

4.3 OUTPUT POWER MEASUREMENT

4.3.1 Test Limit

According to §15.407 (a)(1), 15.407(a)(2) and 15.407(a)(3),

UNII-1 :

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 (24 dBm), whichever power is less. B is the 99% emission bandwidth in megahertz, 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.

UNII-2a and 2c:

the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, 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. and The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log_{10} B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz. 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.

UNII-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.

UNII-1 Limit	☒ Antenna not exceed 6 dBi : 24dBm ☐ Antenna with DG greater than 6 dBi : [Limit = 24 – (DG – 6)]
UNII-2a/2c Limit	☒ Antenna not exceed 6 dBi : 24dBm ☐ Antenna with DG greater than 6 dBi : [Limit = 24 – (DG – 6)]
UNII-3 Limit	☒ Antenna not exceed 6 dBi : 30dBm ☐ Antenna with DG greater than 6 dBi : [Limit = 30 – (DG – 6)]

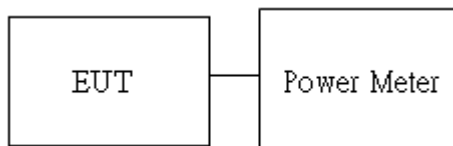
4.3.2 Test Procedure

Test method Refer as KDB 789033 D02, Section E.3.b for BW 20MHz and 40MHz, E.2.b for BW 80MHz.

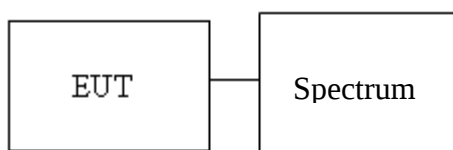
1. The EUT RF output connected to the power meter or spectrum by RF cable.
2. Setting maximum power transmit of EUT.
3. The path loss was compensated to the results for each measurement.
4. Measure and record the result of Average output power. in the test report.

4.3.3 Test Setup

For BW 20MHz and 40MHz



For BW 80MHz



4.3.4 Test Result

Conducted output power :

Temperature: 25.6°C

Test date: November 30, 2020

Humidity: 54% RH

Tested by: Rick Lee

UNII-1										
Config	CH	Freq. (MHz)	Power Set		AV Power (dBm)		AV Total Power (dBm)	AV Total Power (W)	DG (dBi)	Limit (dBm)
			Chain 0	Chain 1	Chain 0	Chain 1				
IEEE 802.11a Data rate: 6Mbps	36	5180	9	9	8.63	8.59	11.62	0.0145	2.64	24
	44	5220	9	9	8.56	8.51	11.55	0.0143		
	48	5240	9	9	8.64	8.67	11.67	0.0147		
IEEE 802.11n HT20 Data rate: MCS8	36	5180	9	9	8.59	8.52	11.57	0.0143		
	44	5220	9	9	8.73	8.69	11.72	0.0149		
	48	5240	9	9	8.76	8.67	11.73	0.0149		
IEEE 802.11n HT40 Data rate: MCS8	38	5190	7	7	7.60	7.57	10.60	0.0115		
	46	5230	8	8	7.69	7.60	10.66	0.0116		
IEEE 802.11ac VHT80 Data rate: MCS8	42	5210	6	6	7.56	7.51	10.55	0.0113		

UNII-2a										
Config	CH	Freq. (MHz)	Power Set		AV Power (dBm)		AV Total Power (dBm)	AV Total Power (W)	DG (dBi)	Limit (dBm)
			Chain 0	Chain 1	Chain 0	Chain 1				
IEEE 802.11a Data rate: 6Mbps	52	5260	9	9	8.76	8.63	11.71	0.0148	2.64	24
	56	5280	9	9	8.85	8.76	11.82	0.0152		
	64	5320	9	9	8.96	8.84	11.91	0.0155		
IEEE 802.11n HT20 Data rate: MCS8	52	5260	9	9	8.94	8.88	11.92	0.0156		
	56	5280	9	9	8.96	8.91	11.95	0.0157		
	64	5320	8	8	8.56	8.51	11.55	0.0143		
IEEE 802.11n HT40 Data rate: MCS8	54	5270	8	8	7.86	7.62	10.75	0.0119		
	62	5310	8	8	7.86	7.56	10.72	0.0118		
IEEE 802.11ac VHT80 Data rate: MCS8	58	5290	7	7	7.63	7.59	10.62	0.0115		

UNII-2c										
Config	CH	Freq. (MHz)	Power Set		AV Power (dBm)		AV Total Power (dBm)	AV Total Power (W)	DG (dBi)	Limit (dBm)
			Chain 0	Chain 1	Chain 0	Chain 1				
IEEE 802.11a Data rate: 6Mbps	100	5500	9	9	8.65	8.53	11.60	0.0145	2.64	24
	116	5580	7	7	8.50	8.58	11.55	0.0143		
	140	5700	6	6	8.86	8.59	11.74	0.0149		
IEEE 802.11n HT20 Data rate: MCS8	100	5500	9	9	8.86	8.73	11.81	0.0152		
	116	5580	7	7	8.68	8.77	11.74	0.0149		
	140	5700	6	6	8.93	8.57	11.76	0.0150		
IEEE 802.11n HT40 Data rate: MCS8	102	5510	8	8	7.93	7.77	10.86	0.0122		
	110	5550	8	8	7.96	7.72	10.85	0.0122		
	134	5670	5	5	7.78	7.69	10.75	0.0119		
IEEE 802.11ac VHT80 Data rate: MCS8	106	5530	7	7	7.63	7.51	10.58	0.0114		
	122	5610	5	5	7.56	7.52	10.55	0.0114		

UNII-3										
Config	CH	Freq. (MHz)	Power Set		AV Power (dBm)		AV Total Power (dBm)	AV Total Power (W)	DG (dBi)	Limit (dBm)
			Chain 0	Chain 1	Chain 0	Chain 1				
IEEE 802.11a Data rate: 6Mbps	149	5745	7	7	7.68	7.52	10.61	0.0115	3.35	30
	157	5785	7	7	7.71	7.56	10.65	0.0116		
	165	5825	7	7	7.72	7.61	10.68	0.0117		
IEEE 802.11n HT20 Data rate: MCS8	149	5745	6	6	6.69	6.54	9.63	0.0092		
	157	5785	6	6	6.62	6.51	9.58	0.0091		
	165	5825	6	6	6.68	6.57	9.64	0.0092		
IEEE 802.11n HT40 Data rate: MCS8	151	5755	6	6	6.89	6.58	9.75	0.0094		
	159	5795	6	6	6.73	6.59	9.67	0.0093		
IEEE 802.11ac VHT80 Data rate: MCS8	155	5775	5	5	6.84	6.73	9.80	0.0095		

4.4 POWER SPECTRAL DENSITY

4.4.1 Test Limit

According to §15.407 (a)(1), 15.407(a)(2) and 15.407(a)(3)

UNII-1 :

The maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

UNII-2a and 2c:

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.

UNII-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.

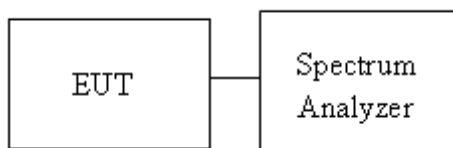
UNII-1 Limit	☒ Antenna not exceed 6 dBi : 11 dBm ☐ Antenna with DG greater than 6 dBi : [Limit = 11 – (DG – 6)]
UNII-2a Limit	☒ Antenna not exceed 6 dBi : 11 dBm ☐ Antenna with DG greater than 6 dBi : [Limit = 11 – (DG – 6)]
UNII-2c Limit	☒ Antenna not exceed 6 dBi : 11 dBm ☐ Antenna with DG greater than 6 dBi : [Limit = 11 – (DG – 6)]
UNII-3 Limit	☒ Antenna not exceed 6 dBi : 30 dBm ☐ Antenna with DG greater than 6 dBi : [Limit = 30 – (DG – 6)]

4.4.2 Test Procedure

Test method Refer as KDB 789033 D02

1. The EUT RF output connected to the spectrum analyzer by RF cable.
2. Setting maximum power transmit of EUT
3. UNII-1, UNII-2a and UNII-2c, SA set RBW = 1MHz, VBW = 3MHz and Detector = RMS, to measurement Power Density.
4. UNII-3, SA set RBW = 500kHz, VBW = 2MHz and Detector = RMS, to measurement Power Density
5. The path loss and Duty Factor were compensated to the results for each measurement by SA.
6. Mark the maximum level.
7. Measure and record the result of power spectral density. in the test report.

4.4.3 Test Setup



4.4.4 Test Result

Chain 0:

Temperature: 24.1°C

Test date: November 17, 2020

Humidity: 54.2% RH

Tested by: Rick Lee

Chain 1:

Temperature: 25.9°C

Test date: November 24, 2020

Humidity: 50% RH

Tested by: Rick Lee

UNII-1 5150-5250 MHz					
Test mode: IEEE 802.11a mode					
Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)
Low	5180	-1.227	-2.264	1.30	11
Mid	5220	-2.107	-2.711	0.61	
High	5240	-1.957	-2.598	0.74	

Test mode: IEEE 802.11n HT20 mode					
Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)
Low	5180	-2.325	-2.004	0.85	11
Mid	5220	-2.9	-2.725	0.20	
High	5240	-2.965	-2.774	0.14	
Test mode: IEEE 802.11n HT40 mode					
Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)
Low	5190	-6.616	-7.158	-3.87	11
High	5230	-5.704	-6.916	-3.26	
Test mode: IEEE 802.11ac VHT80 mode					
Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)
Low	5210	-10.975	-11.277	-8.11	11

UNII-2a 5250-5350 MHz					
Test mode: IEEE 802.11a mode					
Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)
Low	5260	-1.977	-2.488	0.79	11
Mid	5280	-1.883	-2.414	0.87	
High	5320	-1.453	-2.182	1.21	

Test mode: IEEE 802.11n HT20 mode					
Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)
Low	5260	-2.867	-2.714	0.22	11
Mid	5280	-2.934	-2.355	0.38	
High	5320	-2.468	-3.019	0.28	
Test mode: IEEE 802.11n HT40 mode					
Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)
Low	5270	-6.798	-6.863	-3.82	11
High	5310	-6.516	-7.23	-3.85	
Test mode: IEEE 802.11ac VHT80 mode					
Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)
Low	5290	-10.104	-11.618	-7.79	11

UNII-2c 5470-5725 MHz					
Test mode: IEEE 802.11a mode					
Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)
Low	5500	-2.708	-2.893	0.21	11
Mid	5580	-3.392	-4.033	-0.69	
High	5700	-3.489	-4.456	-0.94	

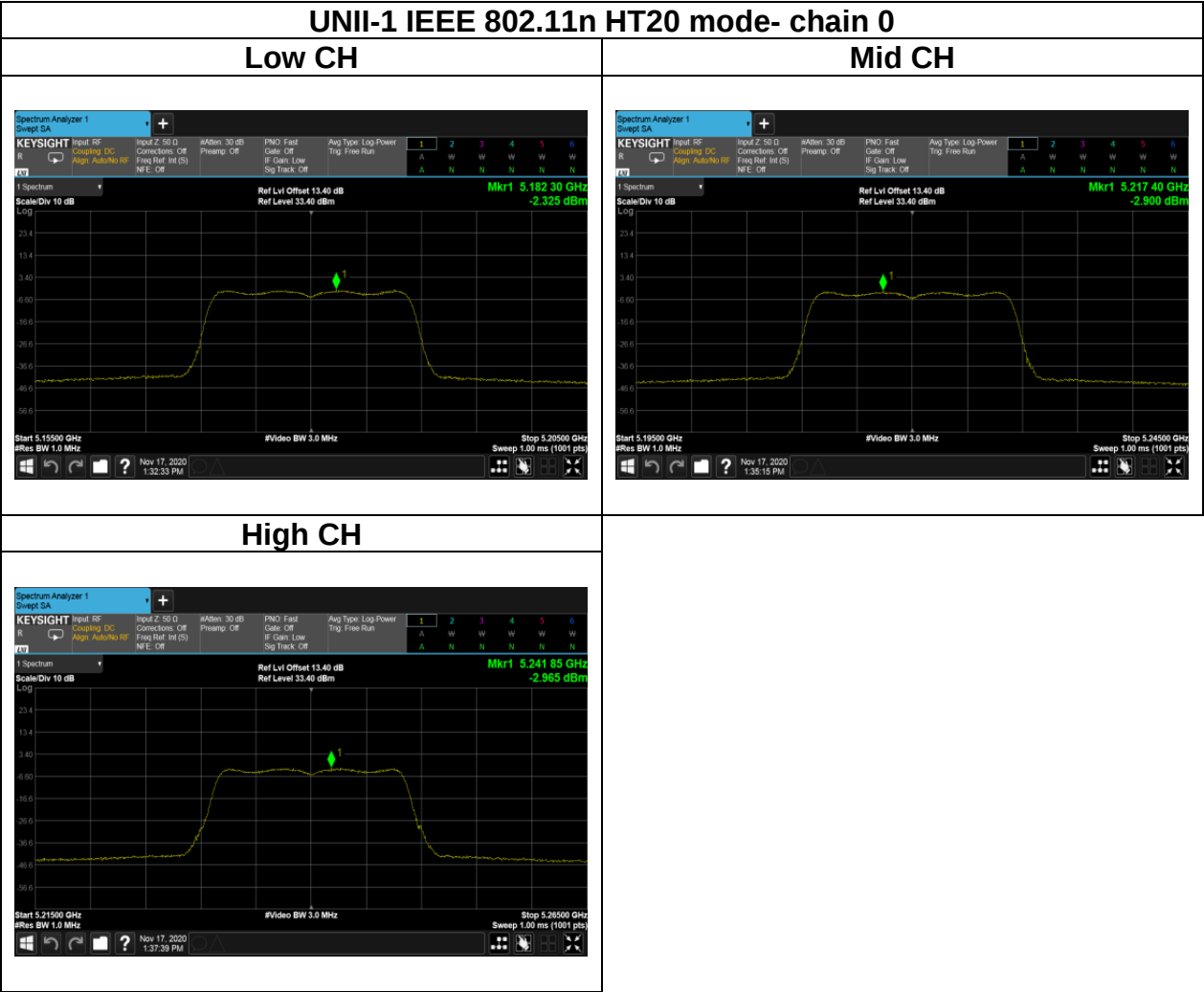
Test mode: IEEE 802.11n HT20 mode					
Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)
Low	5500	-2.461	-4.289	-0.27	11
Mid	5580	-3.405	-6.322	-1.61	
High	5700	-3.648	-6.974	-1.99	
Test mode: IEEE 802.11n HT40 mode					
Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)
Low	5510	-6.475	-8.235	-4.26	11
Mid	5550	-6.432	-8.225	-4.23	
High	5670	-7.655	-11.107	-6.04	
Test mode: IEEE 802.11ac VHT80 mode					
Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)
Low	5530	-11.219	-12.25	-8.69	11
High	5610	-13.3	-14.692	-10.93	

UNII-3 5725-5825 MHz					
Test mode: IEEE 802.11a mode					
Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)
Low	5745	-3.891	-6.683	-2.06	30
Mid	5785	-3.928	-6.776	-2.11	
High	5825	-4.074	-6.619	-2.15	

Test mode: IEEE 802.11n HT20 mode					
Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)
Low	5745	-5.056	-6.761	-2.82	30
Mid	5785	-4.949	-6.663	-2.71	
High	5825	-5.236	-6.714	-2.90	
Test mode: IEEE 802.11n HT40 mode					
Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)
Low	5755	-8.847	-11.651	-7.02	30
High	5795	-8.823	-12.01	-7.12	
Test mode: IEEE 802.11ac VHT80 mode					
Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)
Low	5775	-14.549	-15.892	-12.16	30

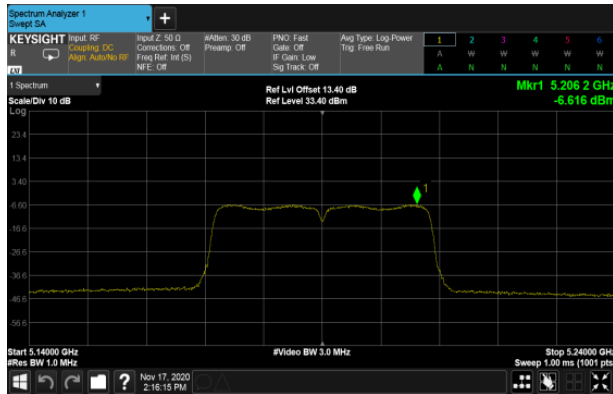
Test Data



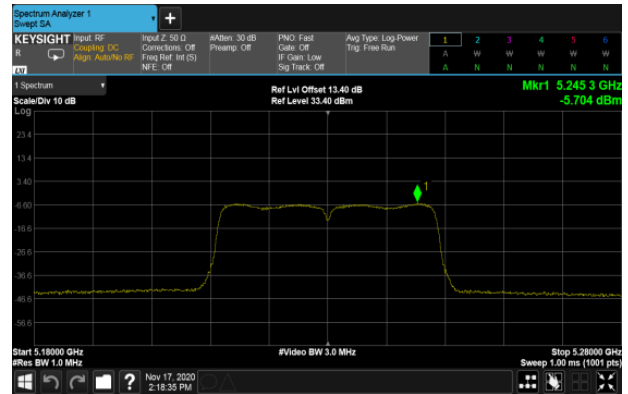


UNII-1 IEEE 802.11n HT40 mode- chain 0

Low CH

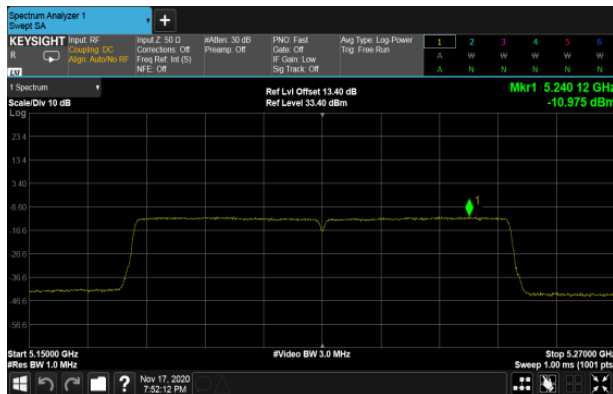


High CH

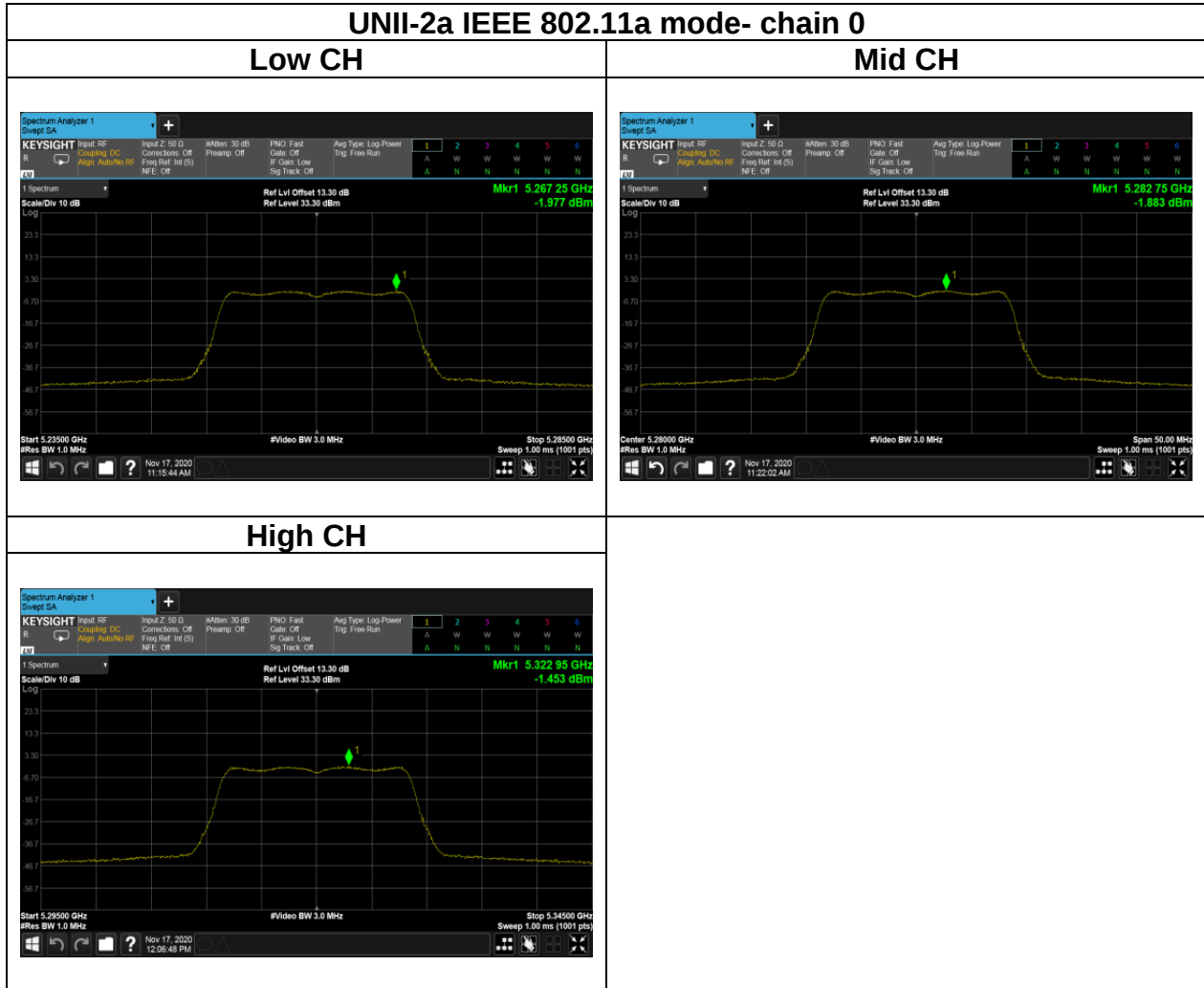


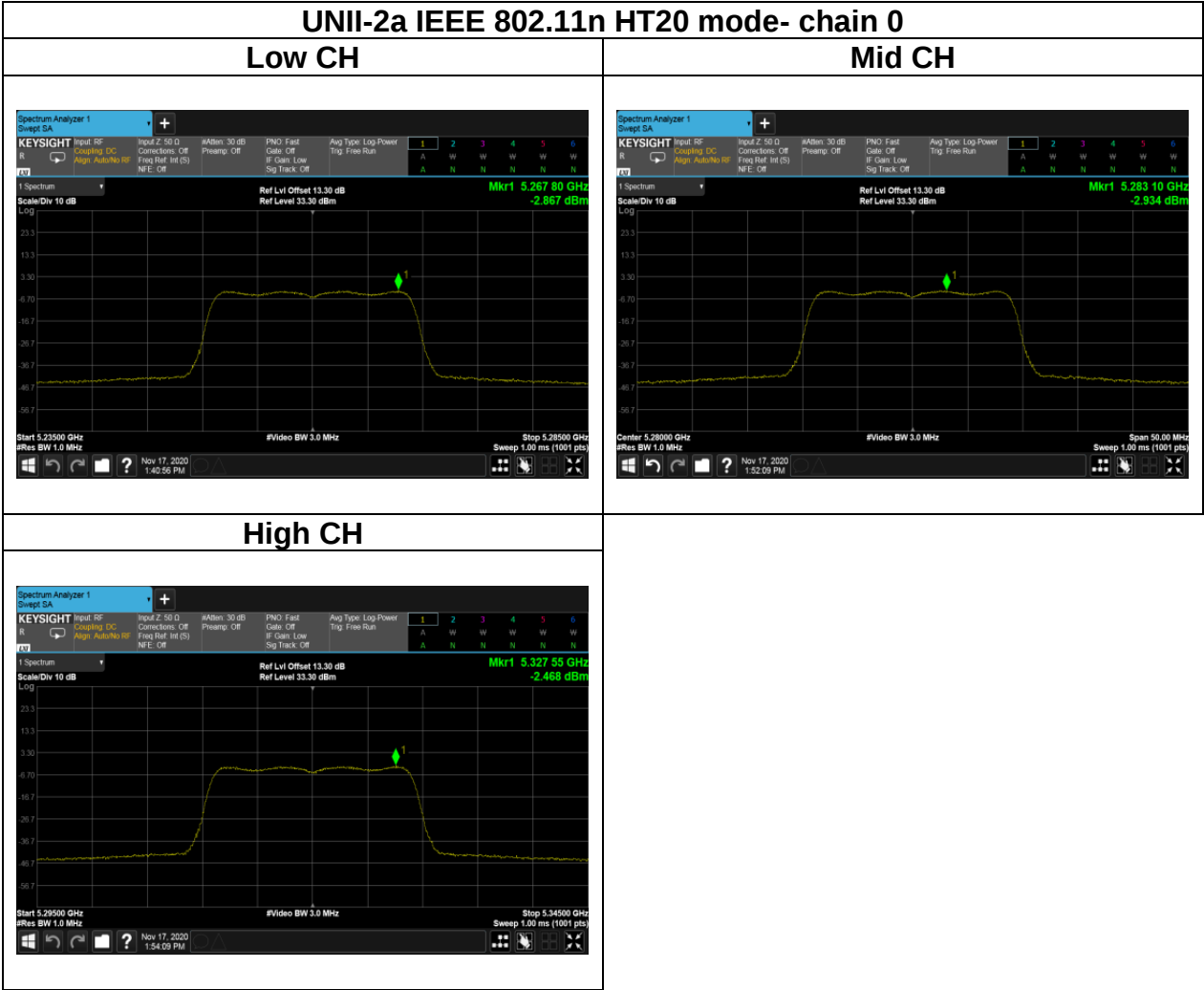
UNII-1 IEEE 802.11ac VHT80 mode- chain 0

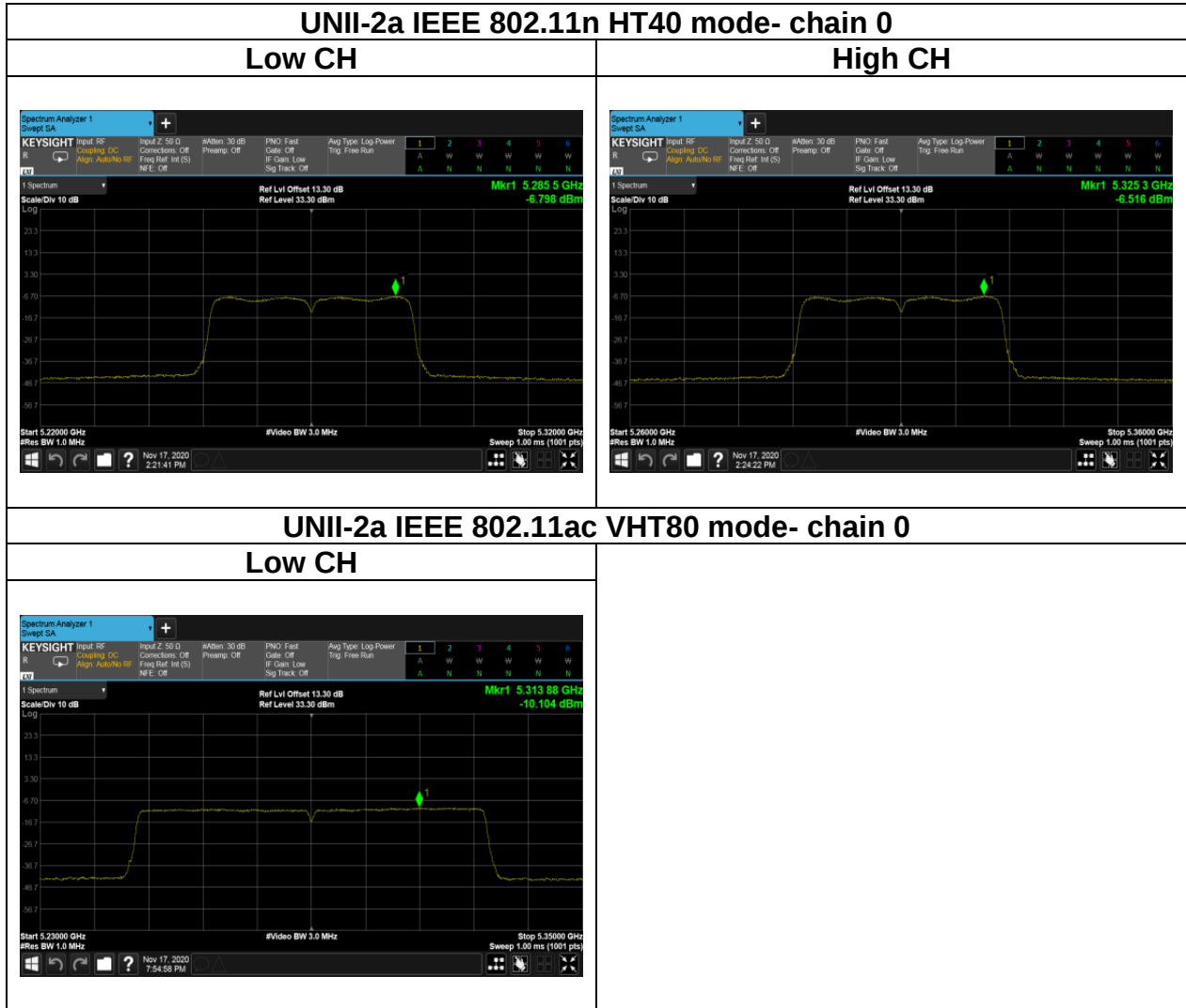
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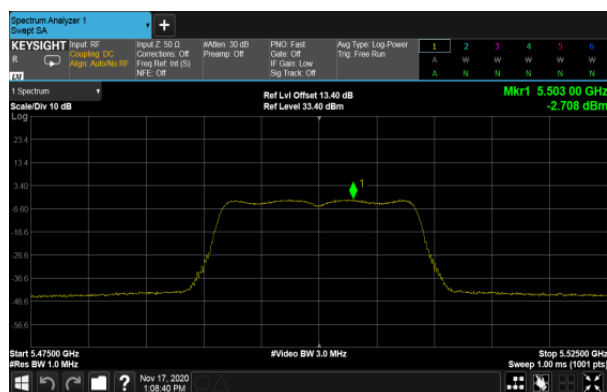


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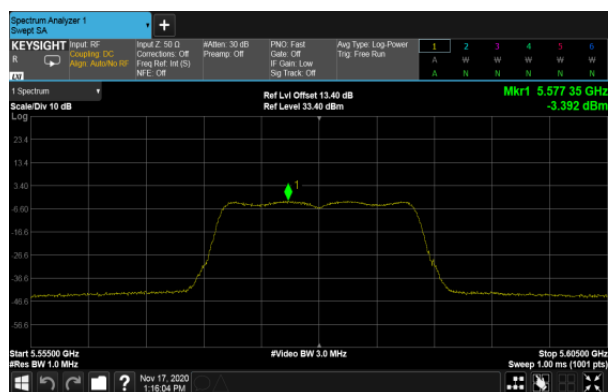
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UNII-2c IEEE 802.11a mode- chain 0

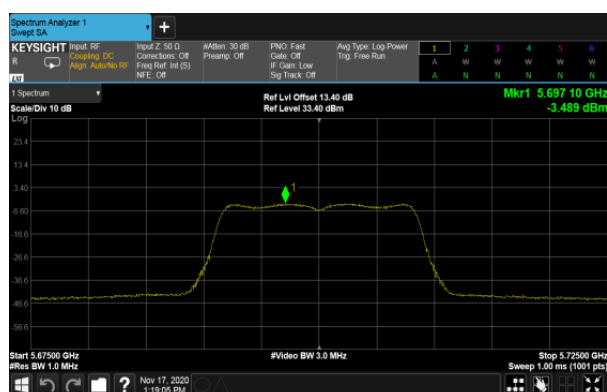
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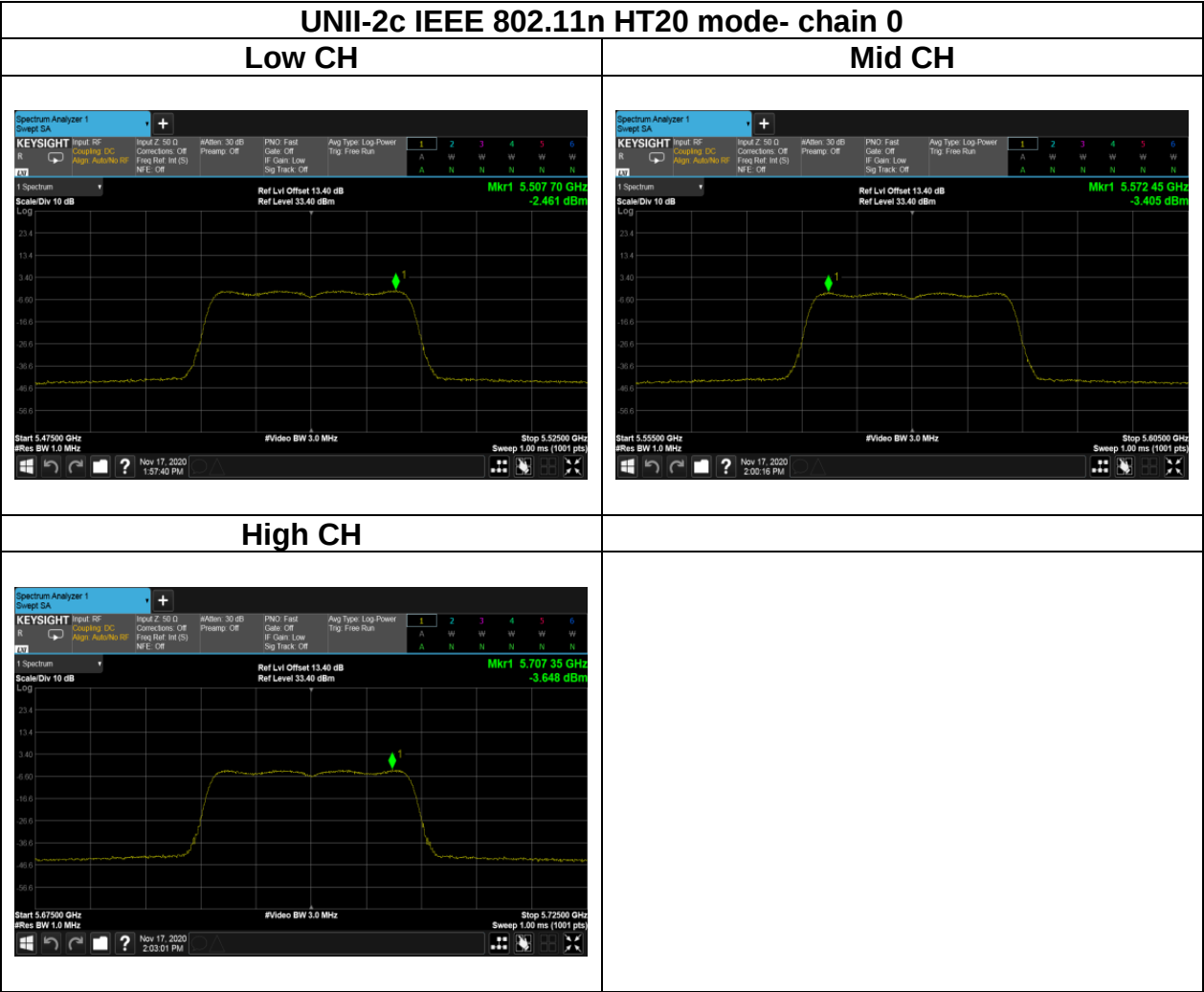


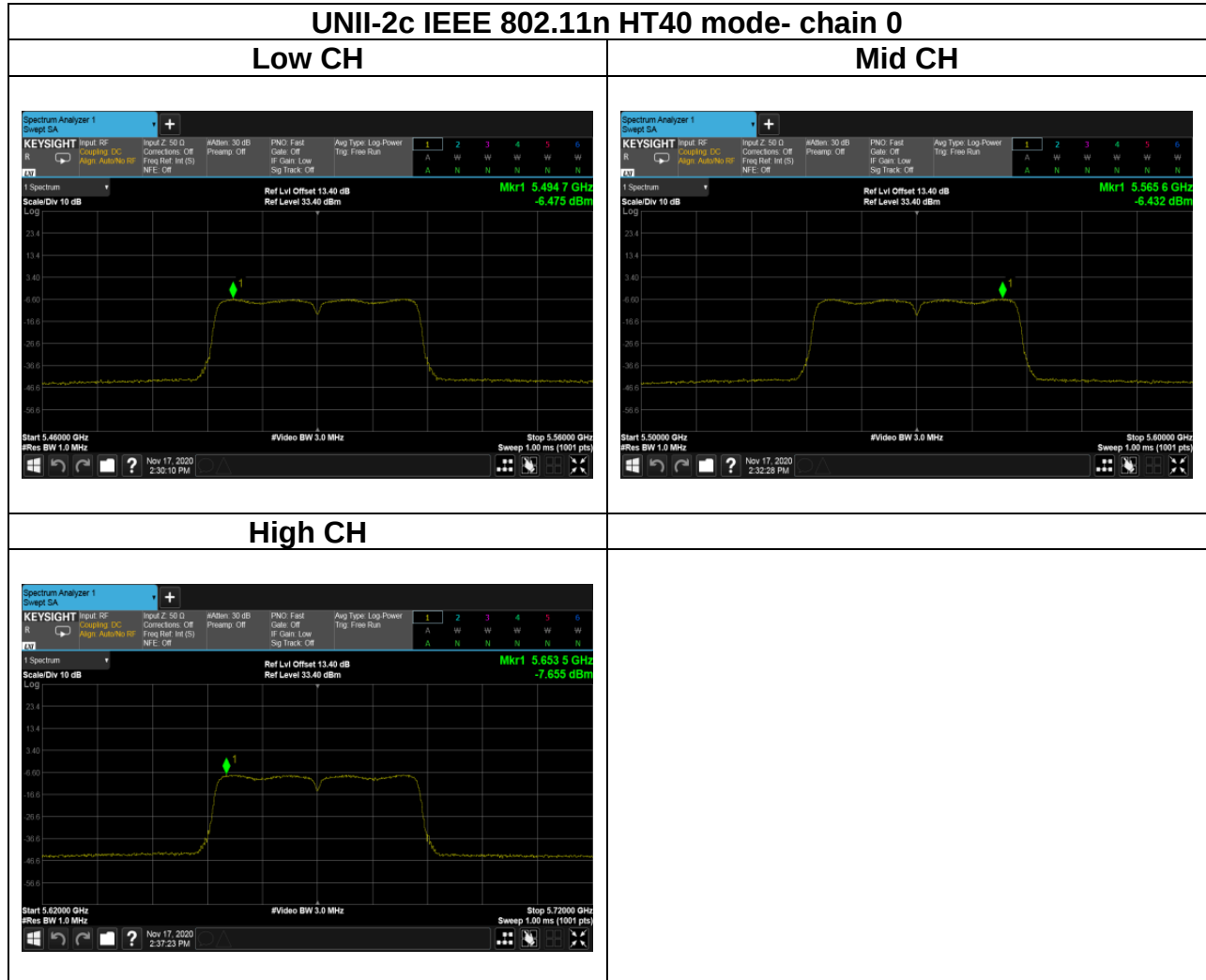
Mid CH



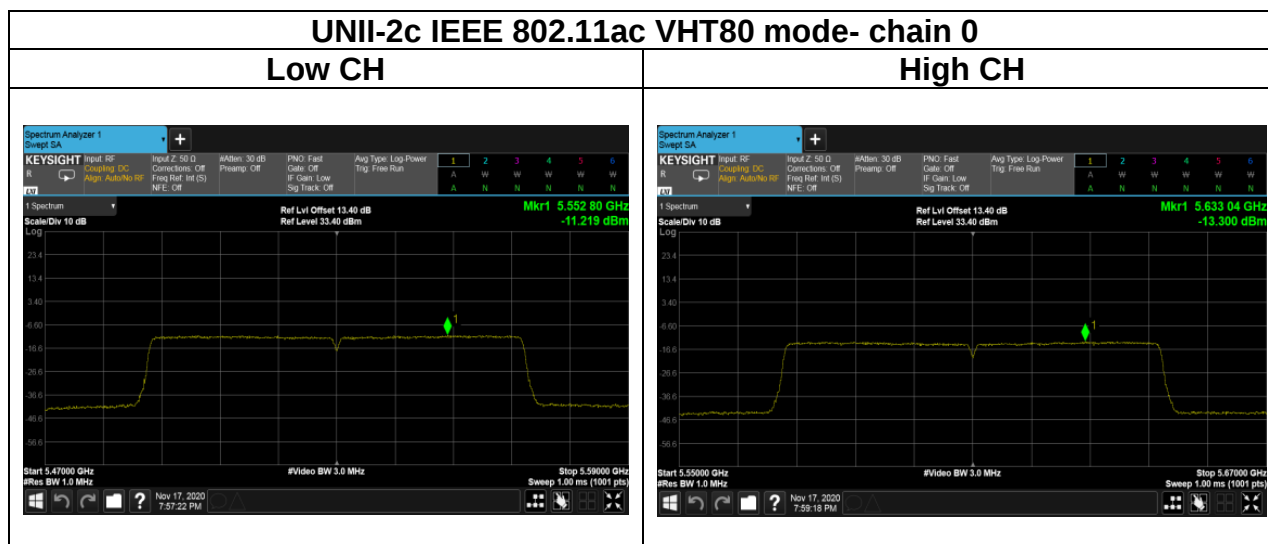
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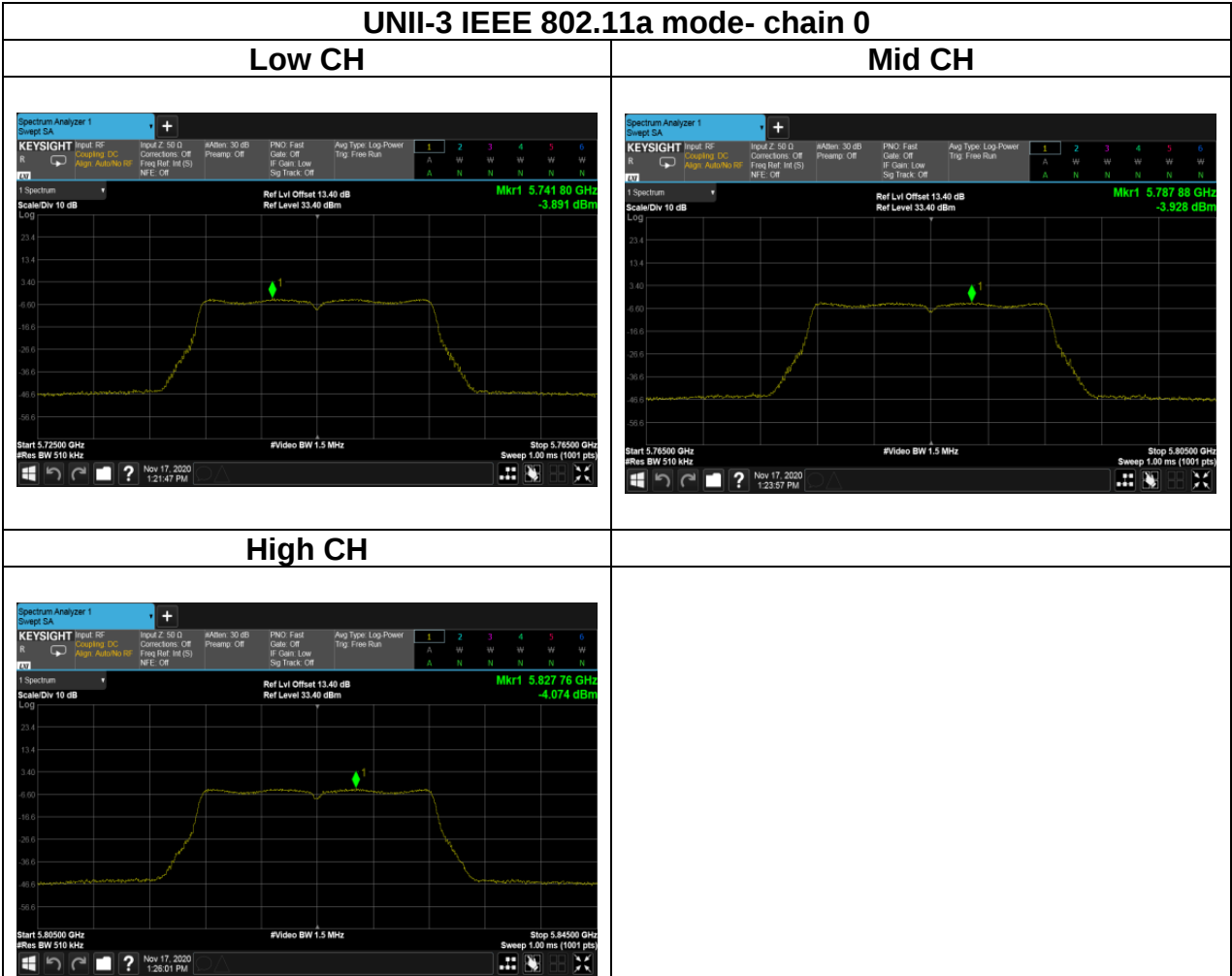


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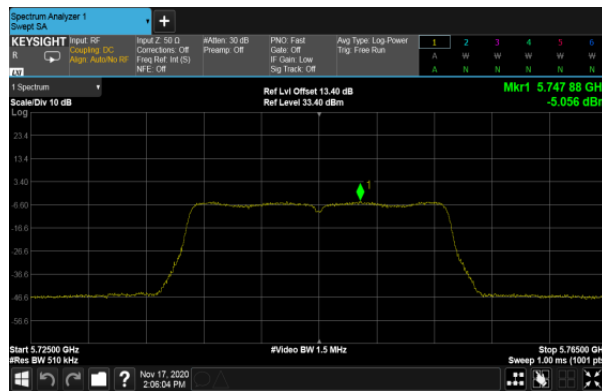
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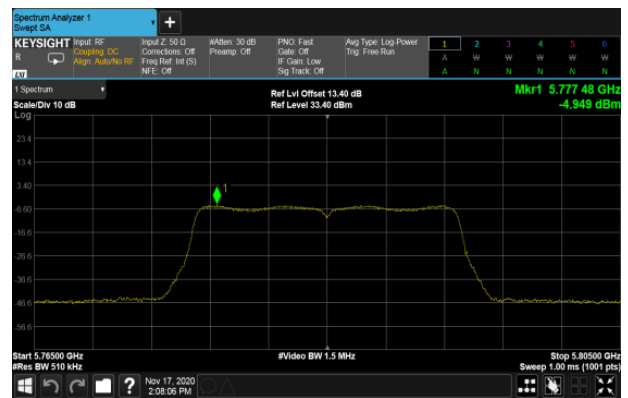


UNII-3 IEEE 802.11n HT20 mode- chain 0

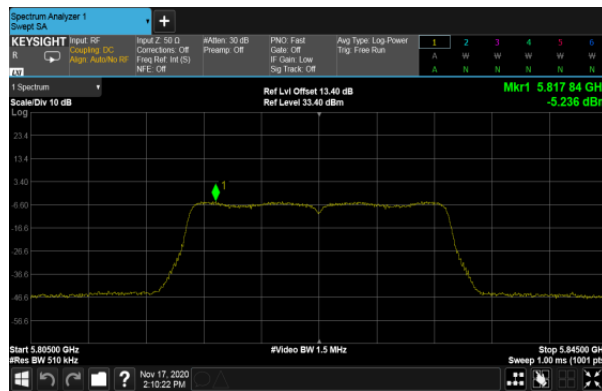
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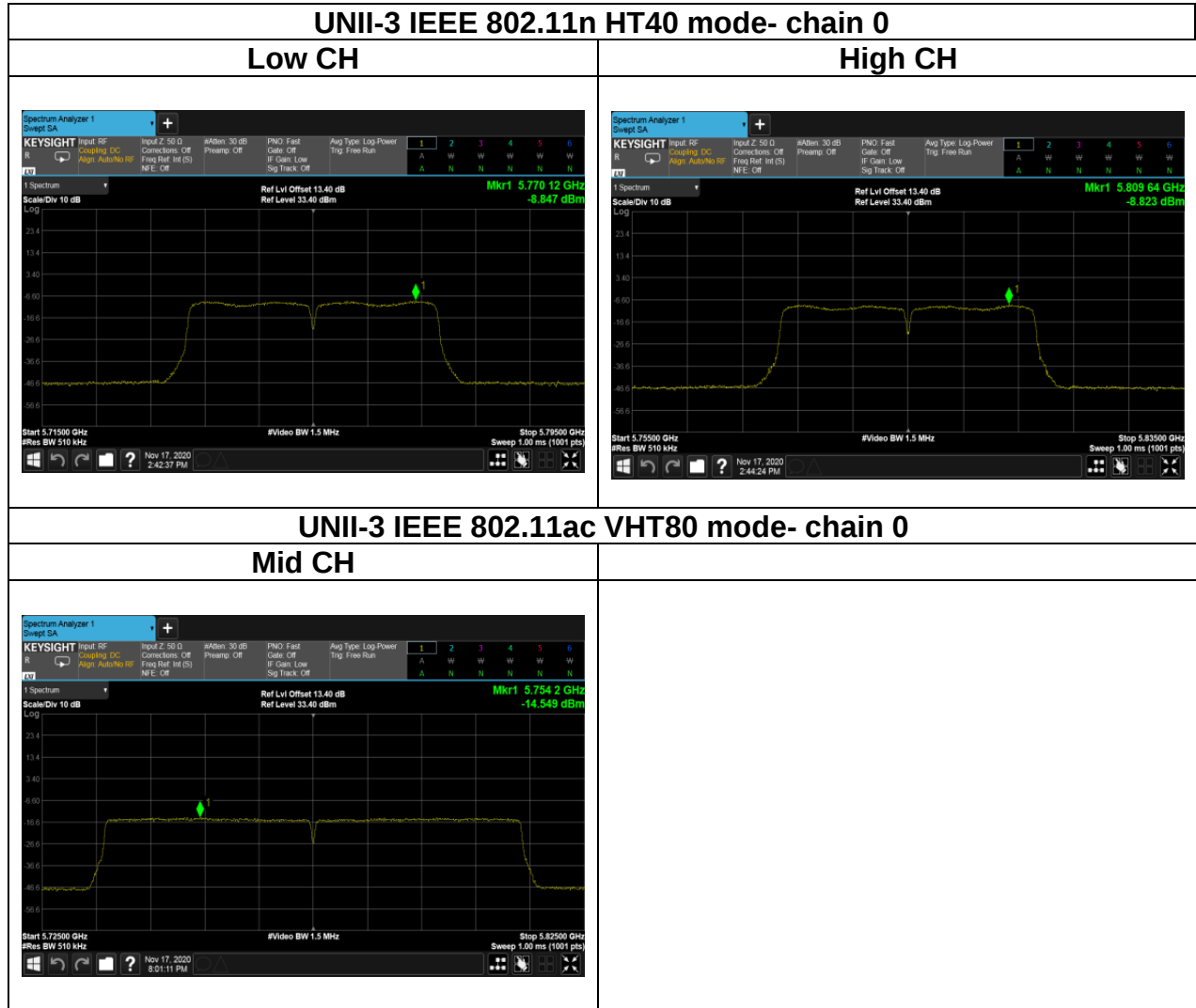


Mid CH



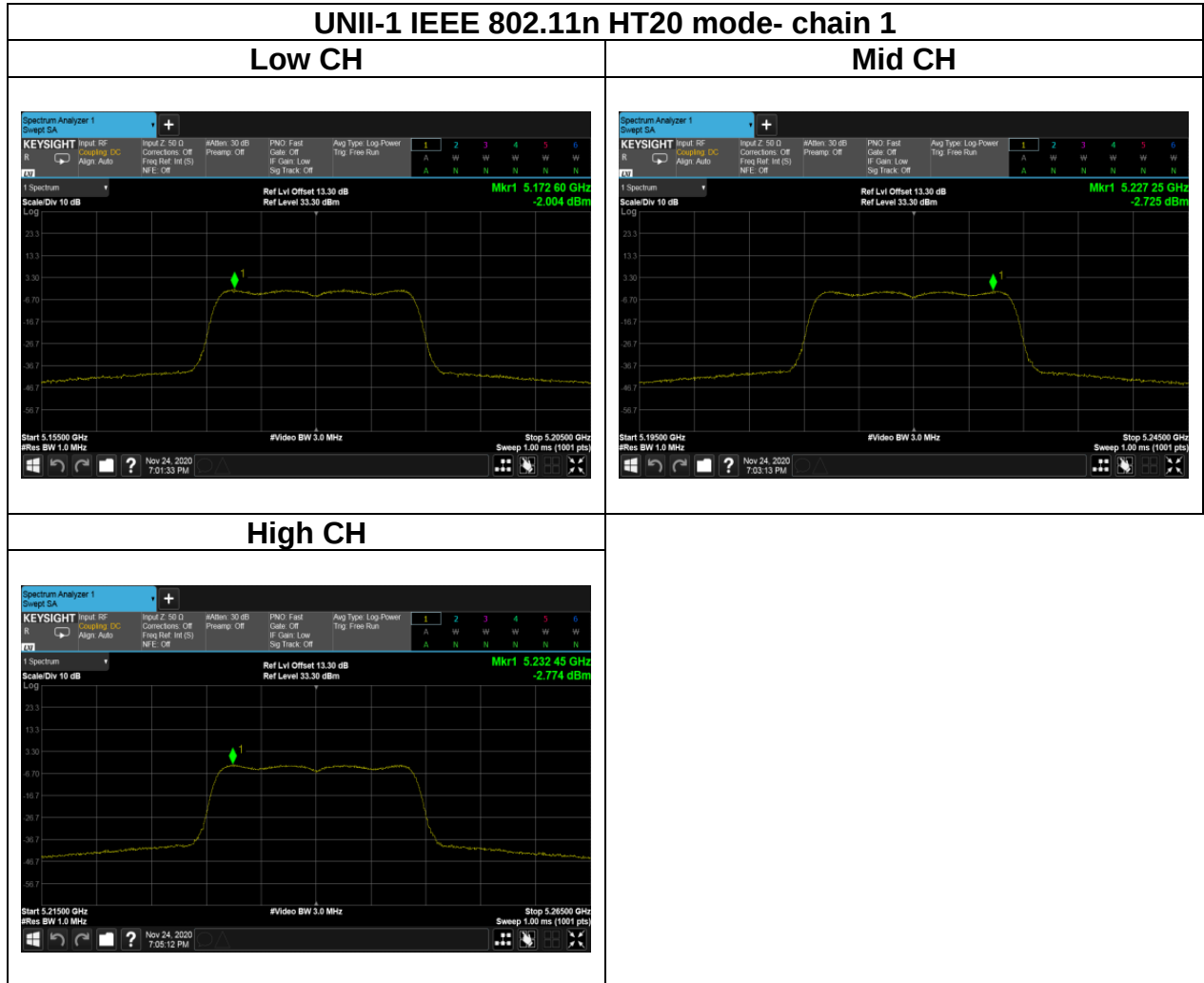
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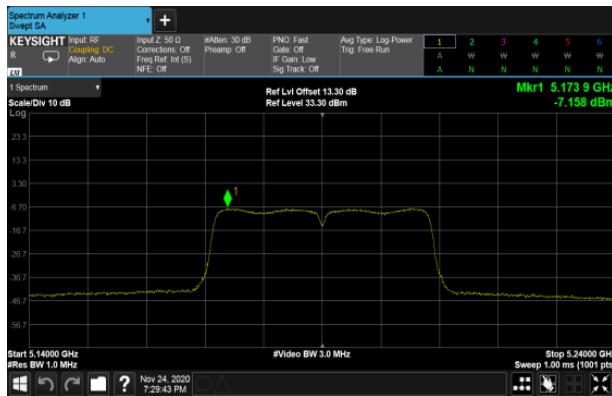
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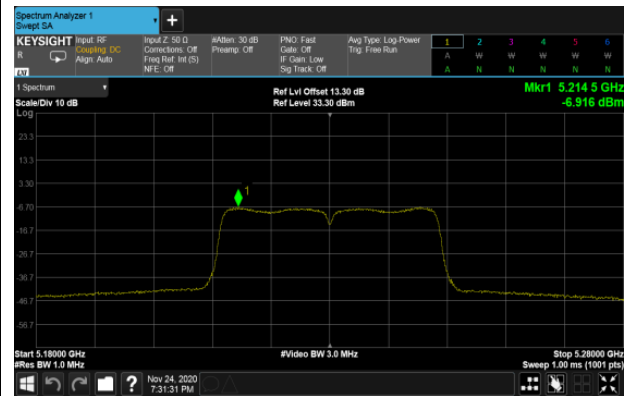


UNII-1 IEEE 802.11n HT40 mode- chain 1

Low CH



High CH



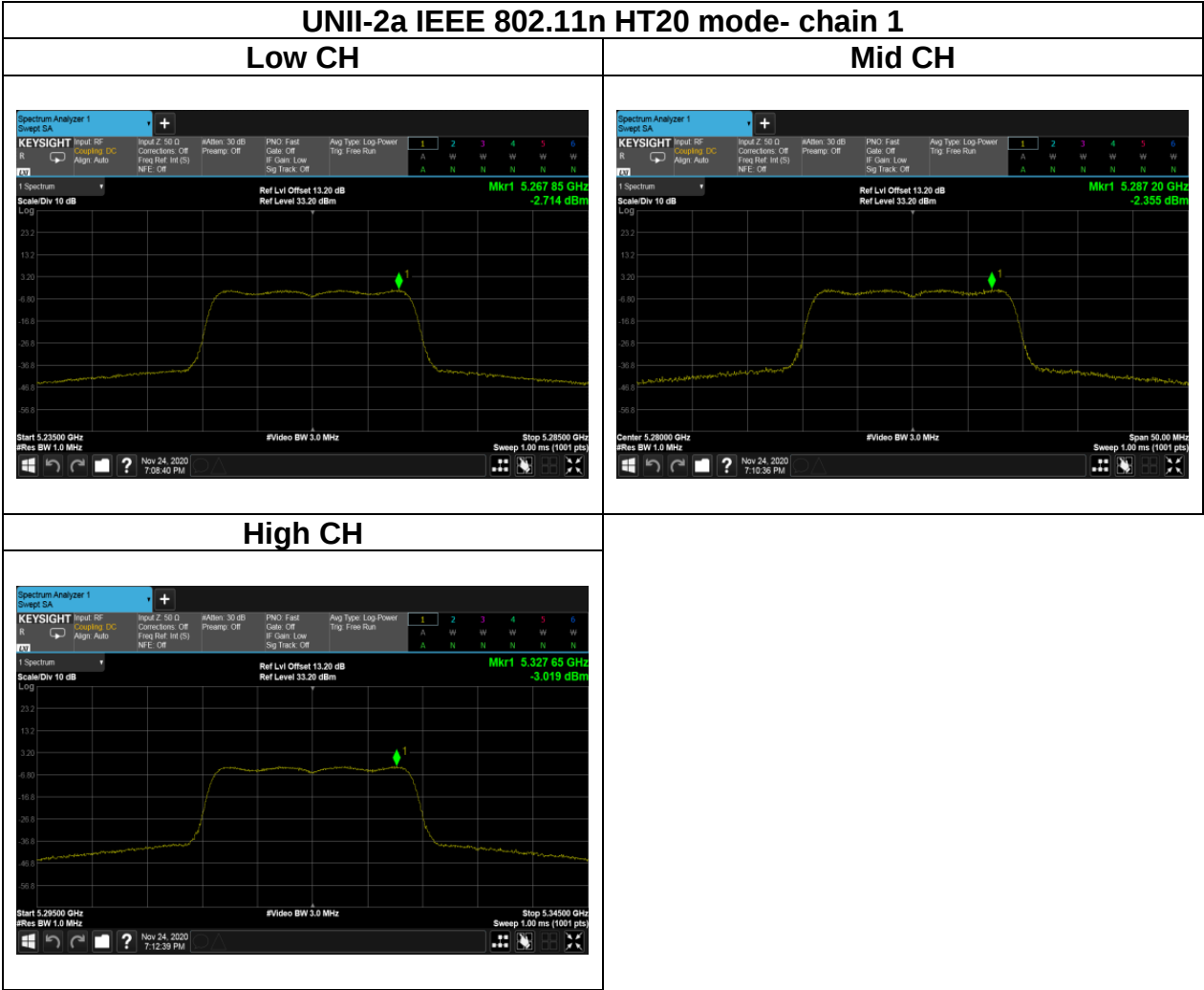
UNII-1 IEEE 802.11ac VHT80 mode- chain 1

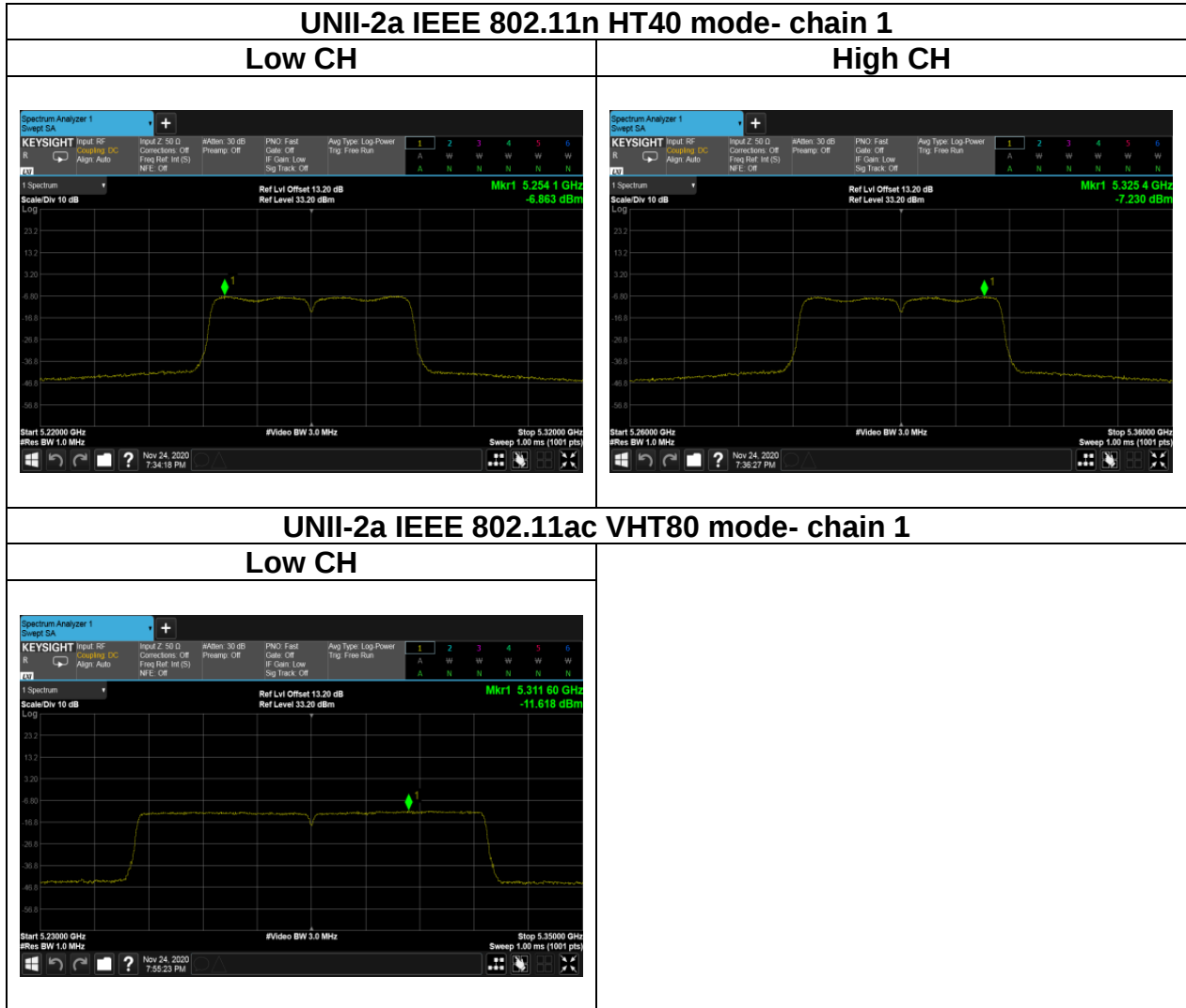
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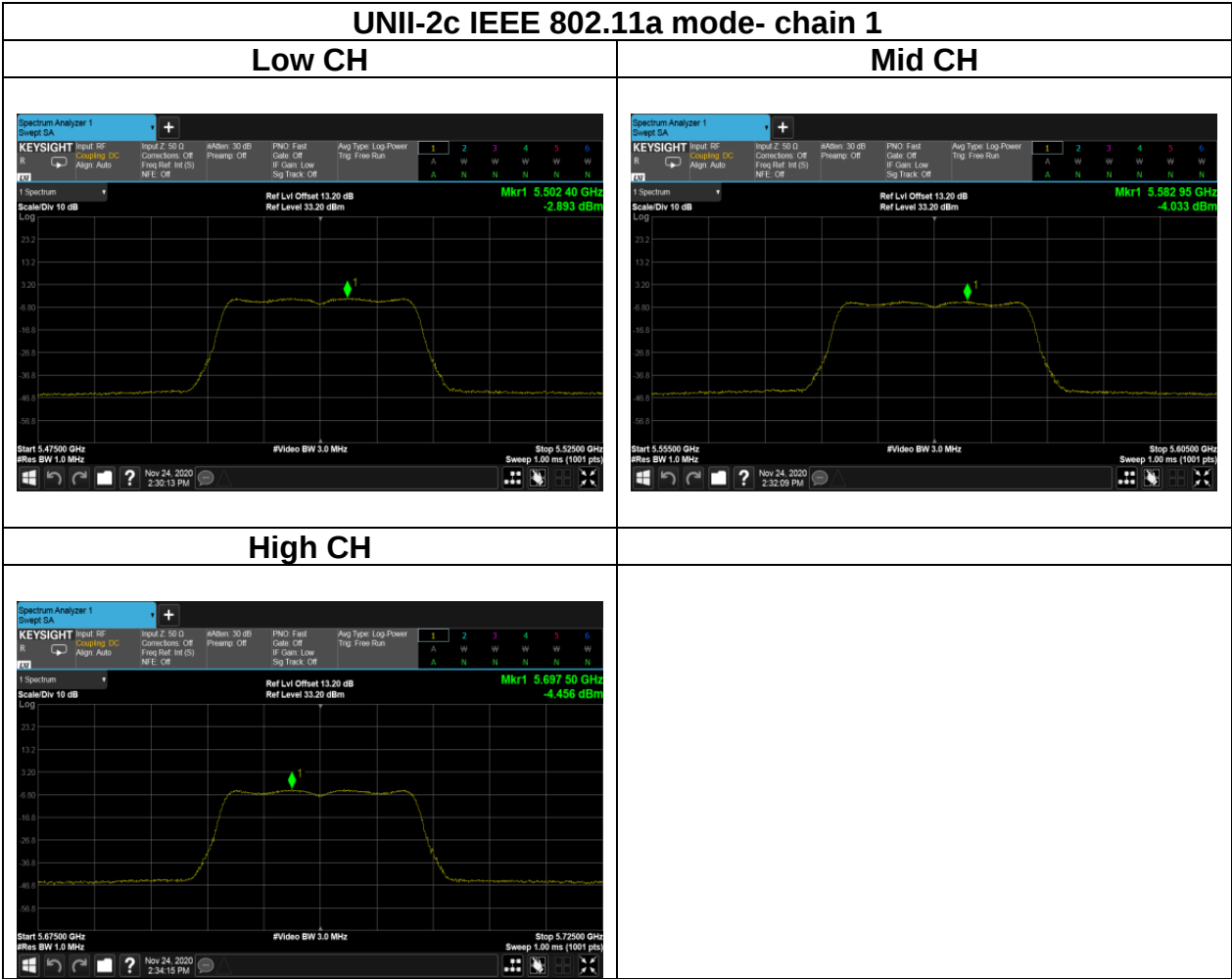
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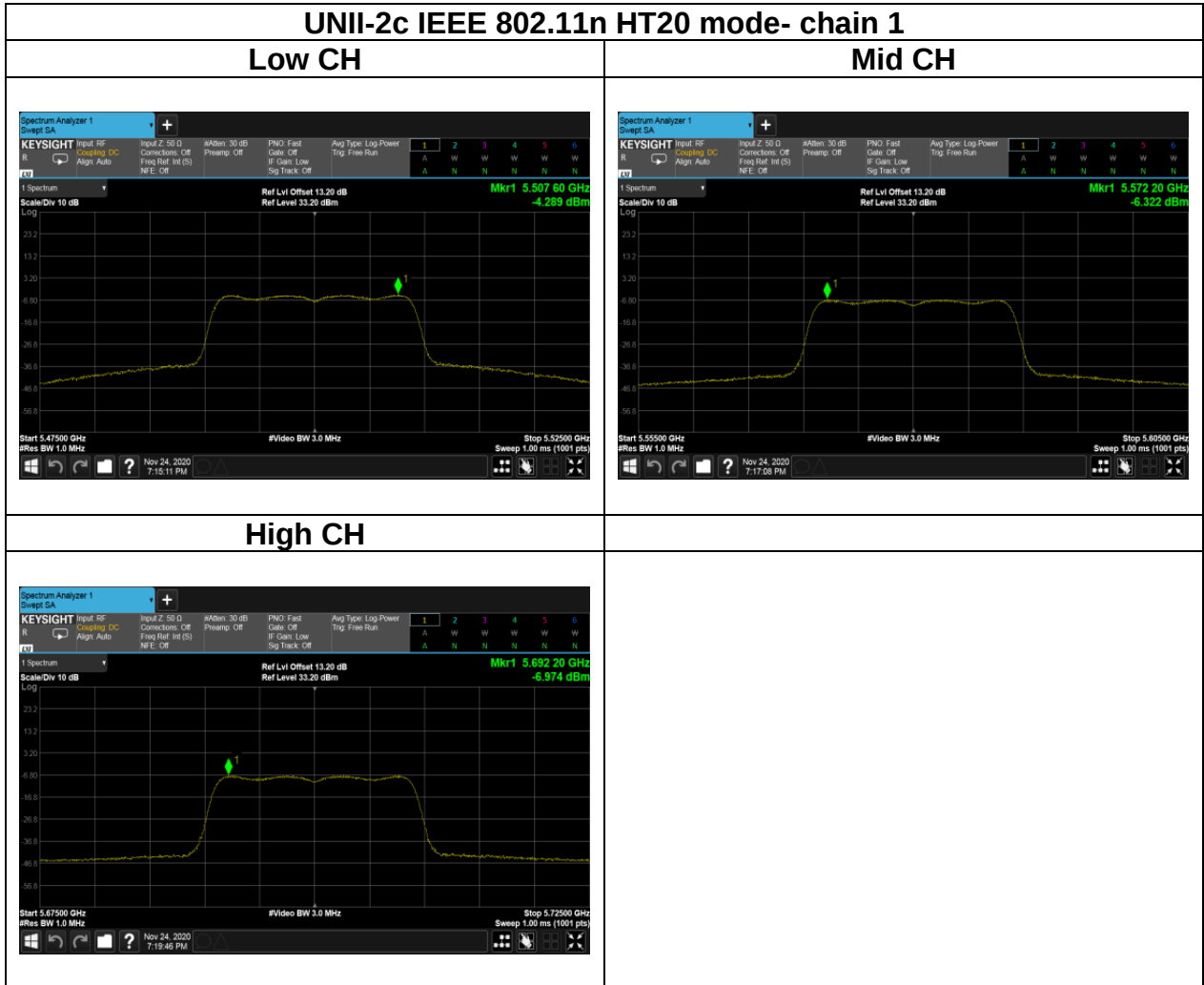






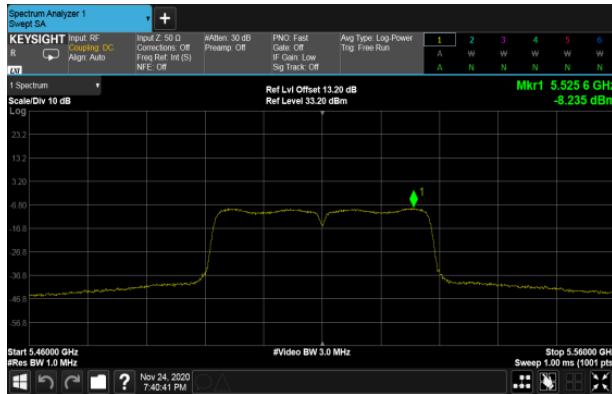
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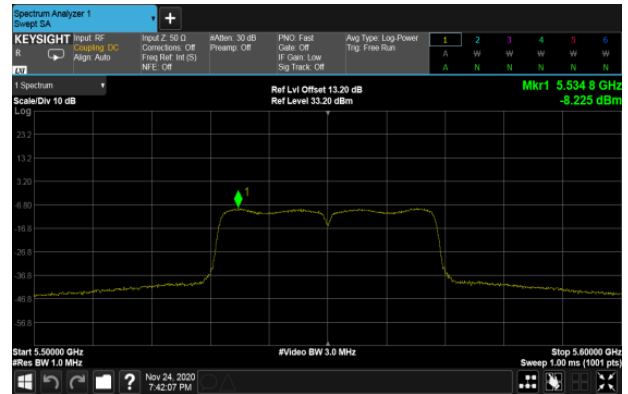


UNII-2c IEEE 802.11n HT40 mode- chain 1

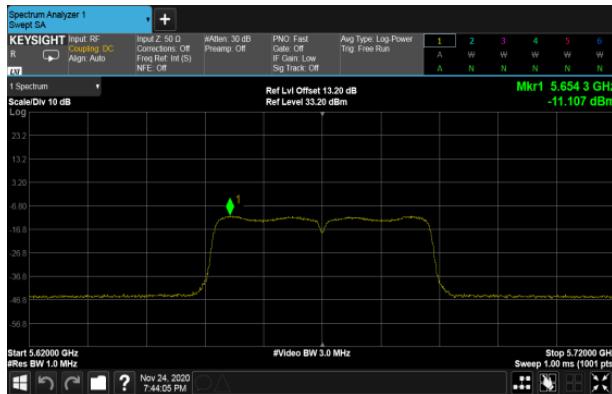
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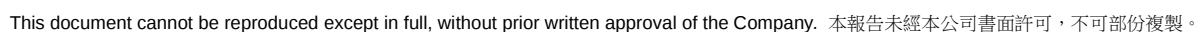
Mid CH



High CH

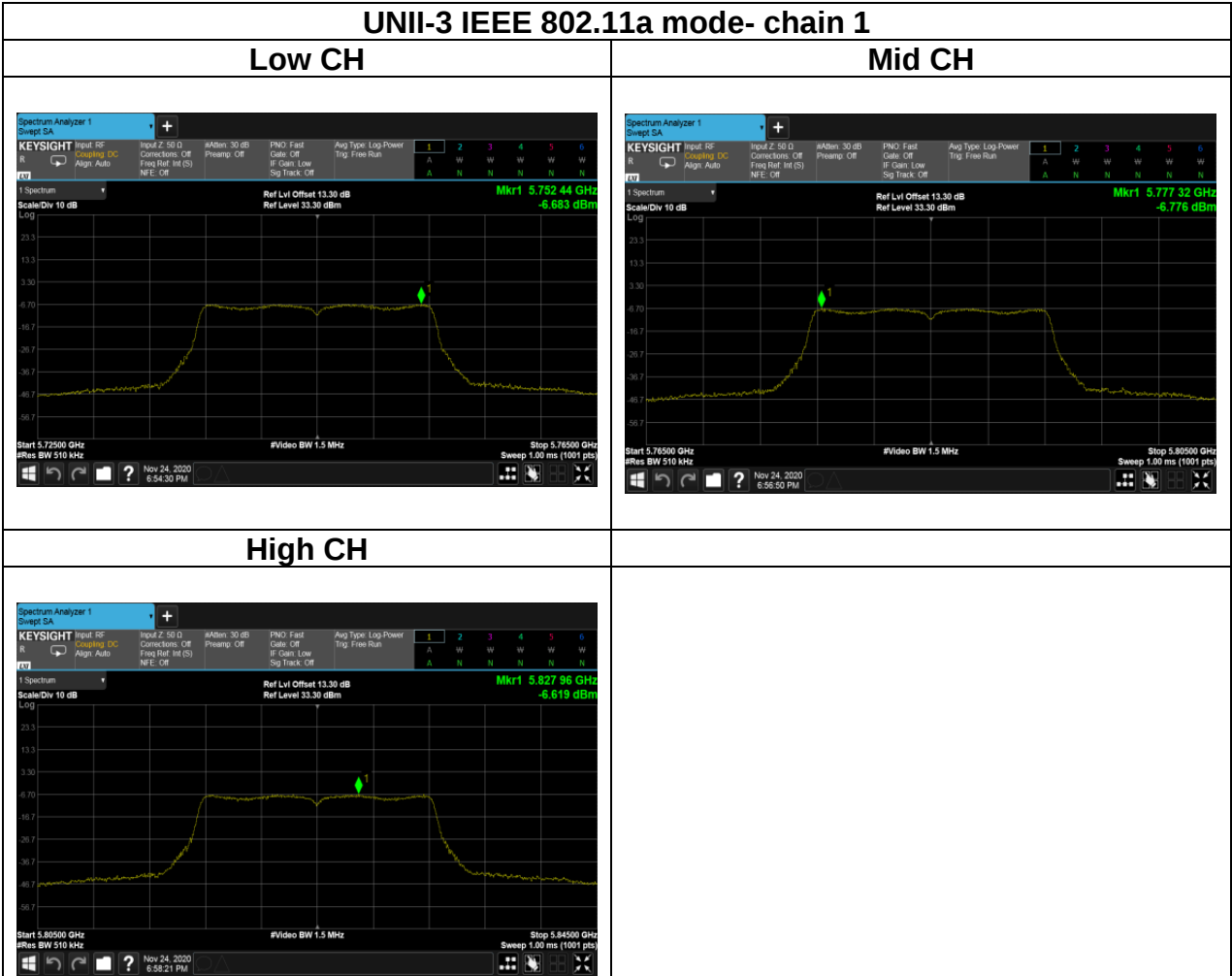


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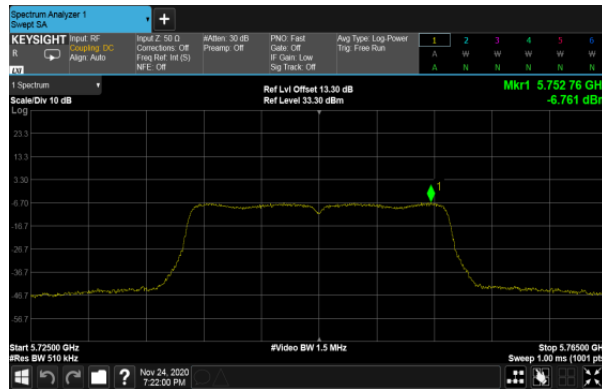
Report No.: T201104D06-RP4

Test Data

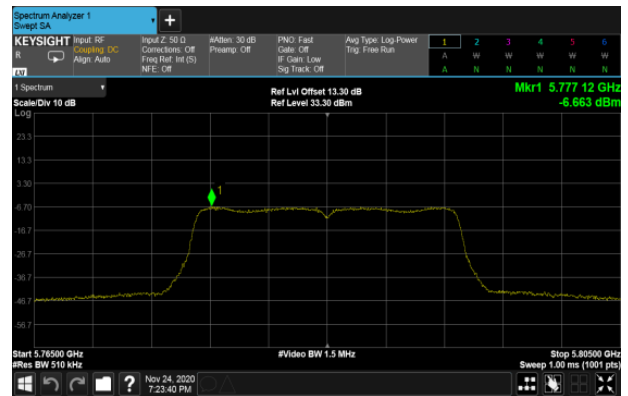


UNII-3 IEEE 802.11n HT20 mode- chain 1

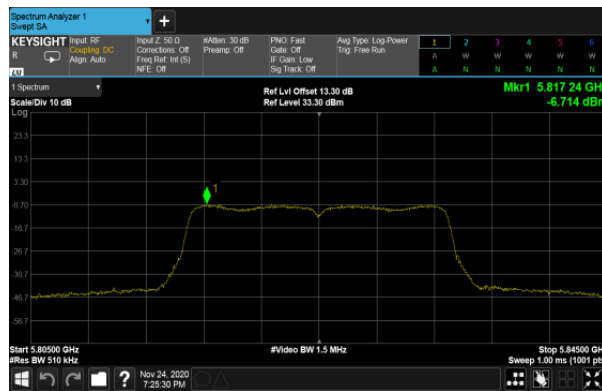
Low CH



Mid CH

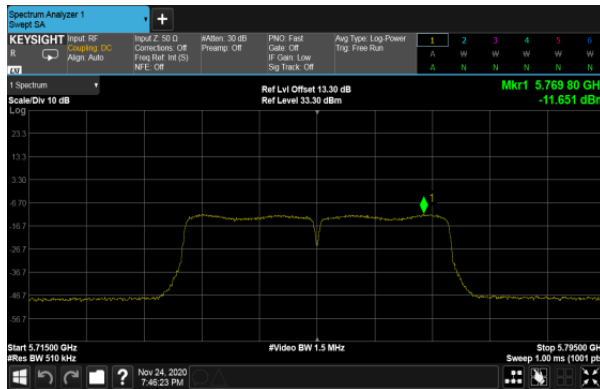


High CH

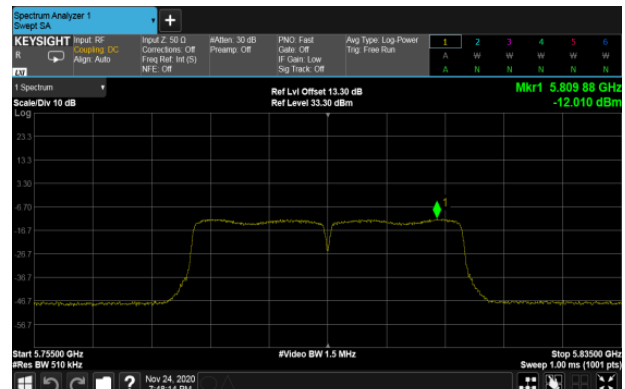


UNII-3 IEEE 802.11n HT40 mode- chain 1

Low CH



High CH



UNII-3 IEEE 802.11ac VHT80 mode- chain 1

Mid CH

