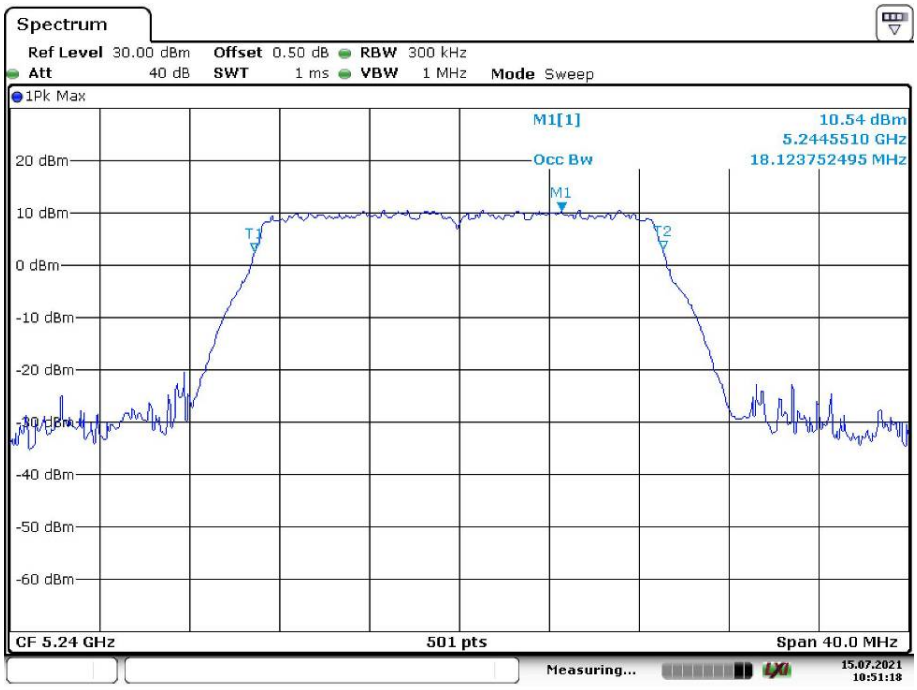
802.11ac vht20 High Channel



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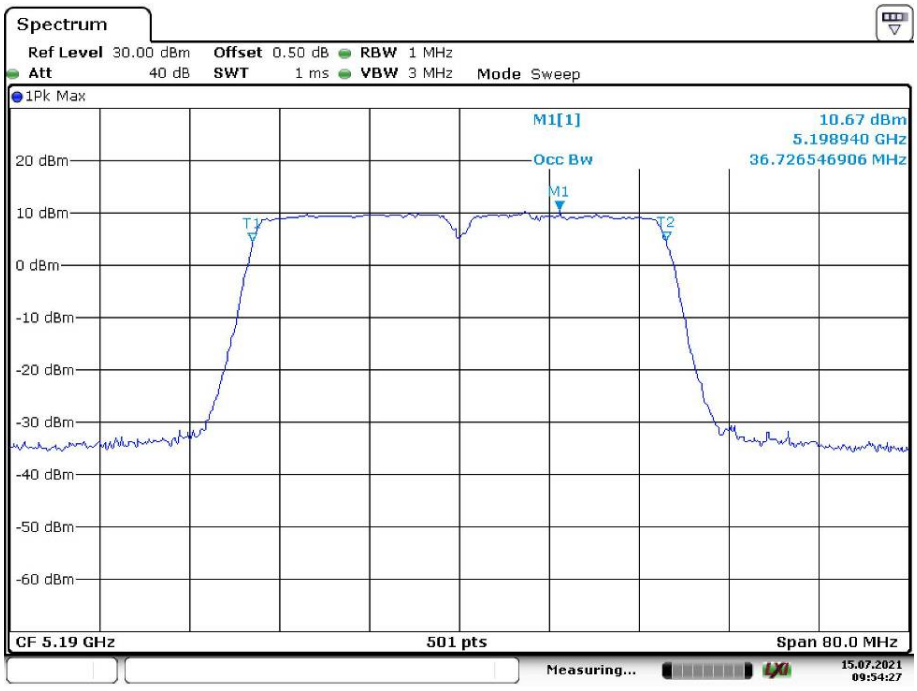

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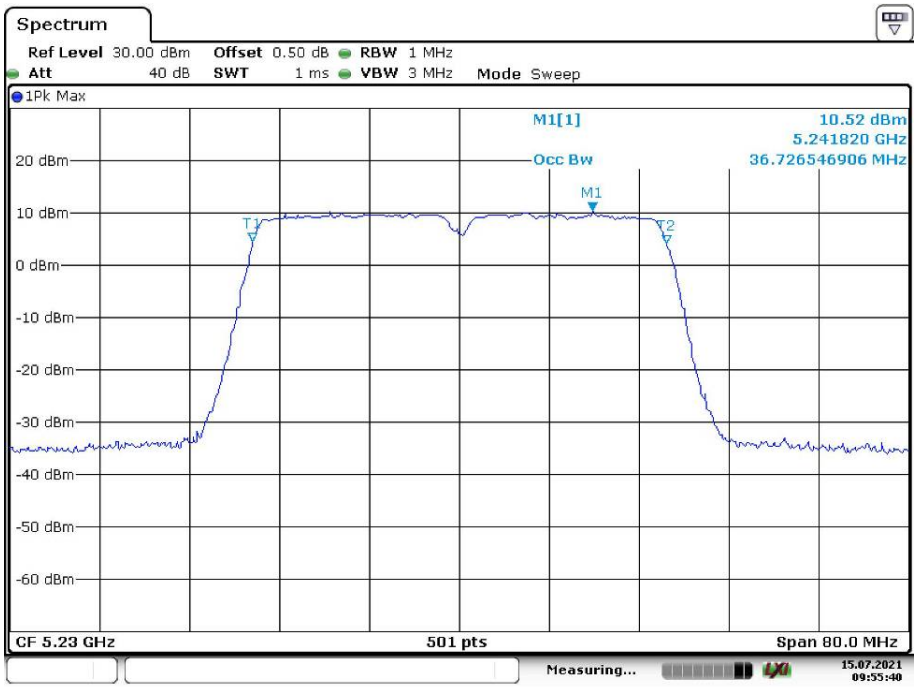
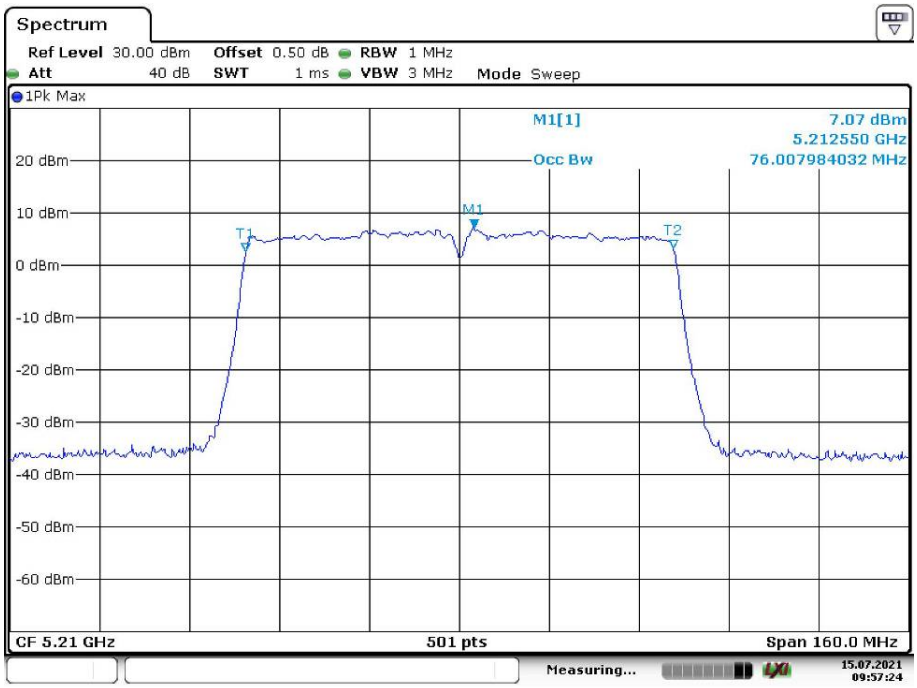
802.11ac vht40 High Channel



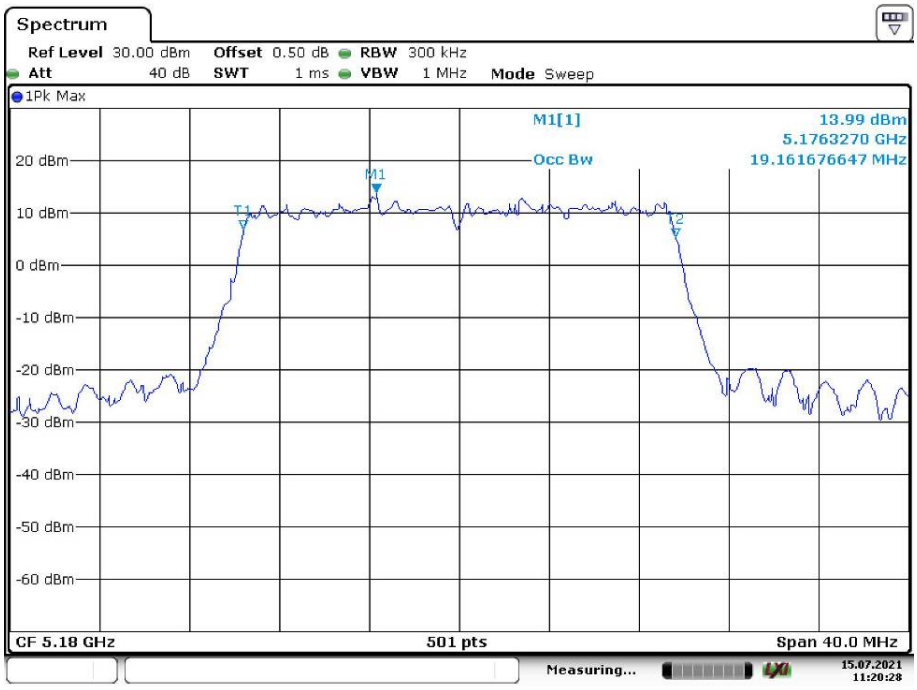
Date: 15.JUL.2021 09:55:40

802.11ac vht80 Middle Channel



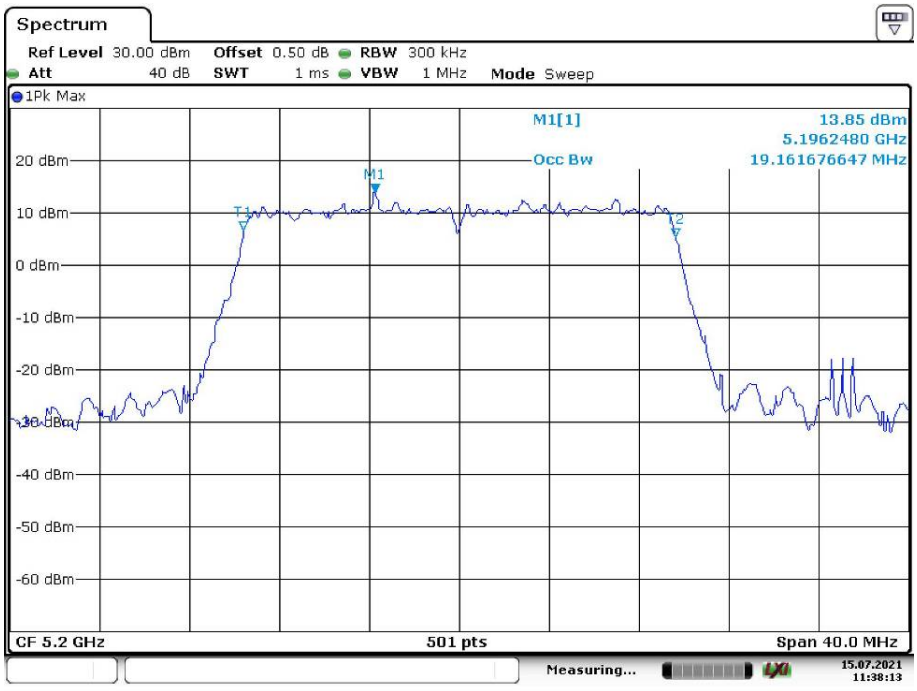
Date: 15.JUL.2021 09:57:24

802.11ax hew20 Low Channel



Date: 15.JUL.2021 11:20:27

802.11ax hew20 Middle Channel



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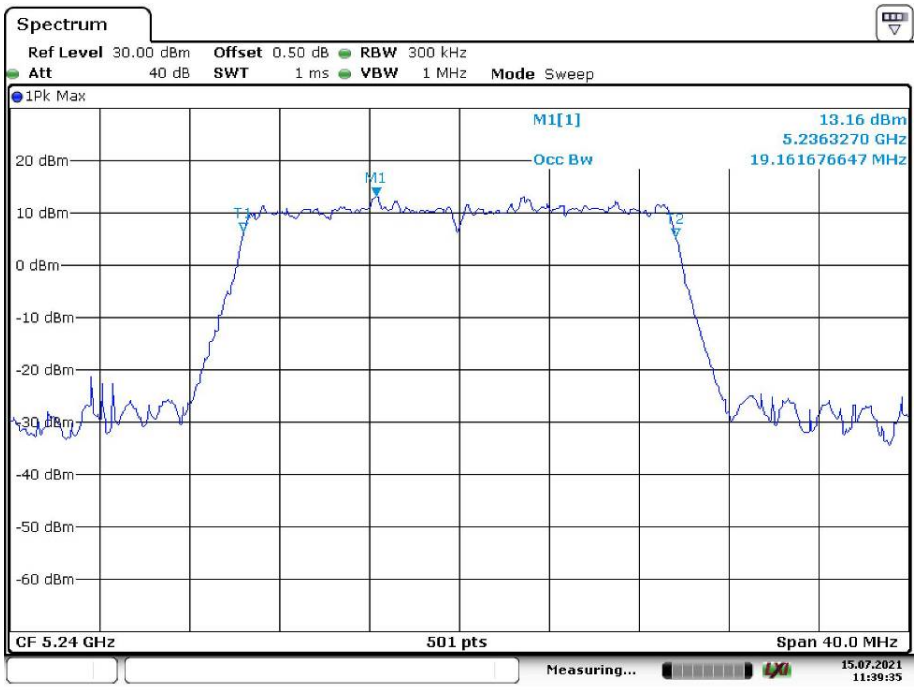
802.11ax hew20 High Channel



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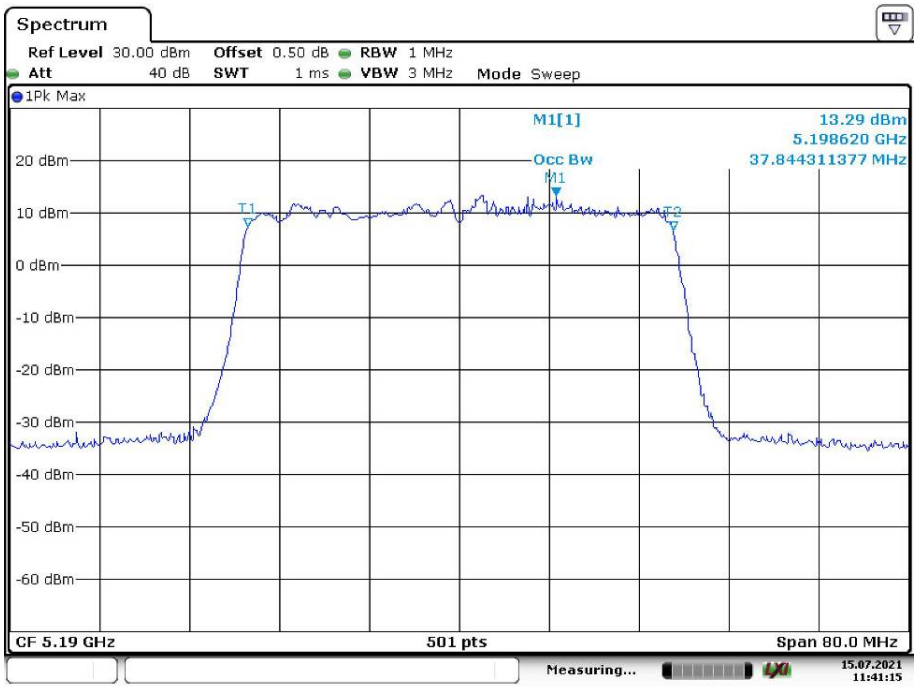
802.11ax hew40 Low Channel



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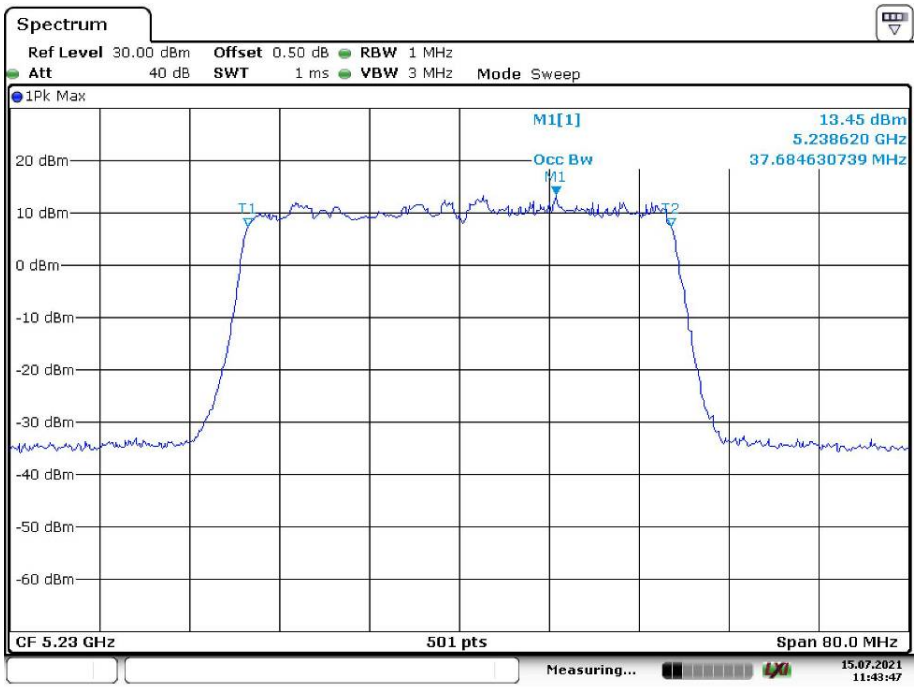
802.11 ax hew40 High Channel



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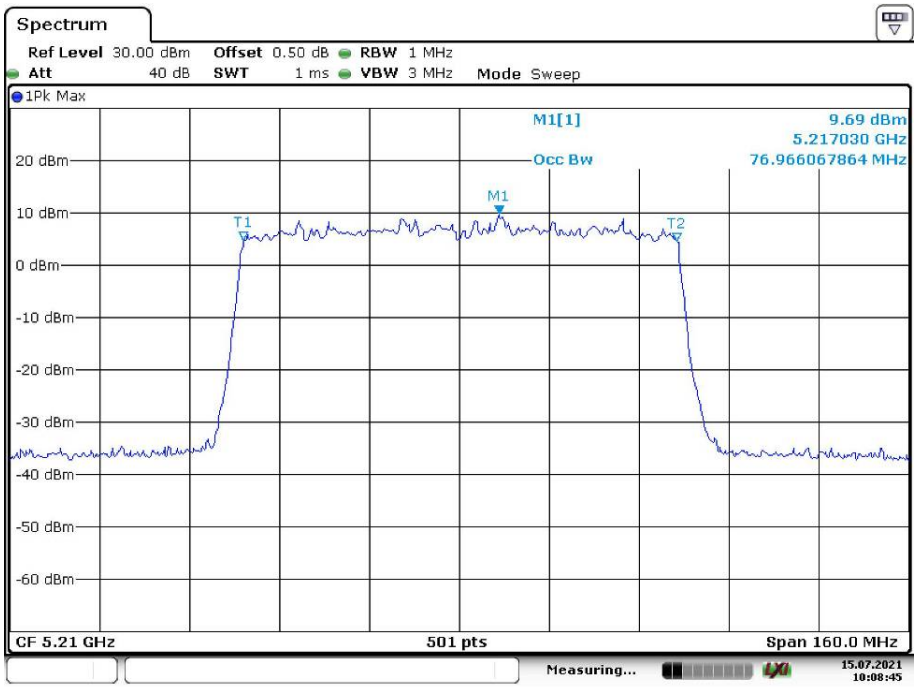
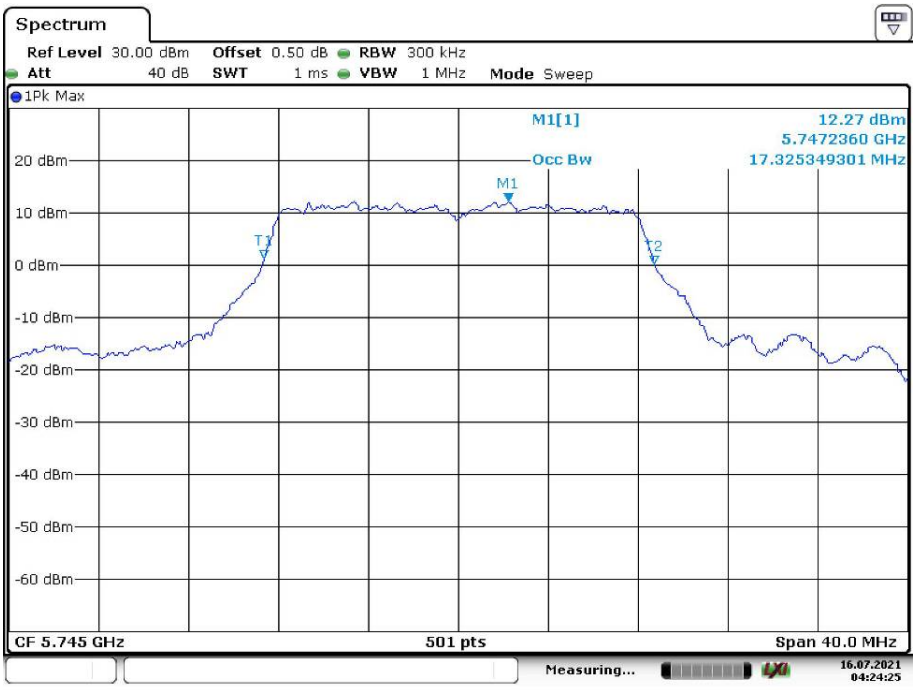
802.11 ax hew80 Middle Channel



Date: 15.JUL.2021 10:08:44

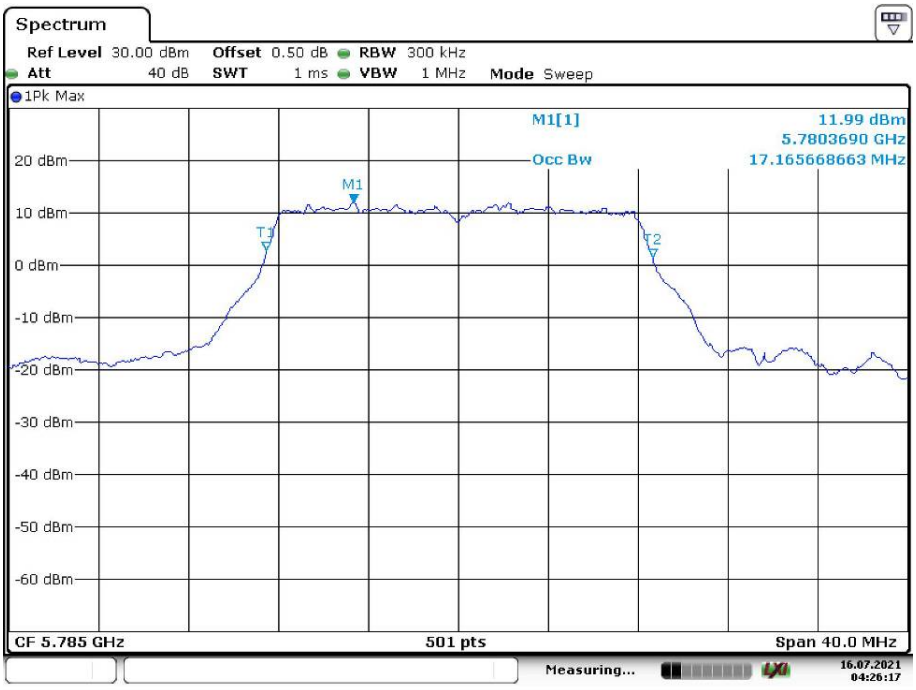
5725-5850 MHz:

802.11a Low Channel



Date: 16.JUL.2021 04:24:25

802.11a Middle Channel



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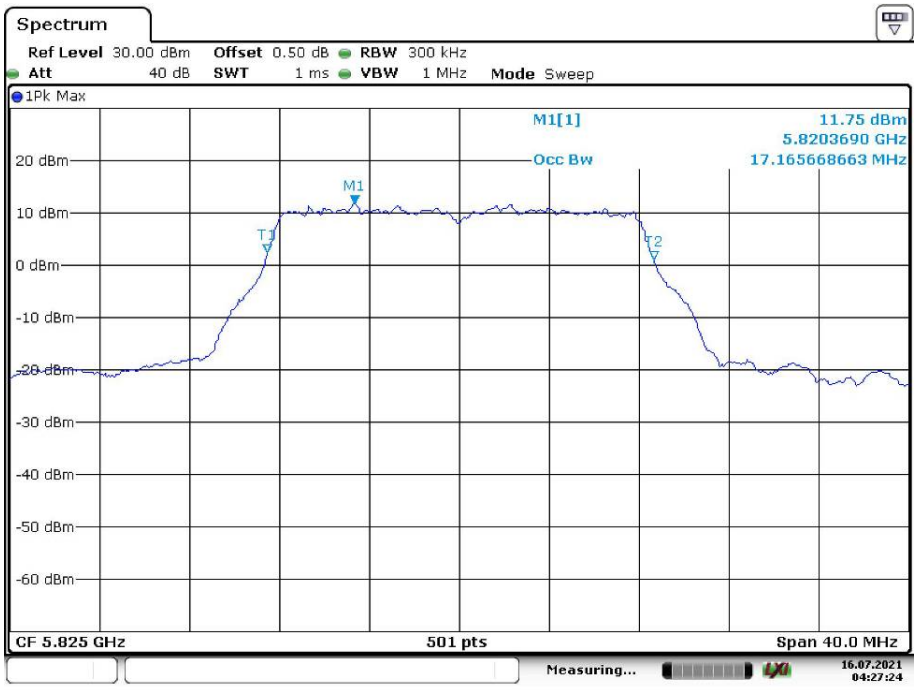
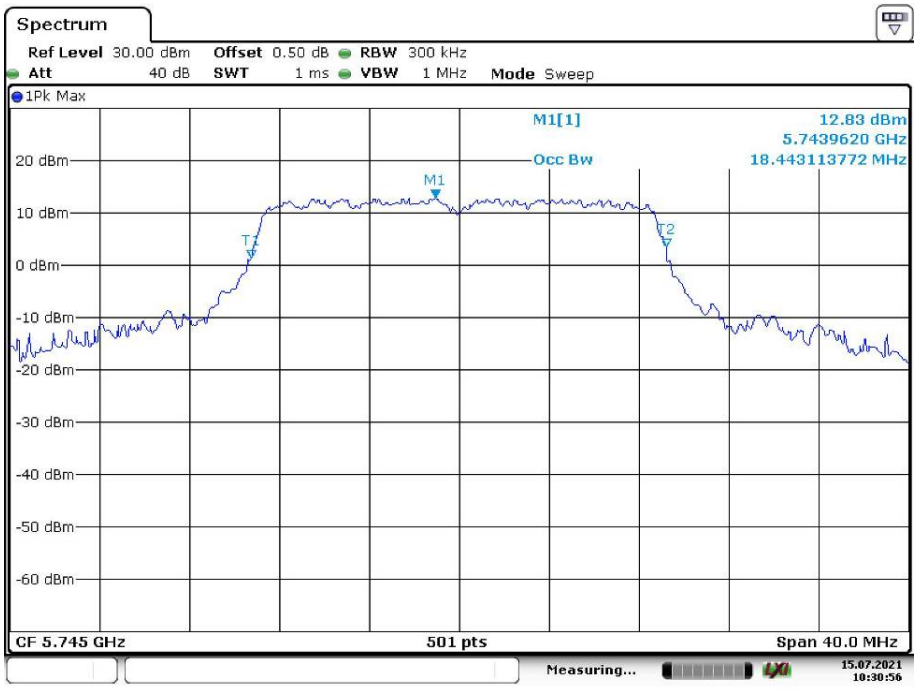


Date: 16.JUL.2021 04:27:24

802.11n ht20 Low Channel



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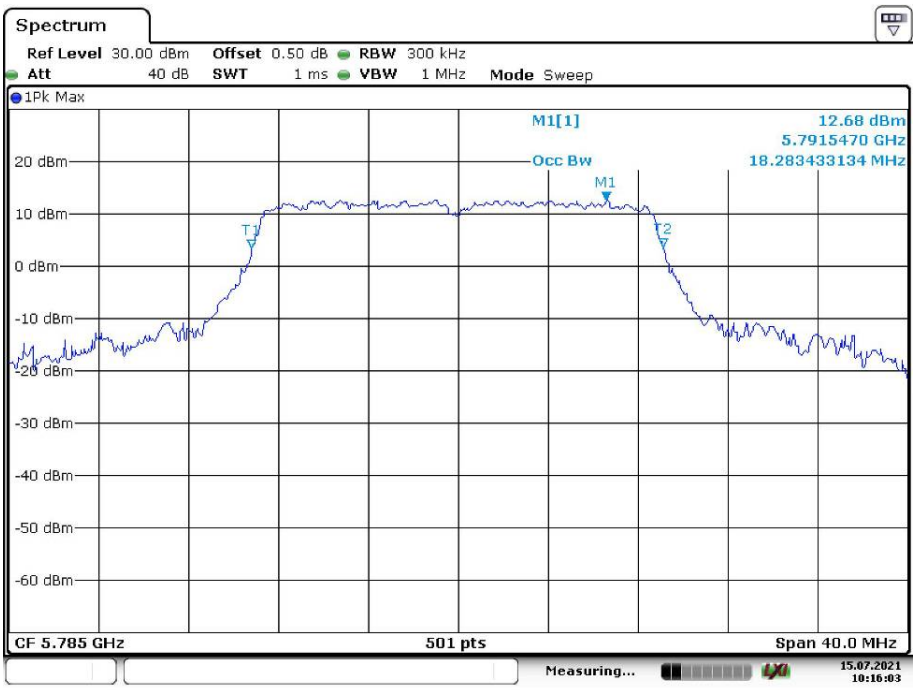

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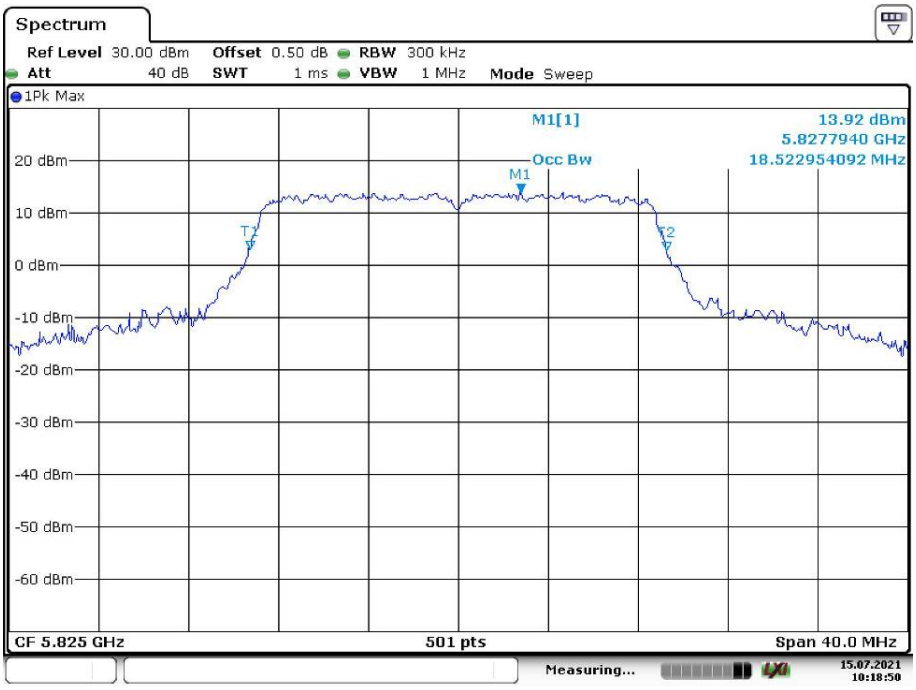

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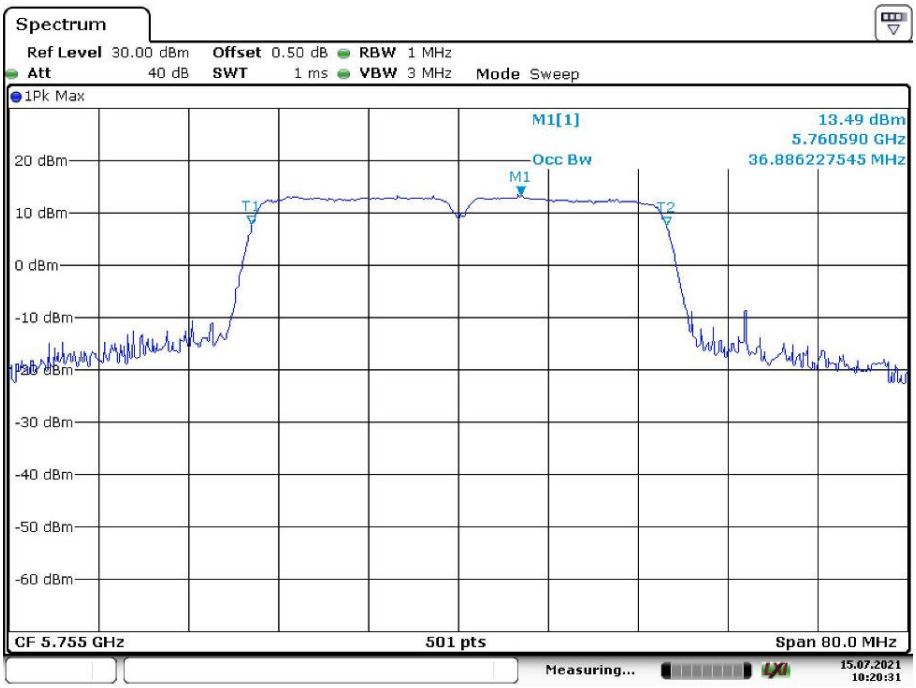
802.11n ht40 Low Channel



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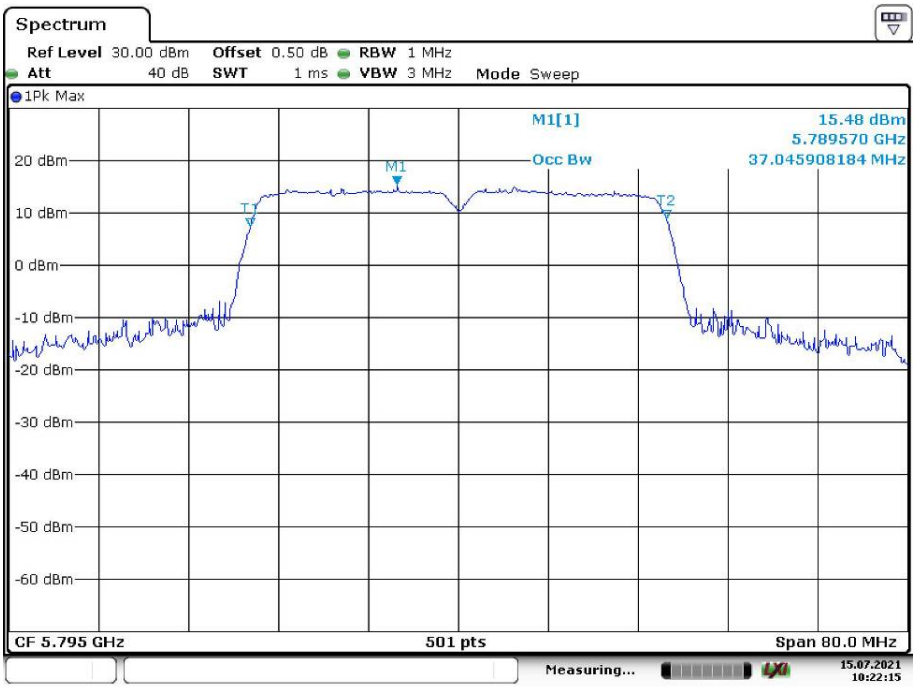
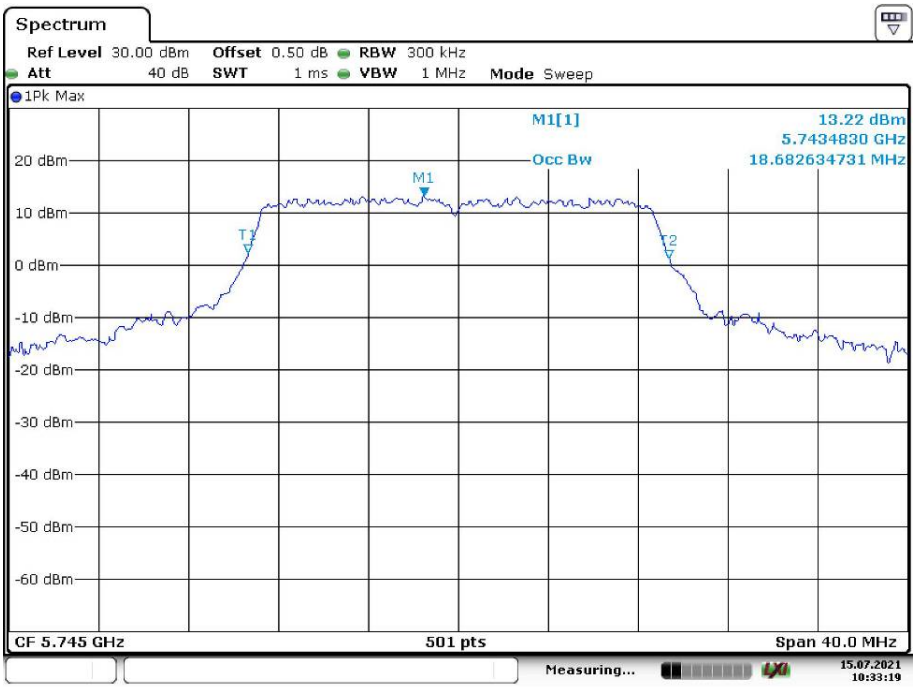
802.11n ht40 High Channel



Date: 15.JUL.2021 10:22:15

802.11ac vht20 Low Channel



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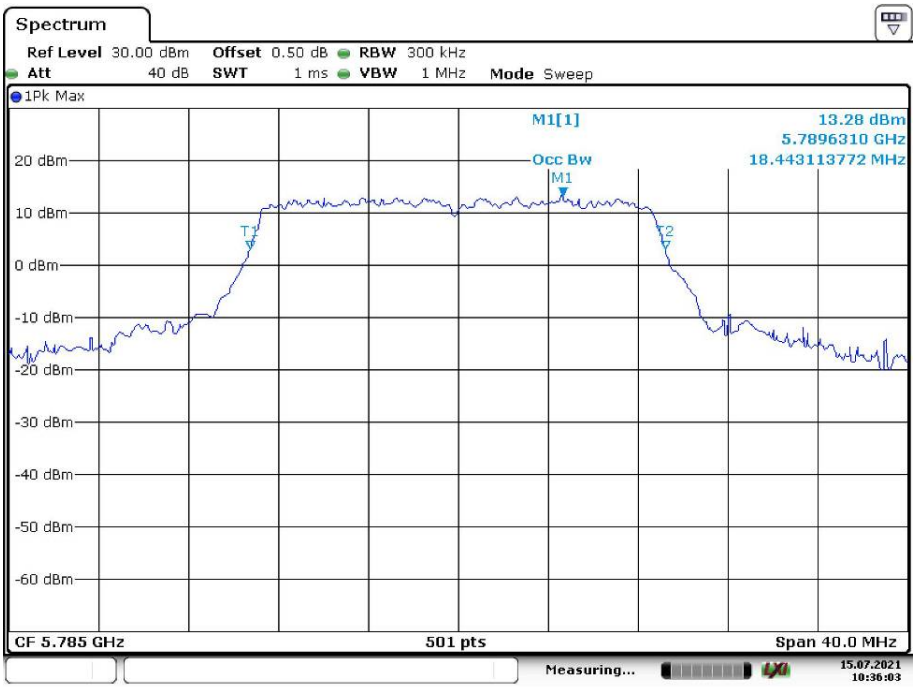
802.11ac vht20 Middle Channel



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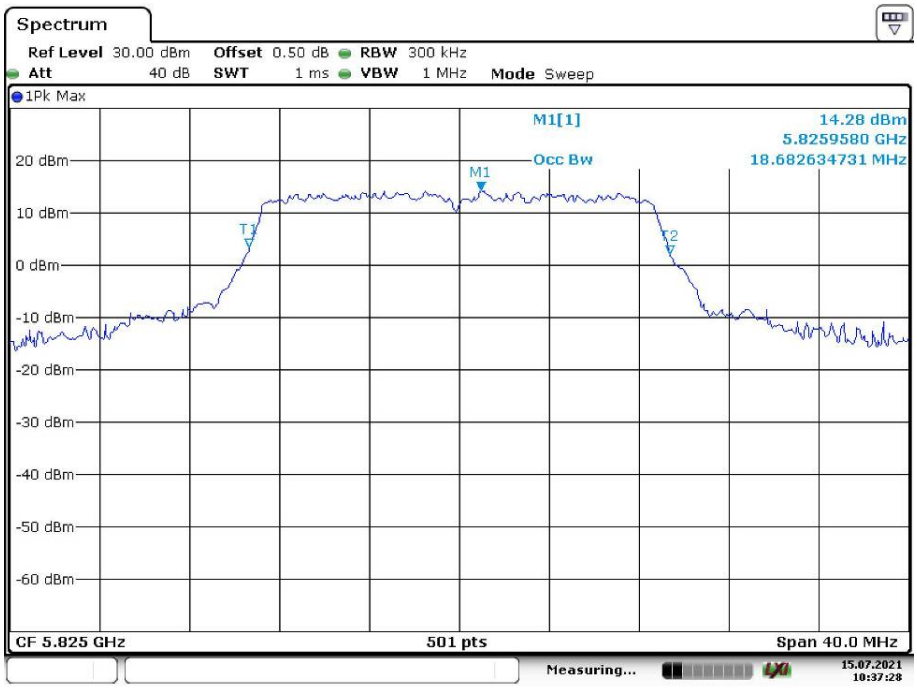

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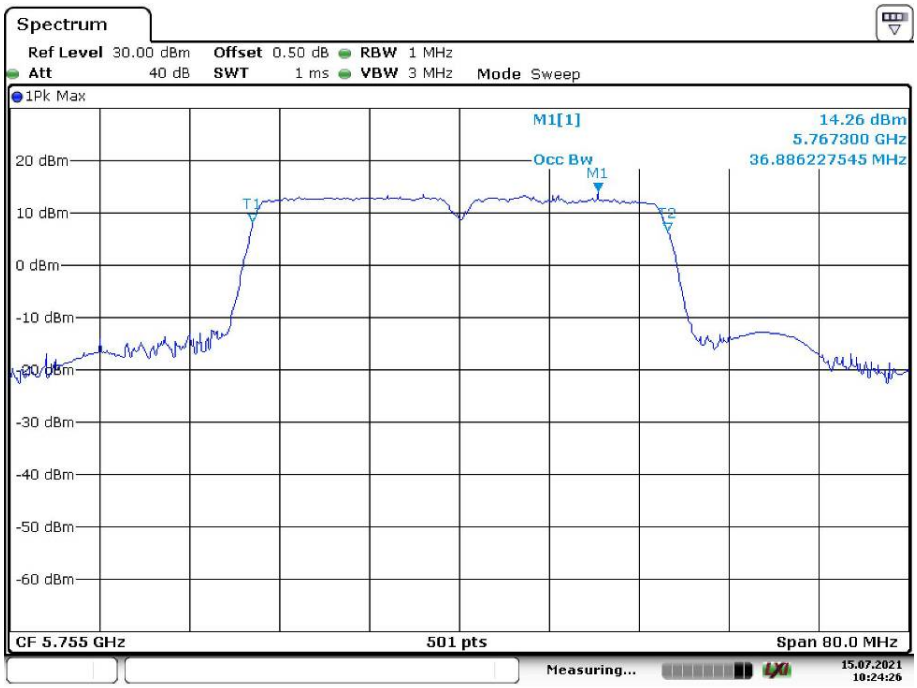

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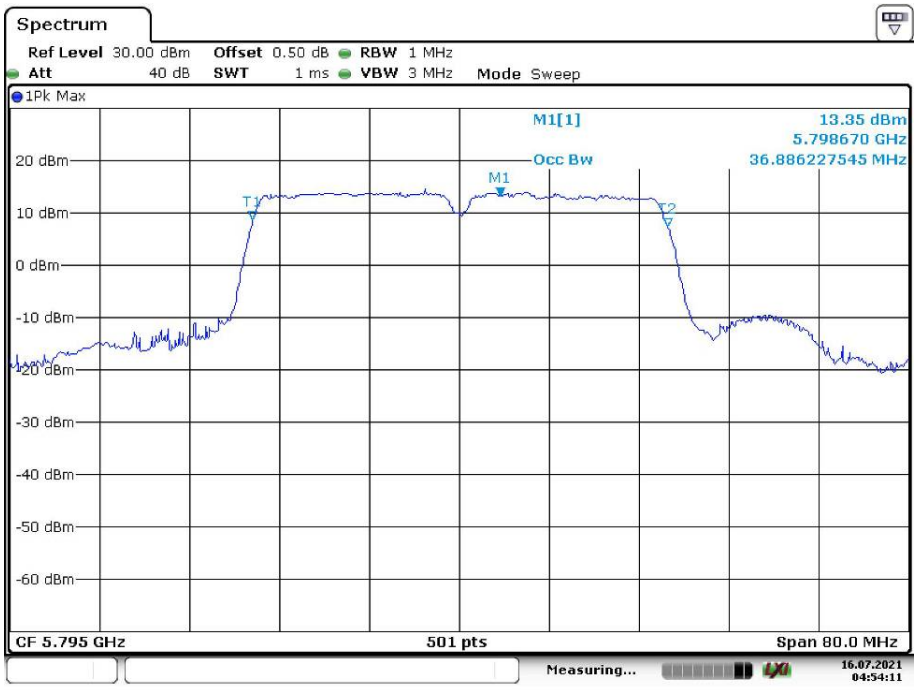
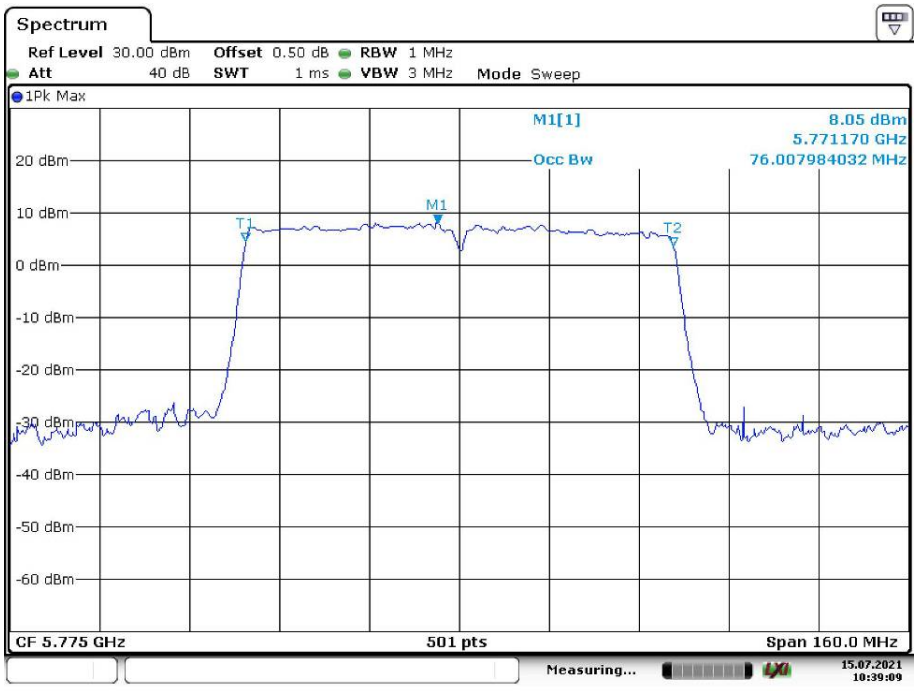


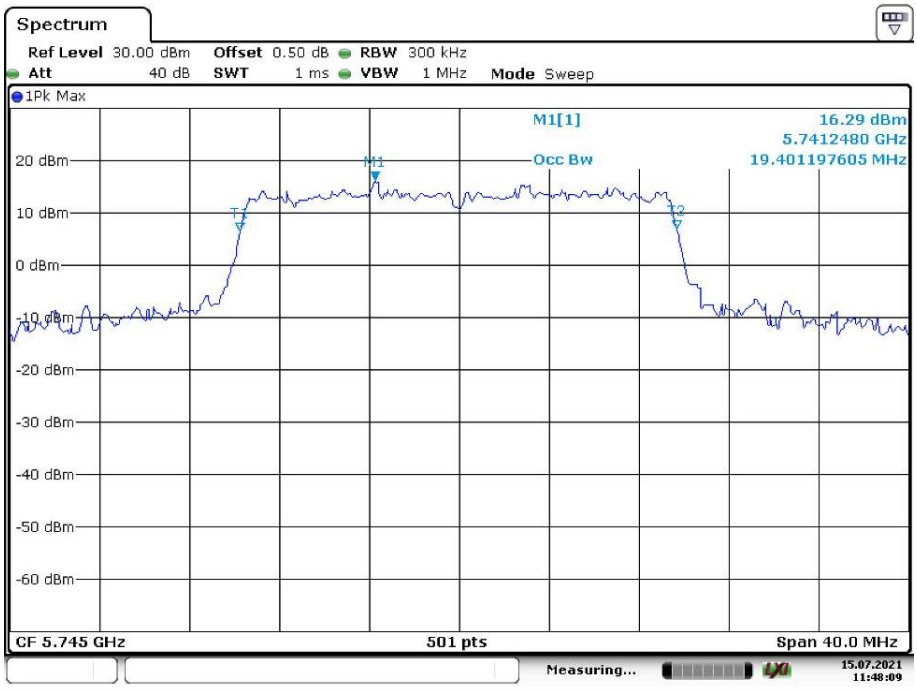
Date: 16.JUL.2021 04:54:12

802.11ac vht80 Middle Channel



Date: 15.JUL.2021 10:39:09

802.11ax hew20 Low Channel



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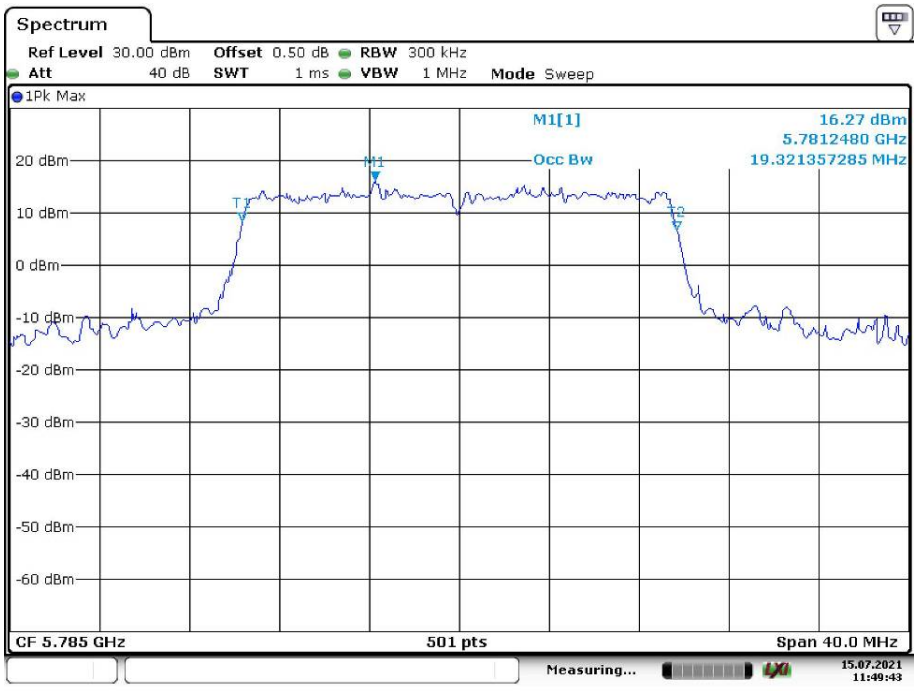
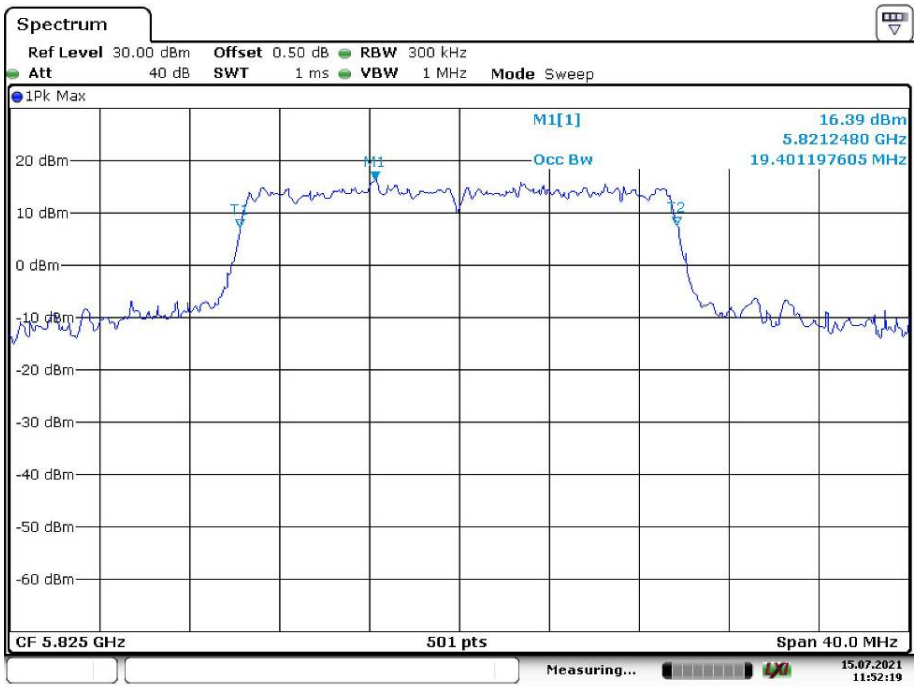


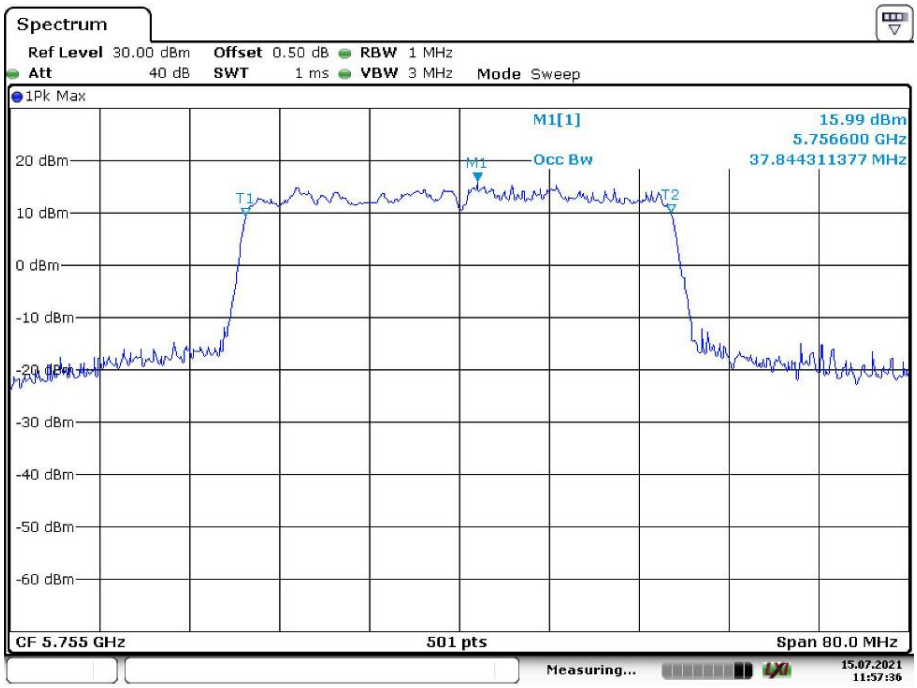
Date: 15.JUL.2021 11:49:43

802.11ax hew20 High Channel



Date: 15.JUL.2021 11:52:19

802.11ax hew40 Low Channel



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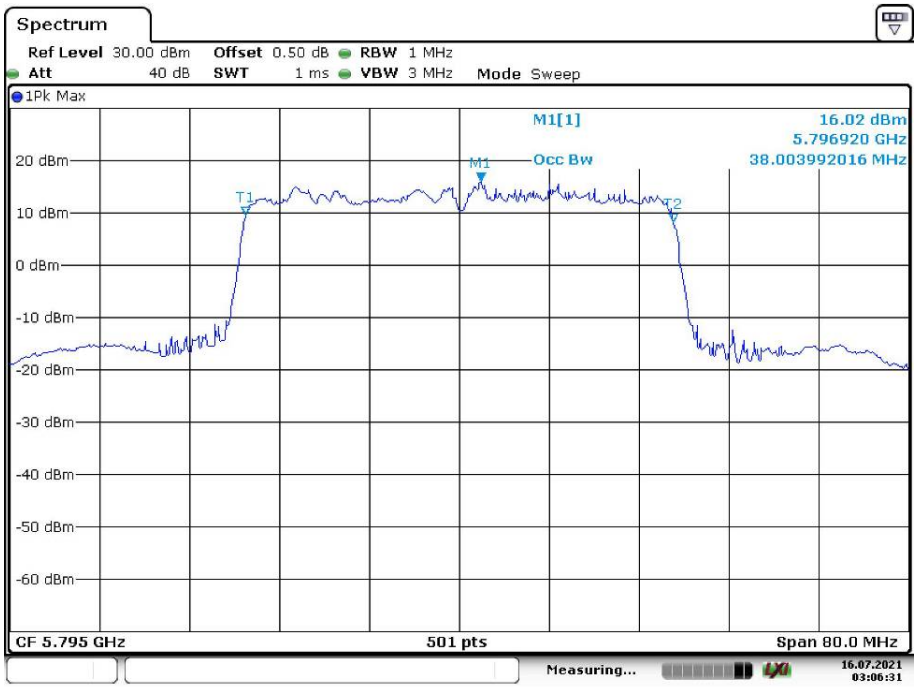
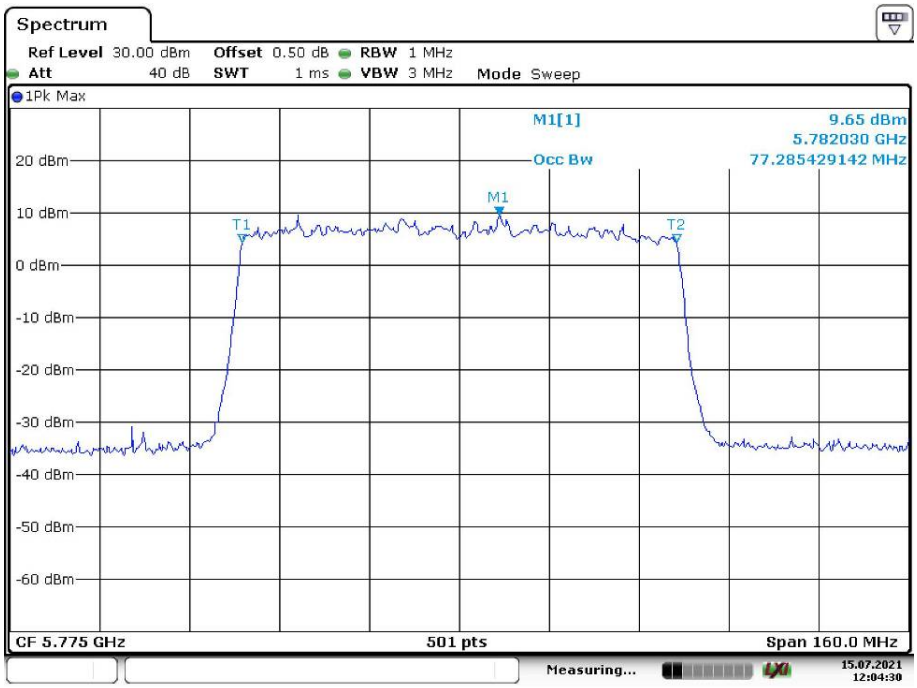
802.11 ax hew40 High Channel



Date: 16.JUL.2021 03:06:32

802.11 ax hew80 Middle Channel



Date: 15.JUL.2021 12:04:30

FCC §15.407(a) –MAXIMUM CONDUCTED OUTPUT POWER

Applicable Standard

According to FCC §15.407(a)

(a) Power limits:

(1) For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi 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 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi 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 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. 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.

(iv) For mobile and portable 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 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi 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 dBi.

(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 dBm 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi 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 dBi.

(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 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi 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 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi 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.

(4) The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A
E-Microwave	Coaxial Attenuators	EMCA10-5RN-6	OE01203239	Each time	N/A
Agilent	USB Wideband Power Sensor	U2022XA	MY5417006	2020-09-12	2021-09-12

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01

Test Data

Environmental Conditions

Temperature:	26.2 °C
Relative Humidity:	47 %
ATM Pressure:	100.3 kPa
Test by:	Bond Qin
Test Date:	2021-07-16

Test Mode: Transmitting

Band	Mode	Channel	Frequency (MHz)	Maximum Average Conducted Output Power (dBm)			Limit For Non-beamforming (dBm)	Limit For beamforming (dBm)
				Chain 0	Chain 1	Total		
5150 - 5250 MHz	802.11 a	Low	5180	21.74	21.98	/	30	/
		Middle	5200	21.73	22.02	/	30	/
		High	5240	21.67	21.88	/	30	/
	802.11n ht20	Low	5180	21.53	22.71	25.17	30	29.2
		Middle	5200	21.49	22.32	24.94	30	29.2
		High	5240	21.43	22.59	25.06	30	29.2
	802.11n ht40	Low	5190	17.54	18.49	21.05	30	29.2
		High	5230	17.32	18.45	20.93	30	29.2
	802.11ac vht20	Low	5180	21.4	22.54	25.02	30	29.2
		Middle	5200	21.37	22.32	24.88	30	29.2
		High	5240	21.35	22.67	25.07	30	29.2
	802.11ac vht40	Low	5190	17.51	18.24	20.9	30	29.2
		High	5230	17.54	18.19	20.89	30	29.2
	802.11ac vht80	Middle	5210	17.41	18.89	21.22	30	29.2
	802.11ax hew20	Low	5180	21.43	22.16	24.82	30	29.2
		Middle	5200	21.56	22.35	24.98	30	29.2
		High	5240	21.72	22.31	25.04	30	29.2
	802.11ax hew40	Low	5190	17.45	18.88	21.23	30	29.2
		High	5230	17.32	18.82	21.14	30	29.2
	802.11ax hew80	Middle	5210	17.21	18.84	21.11	30	29.2
5725 - 5850 MHz	802.11 a	Low	5745	20.89	20.32	/	30	/
		Middle	5785	20.67	20.42	/	30	/
		High	5825	20.81	20.33	/	30	/
	802.11n ht20	Low	5745	21.74	21.05	24.42	30	29.2
		Middle	5785	21.89	21.12	24.53	30	29.2
		High	5825	22.45	21.89	25.19	30	29.2
	802.11n ht40	Low	5755	18.85	18.86	21.87	30	29.2
		High	5795	21.65	21.89	24.78	30	29.2
	802.11 ac vht20	Low	5745	22.08	21.05	24.61	30	29.2
		Middle	5785	22.19	21.21	24.74	30	29.2
		High	5825	22.85	21.98	25.45	30	29.2
	802.11 ac vht40	Low	5755	19.28	18.98	22.14	30	29.2
		High	5795	21.39	21.65	24.53	30	29.2
	802.11 ac vht80	Middle	5775	18.06	17.93	21.01	30	29.2
	802.11 ax hew20	Low	5745	22.69	23.62	26.19	30	29.2
		Middle	5785	22.48	23.55	26.06	30	29.2
		High	5825	22.56	24.49	26.64	30	29.2
	802.11 ax hew40	Low	5755	19.52	19.74	22.64	30	29.2
		High	5795	21.25	21.21	24.24	30	29.2
	802.11 ax hew80	Middle	5775	17.04	17.13	20.1	30	29.2

Note:
The device is an indoor AP.
The duty cycle factor has been calculated into the test data.

The maximum antenna gain is 3.8dBi in 5GHz band. The device employed Cyclic Delay Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01, for power measurements on IEEE 802.11 devices:

Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4;

So:
For Non-beamforming mode:
Directional gain = 3.8dBi
For Beamforming mode:
Directional gain = 3.8+3 =6.8 dBi

FCC §15.407(a) - POWER SPECTRAL DENSITY

Applicable Standard

According to FCC §15.407(a)

(a) Power limits:

(1) For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi 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 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi 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 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. 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.

(iv) For mobile and portable 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 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi 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 dBi.

(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 dBm 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi 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 dBi.

(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 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi 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 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi 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.

Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101591	2021-06-29	2022-06-28
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	26.2 °C
Relative Humidity:	47 %
ATM Pressure:	100.3 kPa
Test by:	Bond Qin
Test Date:	2021-07-16

Test Mode: Transmitting

Test Result:Compliance.Please refer to the following table and plot.

5150-5250MHz:

Mode	Frequency (MHz)	Maximum Power Spectral Density (dBm/MHz)			Limit (dBm/MHz)
		Chain 0	Chain 1	Total	
802.11 a	5180	12.54	12.99	/	17
	5200	12.60	13.06	/	17
	5240	12.77	13.17	/	17
802.11n ht20	5180	10.05	9.45	12.77	13.2
	5200	9.73	9.90	12.83	13.2
	5240	10.08	10.06	13.08	13.2
802.11n ht40	5190	6.32	8.30	10.43	13.2
	5230	6.32	8.40	10.49	13.2
802.11ac vht20	5180	10.17	9.91	13.05	13.2
	5200	9.83	9.98	12.92	13.2
	5240	10.06	10.11	13.1	13.2
802.11ac vht40	5190	6.87	8.44	10.74	13.2
	5230	7.24	8.31	10.82	13.2
802.11ac vht80	5210	4.96	5.91	8.47	13.2
802.11ax hew20	5180	10.01	9.97	13	13.2
	5200	9.84	10.00	12.93	13.2
	5240	9.86	10.10	12.99	13.2
802.11ax hew40	5190	7.89	9.36	11.7	13.2
	5230	8.16	8.81	11.51	13.2
802.11ax hew80	5210	5.34	6.61	9.03	13.2

5725-5850 MHz:

Mode	Frequency (MHz)	Reading (dBm/300kHz)		Maximum Power Spectral Density (dBm/500kHz)			Limit (dBm/500kHz)
		Chain 0	Chain 1	Chain 0	Chain 1	Total	
802.11 a	5745	11.10	10.07	13.32	12.29	/	30
	5785	11.18	10.34	13.40	12.56	/	30
	5825	10.86	10.02	13.08	12.24	/	30
802.11n ht20	5745	12.40	10.84	14.62	13.06	16.92	26.2
	5785	12.32	10.73	14.54	12.95	16.83	26.2
	5825	13.37	11.90	15.59	14.12	17.93	26.2
802.11n ht40	5755	7.35	7.02	9.57	9.24	12.42	26.2
	5795	8.41	8.59	10.63	10.81	13.73	26.2
802.11ac vht20	5745	12.45	10.78	14.67	13.00	16.92	26.2
	5785	12.56	10.84	14.78	13.06	17.01	26.2
	5825	13.35	11.87	15.57	14.09	17.90	26.2
802.11ac vht40	5755	7.21	7.09	9.43	9.31	12.38	26.2
	5795	8.33	8.55	10.55	10.77	13.67	26.2
802.11ac vht80	5775	1.11	0.51	3.33	2.73	6.05	26.2
802.11ax hew20	5745	13.8	15.32	16.02	17.54	19.86	26.2
	5785	13.33	14.81	15.55	17.03	19.36	26.2
	5825	14.26	15.89	16.48	18.11	20.38	26.2
802.11ax hew40	5755	7.25	7.65	9.47	9.87	12.68	26.2
	5795	8.28	9.81	10.50	12.03	14.34	26.2
802.11ax hew80	5775	0.96	1.74	3.18	3.96	6.60	26.2

Note:
The maximum antenna gain is 3.8 dBi in 5GHz band. And beamforming gain is 3dBi.The device employed Cyclic Delay Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01, for power spectral density (PSD) measurements on the devices:

Array Gain = 10 log(NANT/NSS) dB.

So:

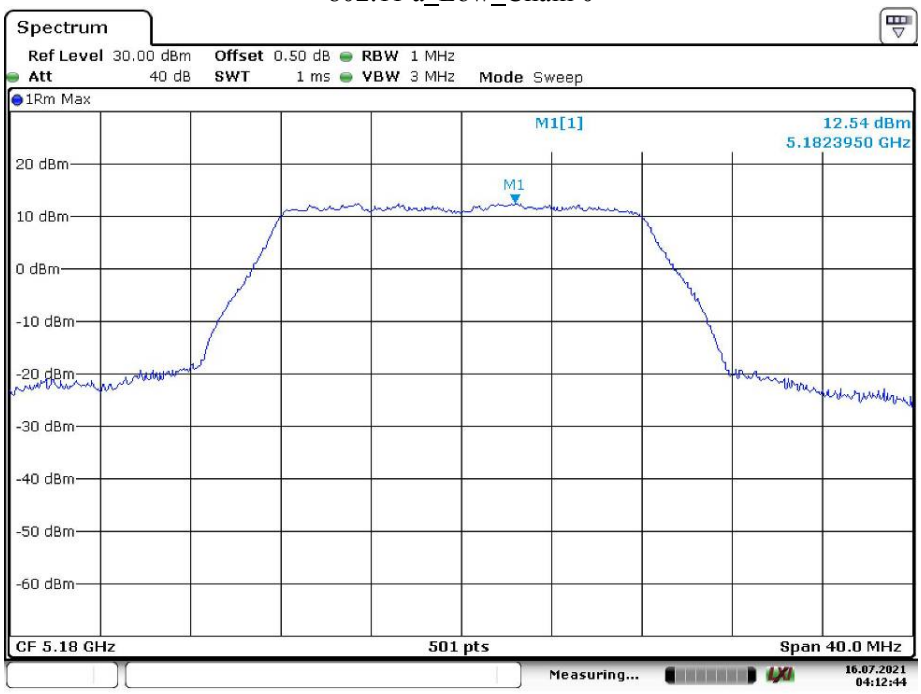
Directional gain = GANT + Array Gain = 3.8dBi+10*log(2/1)=6.8 dBi for Non-beamforming mode
Directional gain = GANT + Array Gain = 3.8dBi+3+10*log(2/1)=9.8 dBi for Beamforming mode

The worst limit Beamforming mode was used in the table.

For 5.8GHz band, If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10log(500kHz/RBW) to the measured result, whereas RBW (< 500 KHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
Method SA-3 in KDB 789033 D02 General UNII Test Procedures New Rules v02r01was used for PSD test.

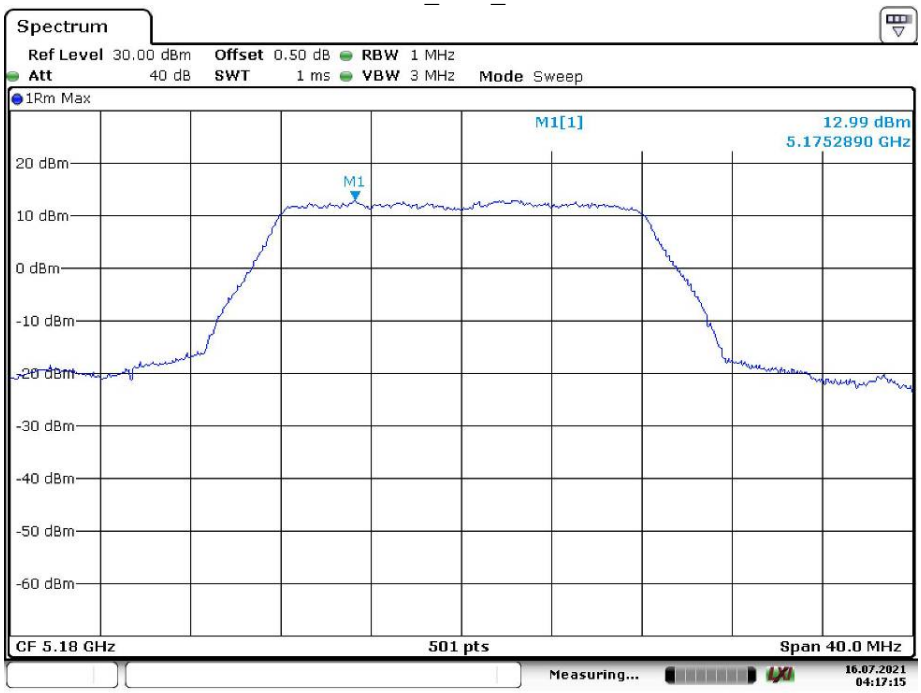
5150-5250 MHz:

802.11 a_Low_Chain 0



Date: 16.JUL.2021 04:12:45

802.11 a_Low_Chain 1



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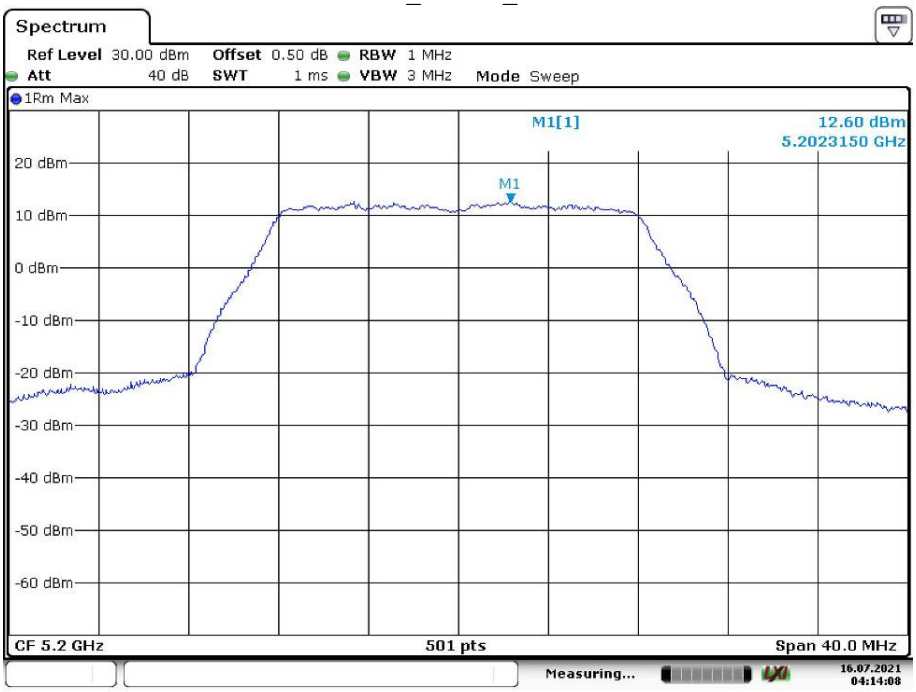
802.11 a_Middle_Chain 0



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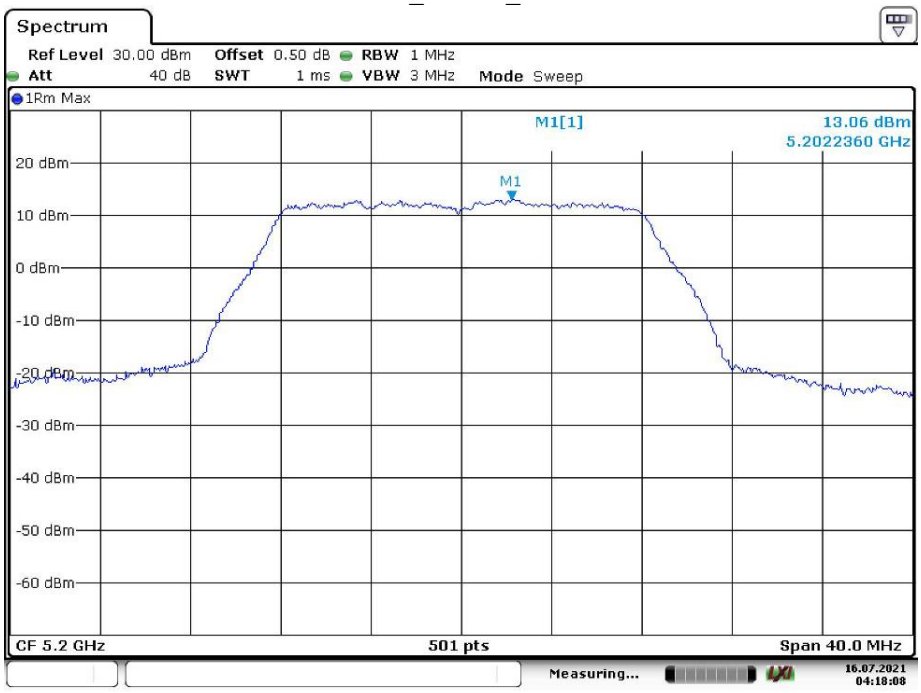
802.11 a_Middle_Chain 1

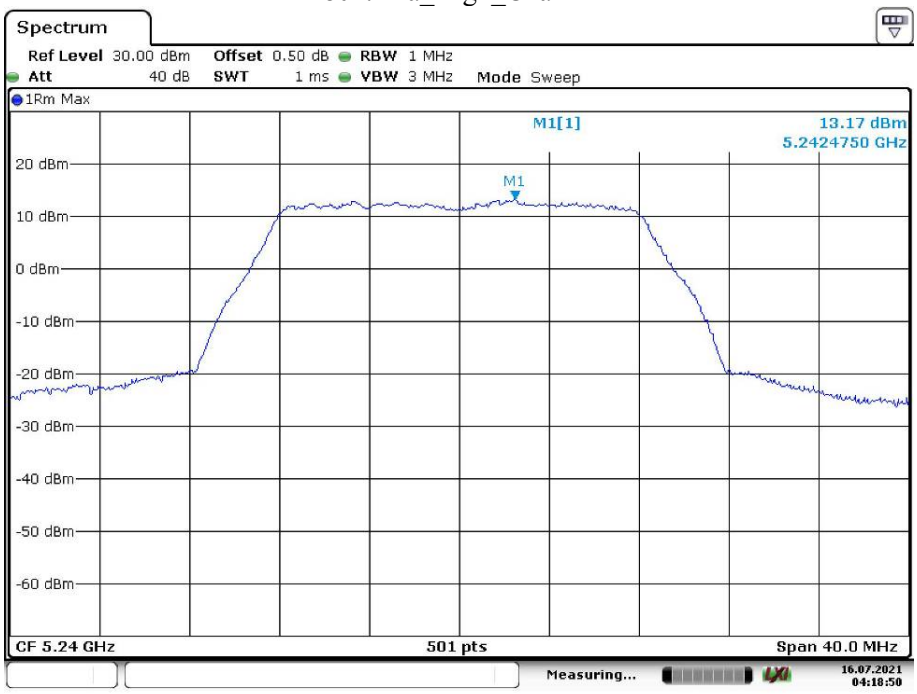


Date: 16.JUL.2021 04:18:09

802.11 a_High_Chain 0

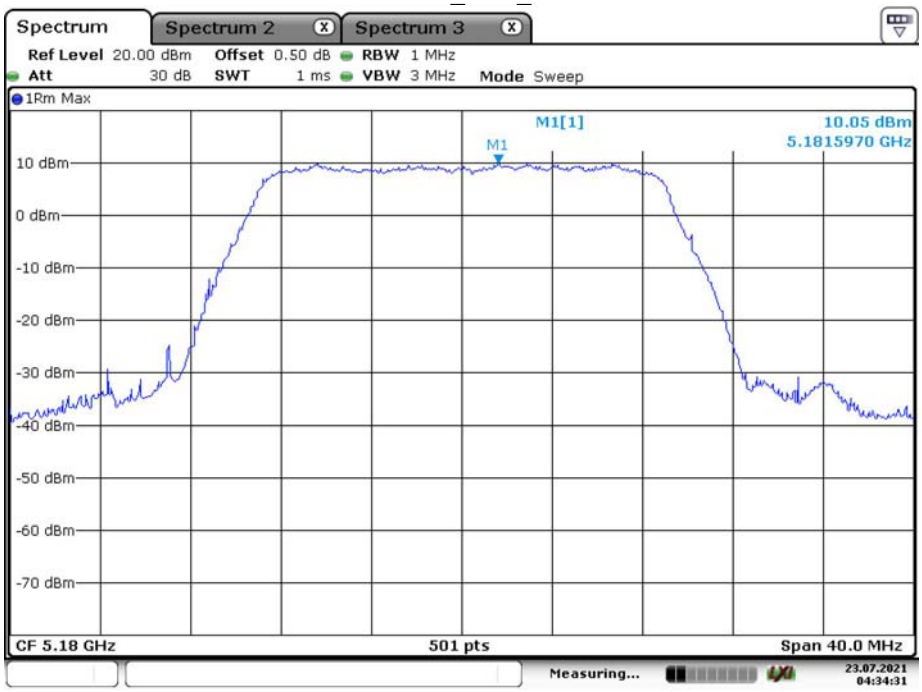
Date: 16.JUL.2021 04:15:45

802.11 a_High_Chain 1



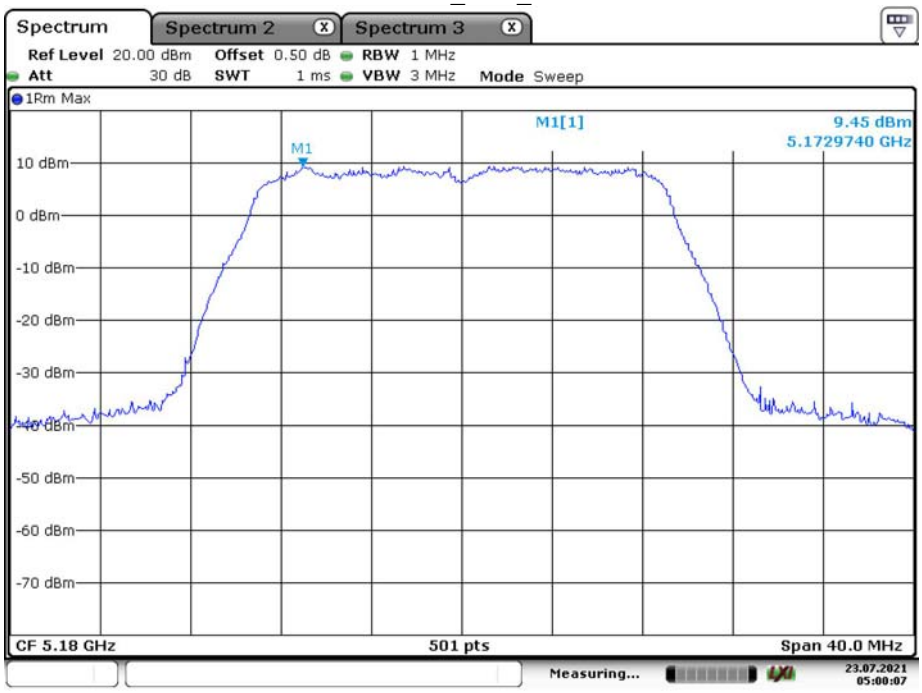
Date: 16.JUL.2021 04:18:50

802.11n ht20_Low_Chain 0



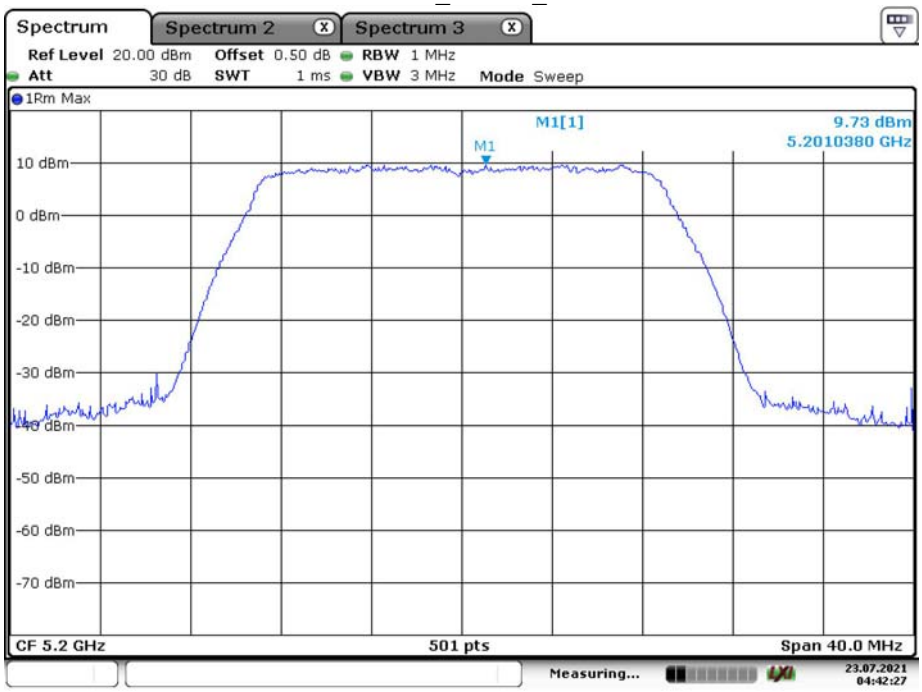
Date: 23.JUL.2021 04:34:31

802.11n ht20_Low_Chain 1



Date: 23.JUL.2021 05:00:07

802.11n ht20_Middle_Chain 0

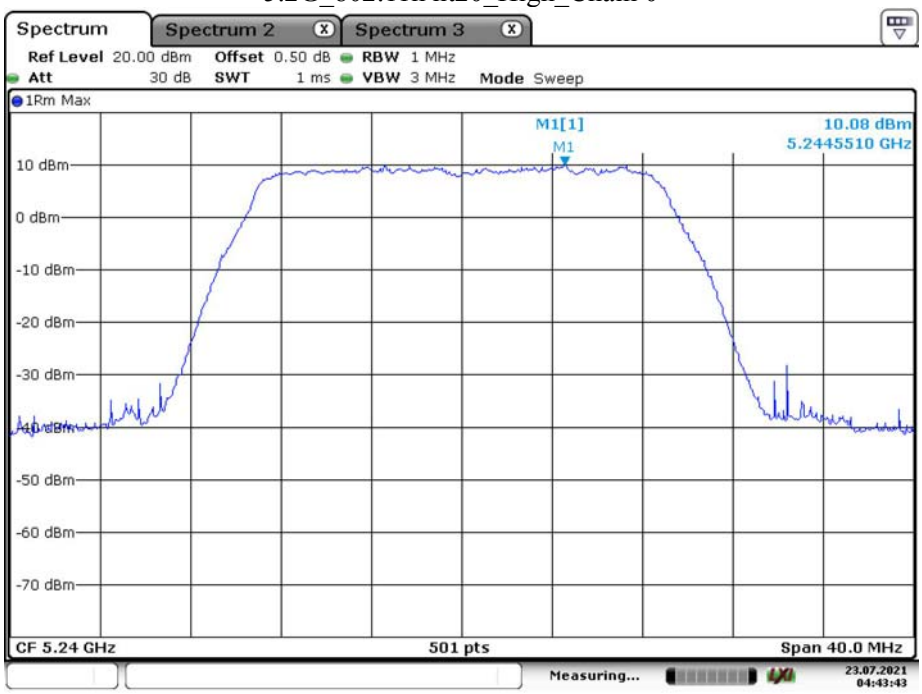


Date: 23.JUL.2021 04:42:27

802.11n ht20_Middle_Chain 1

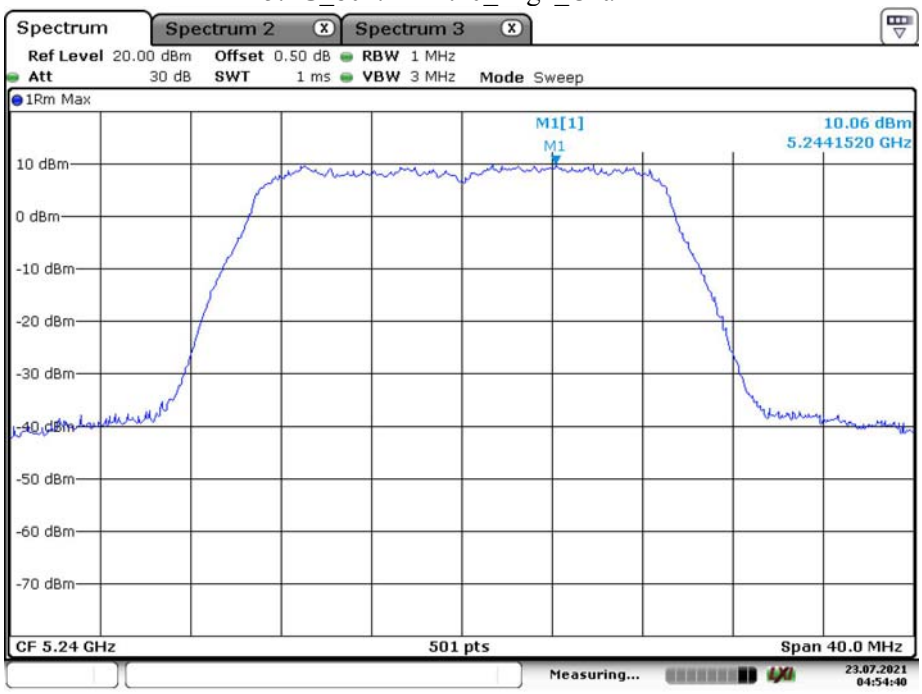
Date: 23.JUL.2021 04:55:45

5.2G_802.11n ht20_High_Chain 0



Date: 23.JUL.2021 04:43:43

5.2G_802.11n ht20_High_Chain 1



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