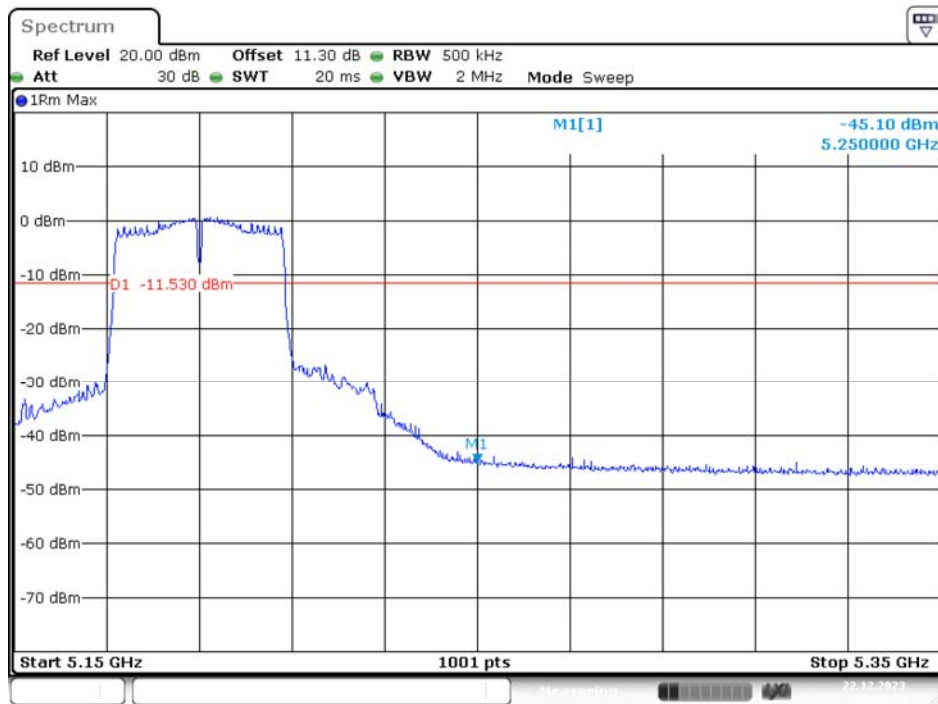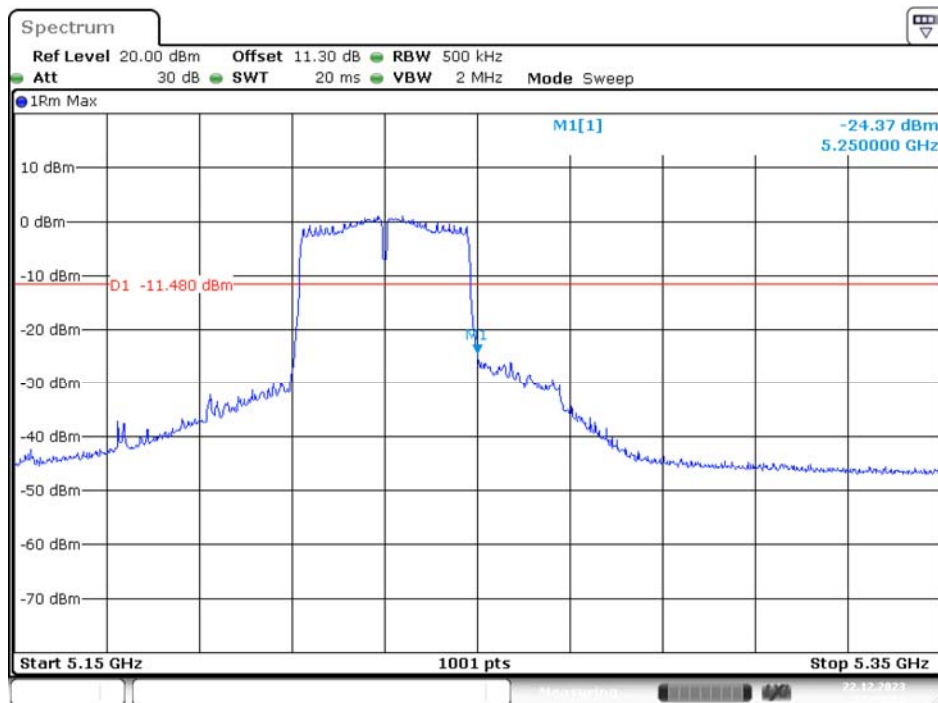## IEEE 802.11ac VHT40 Mode / 5150 ~ 5250MHz

5190MHz

Date: 22.DEC.2023　15:24:40

5230MHz

Date: 22.DEC.2023　15:22:59

IEEE 802.11ac VHT80 Mode / 5150 ~ 5250MHz

5210MHz

Spectrum				
Ref Level 20.00 dBm	Offset 11.30 dB	RBW 1 MHz		
Att 30 dB	SWT 20 ms	VBW 3 MHz	Mode Sweep	

1Rm Max

M1[1]   -25.72 dBm
              5.250000 GHz

10 dBm

0 dBm

-10 dBm   D1 -13.490 dBm

-20 dBm

-30 dBm   M1

-40 dBm

-50 dBm

-60 dBm

-70 dBm

Start 5.15 GHz   1001 pts   Stop 5.35 GHz

Date: 22.DEC.2023   15:09:57

11 FCC §15.407(a)(e) & RSS-247 §6.2, RSS-GEN §6.7 – Emission Bandwidth And Occupied Bandwidth

11.1 Applicable Standard

As per FCC §15.407(a): The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

As per FCC §15.407(e): for equipment operating in the band 5725 – 5850 MHz, the minimum 6 dB bandwidth of U-NII devices shall be 500 kHz.

RSS-247 Clause 6.2.1.2

For transmitters with operating frequencies in the band 5150-5250 MHz, all emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. Any unwanted emissions that fall into the band 5250-5350 MHz shall be attenuated below the channel power by at least 26 dB, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth (i.e. 99% bandwidth), above 5250 MHz. The 26 dB bandwidth may fall into the 5250-5350 MHz band; however, if the occupied bandwidth also falls within the 5250-5350 MHz band, the transmission is considered as intentional and the devices shall comply with all requirements in the band 5250-5350 MHz including implementing dynamic frequency selection (DFS) and TPC, on the portion of the emission that resides in the 5250-5350 MHz band.

RSS-247 Clause 6.2.4.1

For equipment operating in the band 5725-5850 MHz, the minimum 6 dB bandwidth shall be at least 500 kHz.

11.2 Test Procedure

26dB Emission Bandwidth (EBW)

According to ANSI C63.10-2013 Section 12.4.1

a) Set RBW = approximately 1% of the emission bandwidth.

b) Set the VBW > RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

Minimum Emission Bandwidth for the band 5.725-5.85 GHz

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

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

a) Set RBW = 100 kHz.

b) Set the video bandwidth (VBW) ≥ 3 × RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Sweep = auto couple.

f) Allow the trace to stabilize.

g) 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.

99% Occupied Bandwidth:

According to ANSI C63.10-2013 Section 12.4.2&6.9.3

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power bandwidth:

a) The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.

b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.

c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.

d) Step a) through step c) might require iteration to adjust within the specified range.

e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

f) Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.

g) If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.

h) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

11.3 Test Results

Test mode: Transmitting

5150-5250MHz

UNII Band	Mode	Channel	Frequency (MHz)	26dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)
UNII-1	802.11a	36	5180	21.40	16.66
		40	5200	21.44	16.70
		48	5240	21.48	16.70
	802.11ac 20	36	5180	22.44	17.94
		40	5200	21.88	17.82
		48	5240	23.76	17.86
	802.11ac 40	38	5190	45.60	36.36
		46	5230	47.28	36.60
	802.11ac 80	42	5210	82.08	75.44

The 99% Occupied Bandwidth have not fallen into the band 5250-5350MHz, please refer to the test plots of 99% Occupied Bandwidth.

5250-5350MHz

UNII Band	Mode	Channel	Frequency (MHz)	26dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)
UNII-2A	802.11a	52	5260	21.44	16.70
		60	5300	21.56	16.70
		64	5320	21.48	16.66
	802.11ac 20	52	5260	23.24	17.82
		60	5300	23.36	17.78
		64	5320	22.76	17.90
	802.11ac 40	54	5270	47.12	36.44
		62	5310	41.12	36.36
	802.11ac 80	58	5290	81.60	75.60

5470-5725MHz

UNII Band	Mode	Channel	Frequency (MHz)	26dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)
UNII-2C	802.11a	100	5500	21.40	16.66
		116	5580	21.44	16.70
		140	5700	21.64	16.70
	802.11ac 20	100	5500	21.96	17.86
		116	5580	22.56	17.78
		140	5700	22.32	17.82
	802.11ac 40	102	5510	43.12	36.44
		110	5550	44.88	36.52
		134	5670	45.28	36.44
	802.11ac 80	106	5530	81.28	75.76
		122	5610	82.88	75.60

5725-5850MHz

UNII Band	Mode	Channel	Frequency (MHz)	6dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (kHz)	Result
UNII-3	802.11a	149	5745	16.36	16.66	≥500	PASS
		157	5785	16.32	16.66	≥500	PASS
		165	5825	16.32	16.74	≥500	PASS
	802.11ac 20	149	5745	17.56	17.82	≥500	PASS
		157	5785	17.56	17.94	≥500	PASS
		165	5825	17.56	17.94	≥500	PASS
	802.11ac 40	151	5755	36.32	36.44	≥500	PASS
		159	5795	36.32	36.44	≥500	PASS
	802.11ac 80	155	5775	75.52	75.92	≥500	PASS

The 99% Occupied Bandwidth have not fallen into the band 5470-5725MHz, please refer to the test plots of 99% Occupied Bandwidth.

Please refer to the following plots

Transmitting Mode:

UNII-1 Band I / BW 26dBc
IEEE 802.11a Mode / 5150 ~ 5250MHz
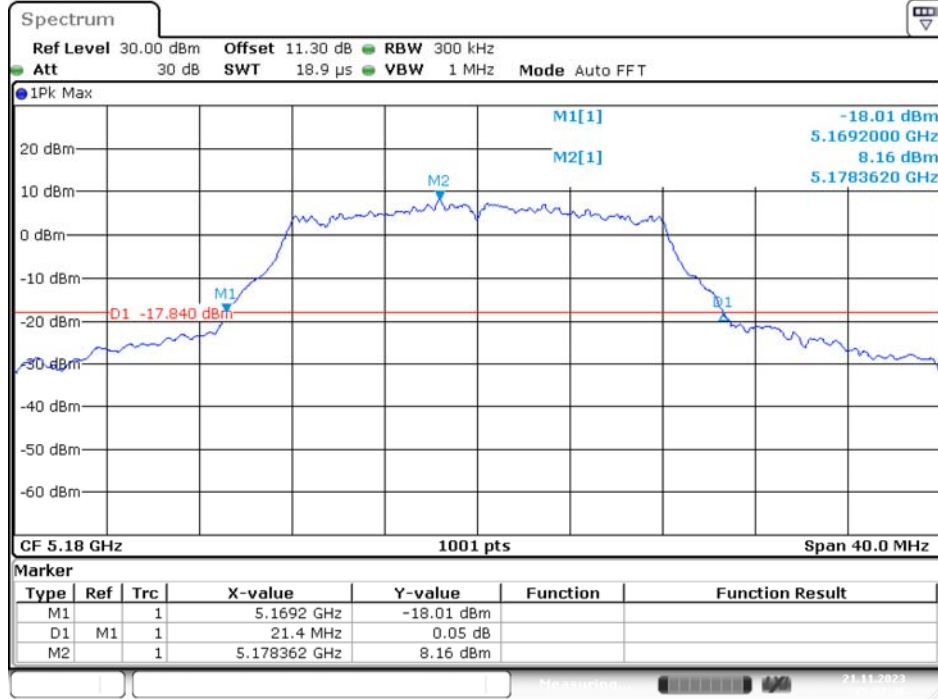
5180MHz

Date: 21.NOV.2023 15:57:36

5200MHz
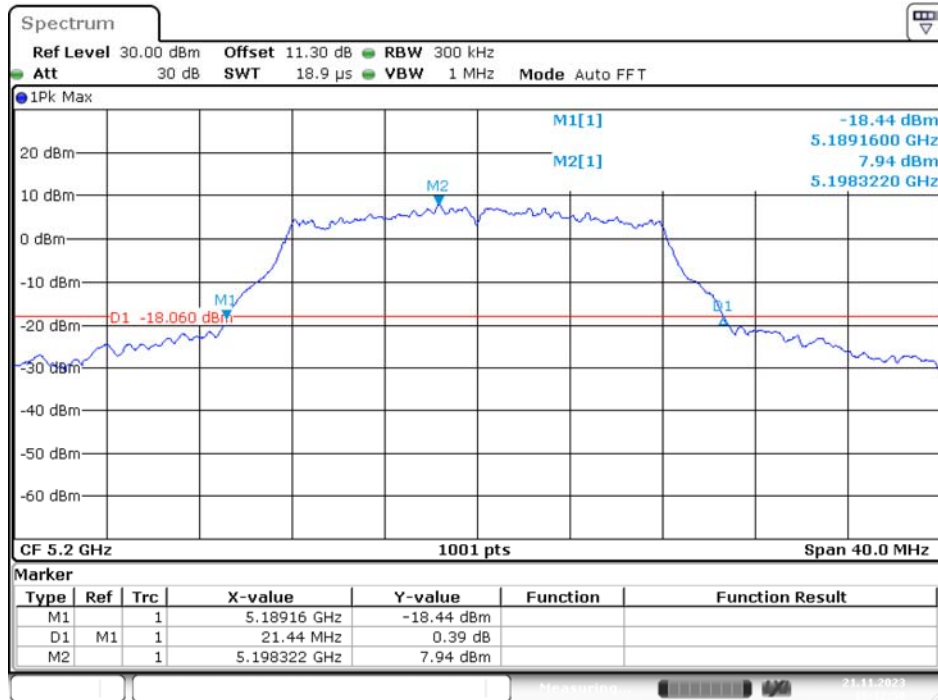
Date: 21.NOV.2023 16:12:50

5240MHz

Marker						
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.2292 GHz	-17.91 dBm		
D1	M1	1	21.48 MHz	-0.19 dB		
M2		1	5.238322 GHz	8.22 dBm		
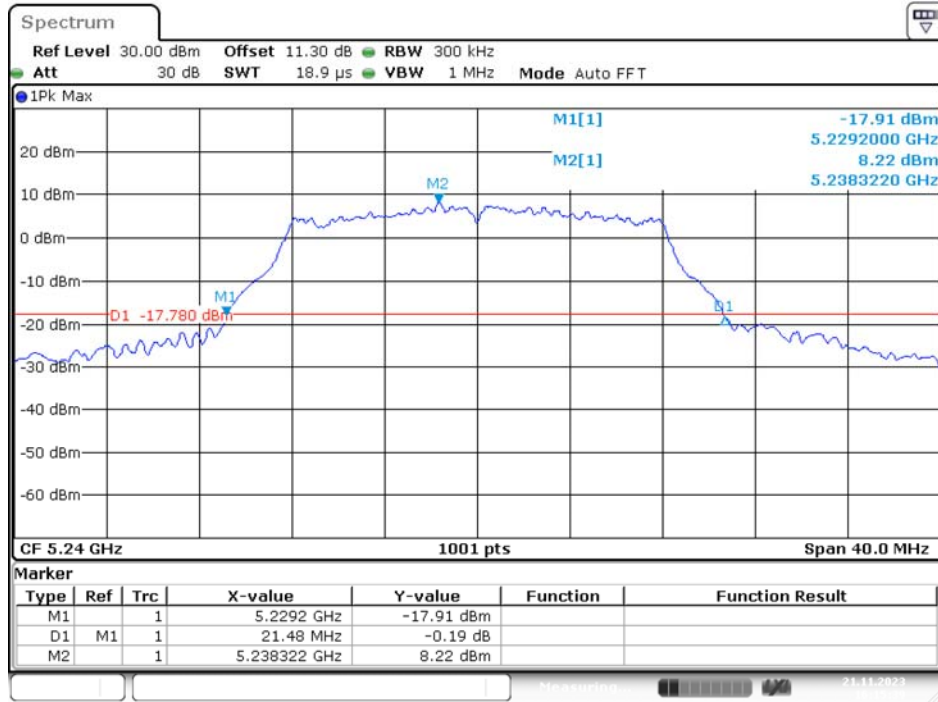
Date: 21.NOV.2023 16:15:40

IEEE 802.11ac VHT20 Mode / 5150 ~ 5250MHz

5180MHz

Marker						
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.16912 GHz	-16.02 dBm		
D1	M1	1	22.44 MHz	-2.70 dB		
M2		1	5.180959 GHz	7.66 dBm		
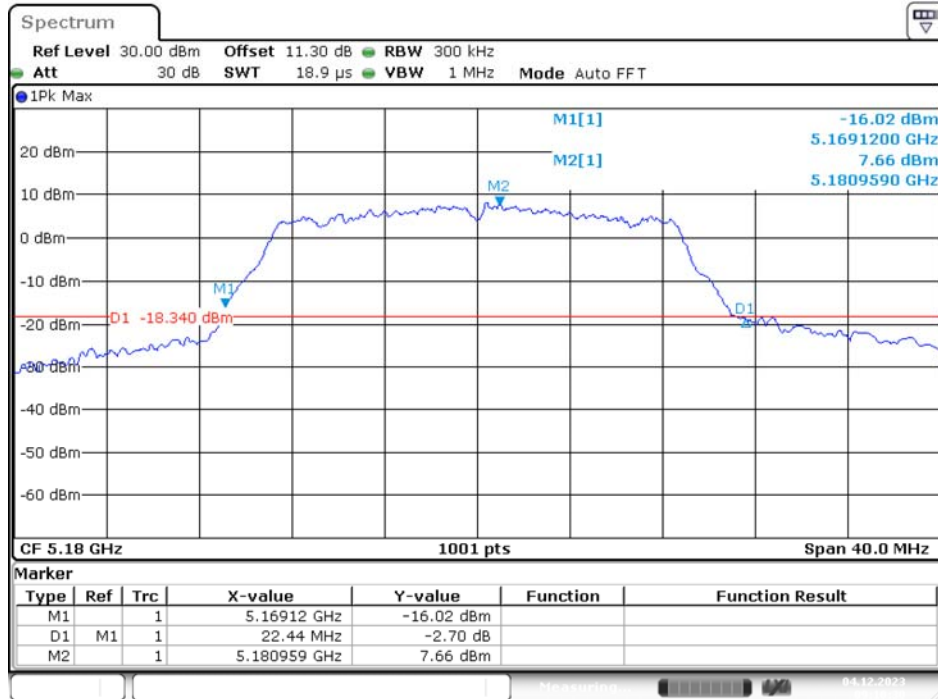
Date: 4.DEC.2023 09:10:30

5200MHz
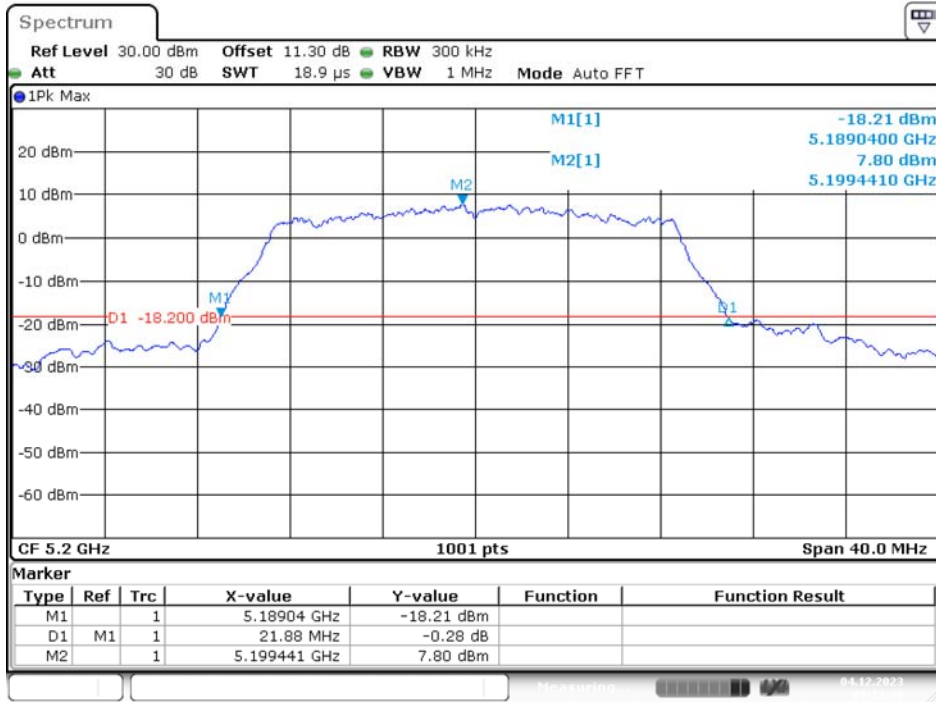
Date: 4.DEC.2023   09:13:30

5240MHz
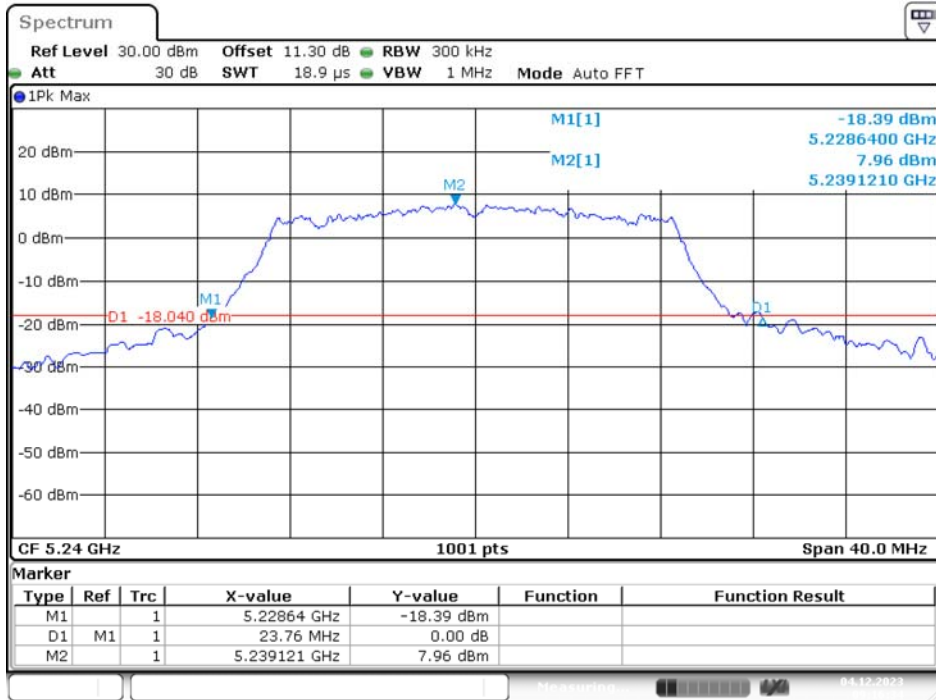
Date: 4.DEC.2023   09:16:35

IEEE 802.11ac VHT40 Mode / 5150 ~ 5250MHz

5190MHz
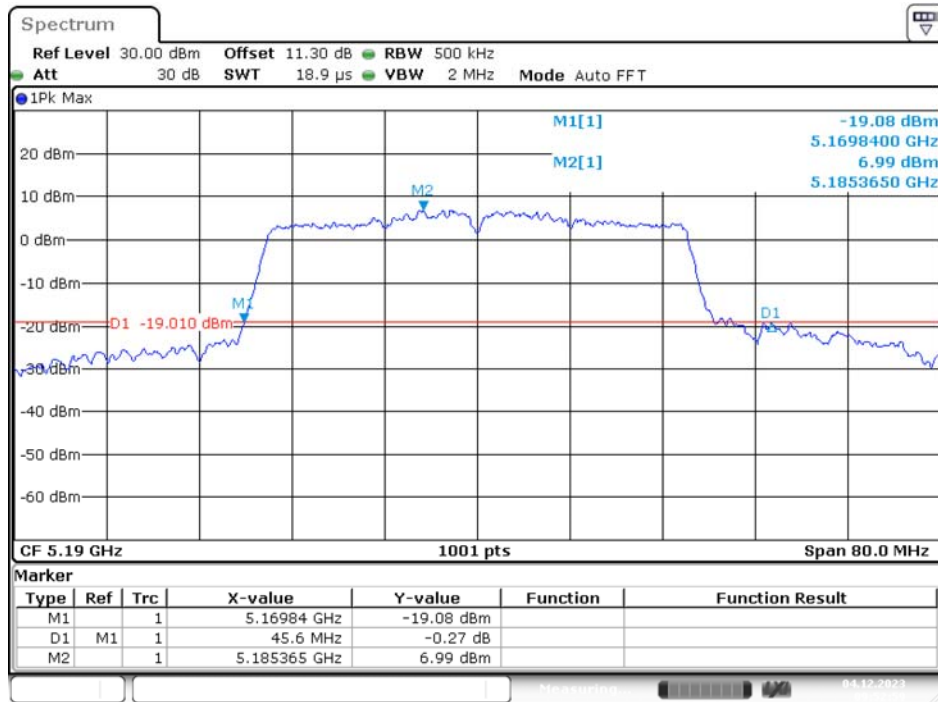
Date: 4.DEC.2023   09:52:59

5230MHz
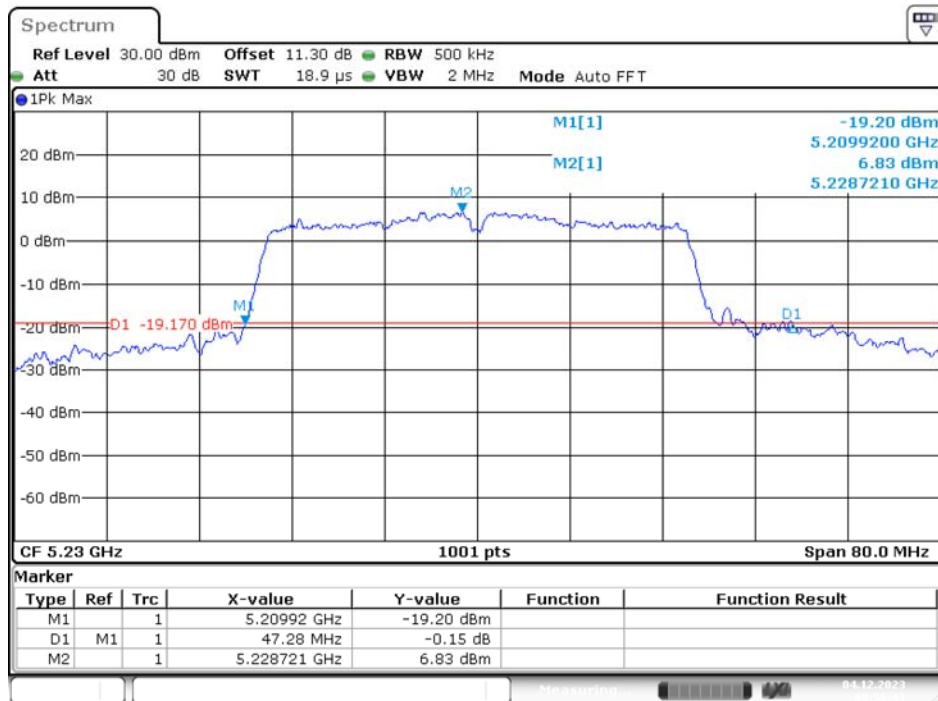
Date: 4.DEC.2023   09:56:41

IEEE 802.11ac VHT80 Mode / 5150 ~ 5250MHz

5210MHz
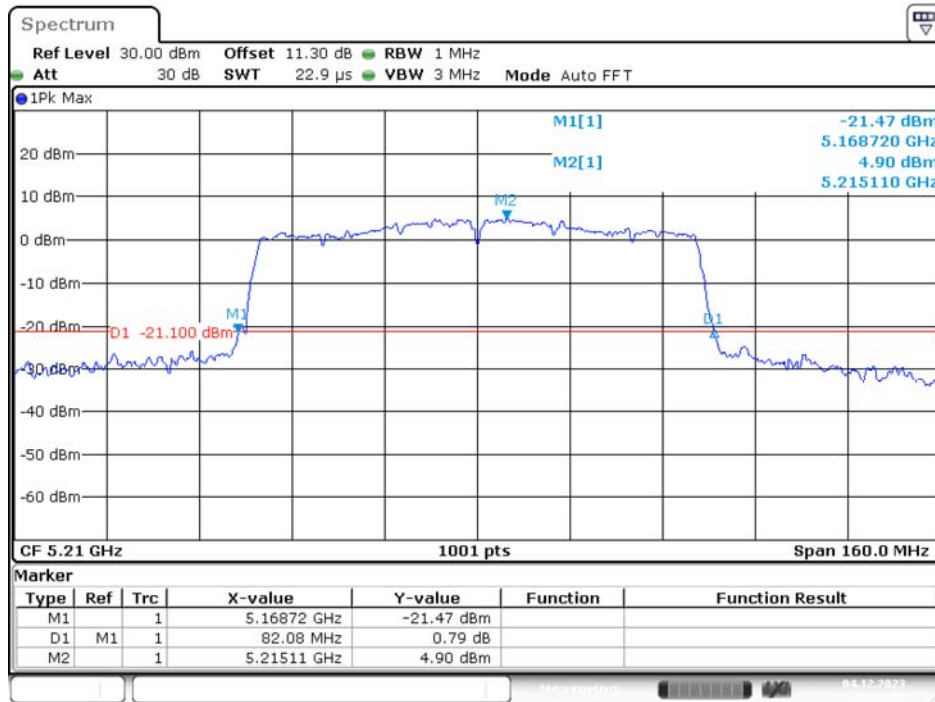
Date: 4.DEC.2023   10:19:31

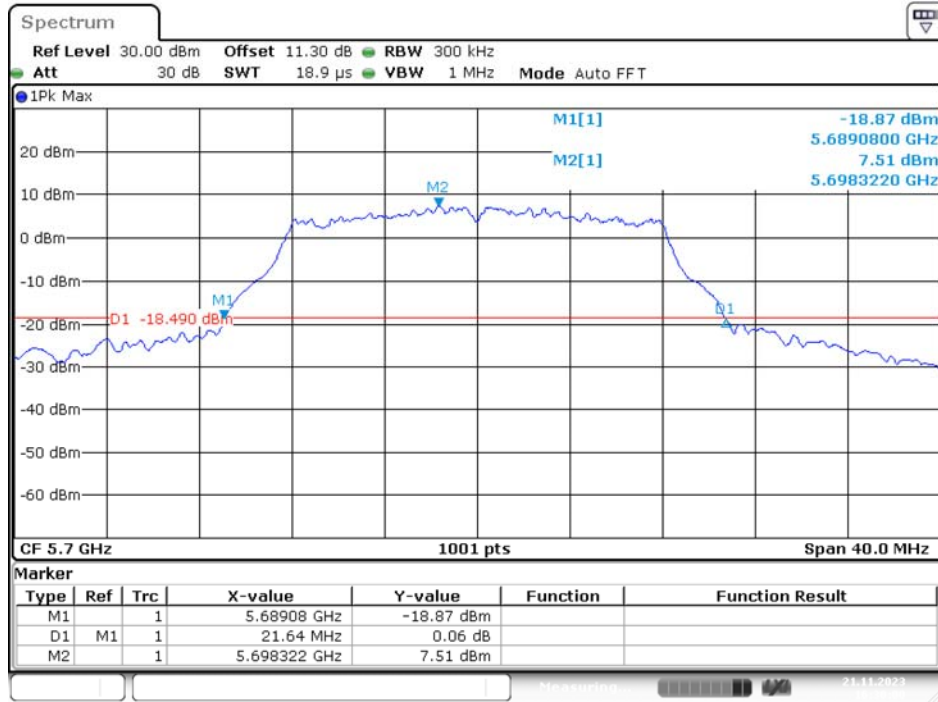## UNII-2A Band II / BW 26dBc
IEEE 802.11a Mode / 5250 ~ 5350MHz
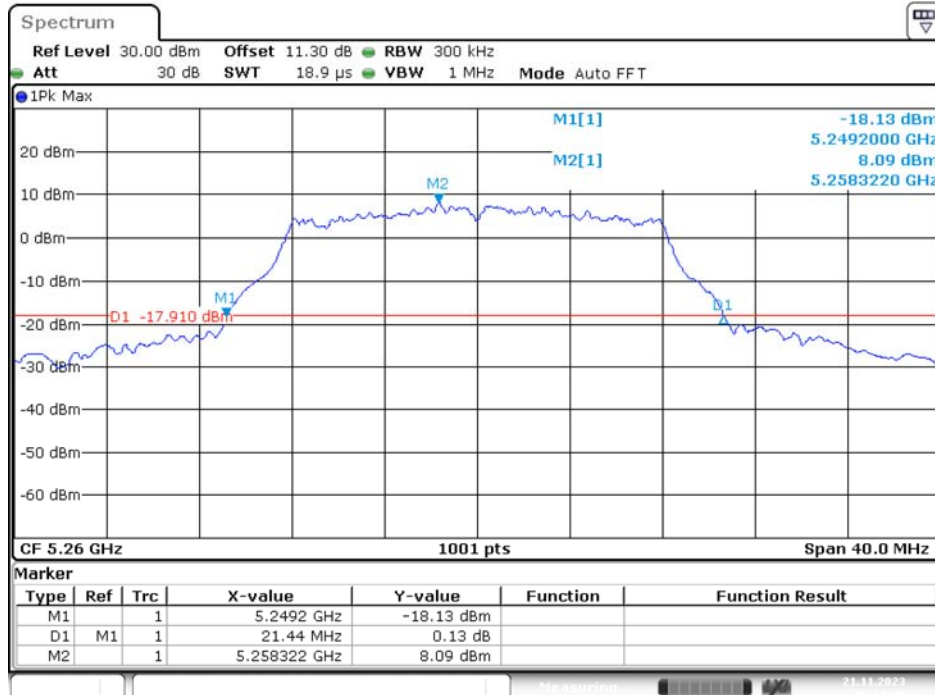
5260MHz

Date: 21.NOV.2023   16:19:39

5300MHz
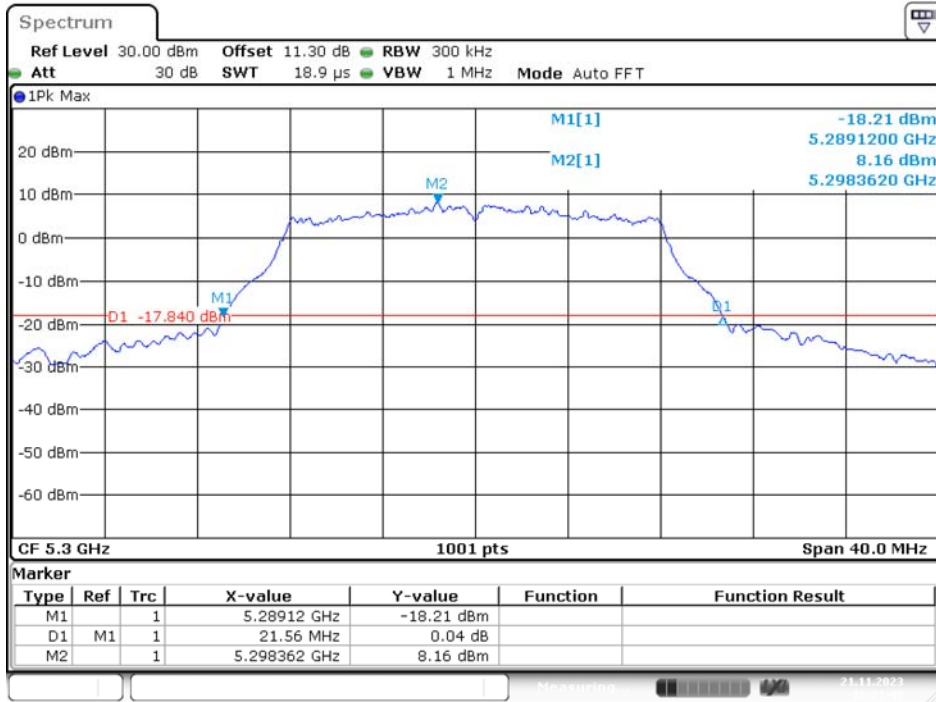
Date: 21.NOV.2023 16:21:48

5320MHz
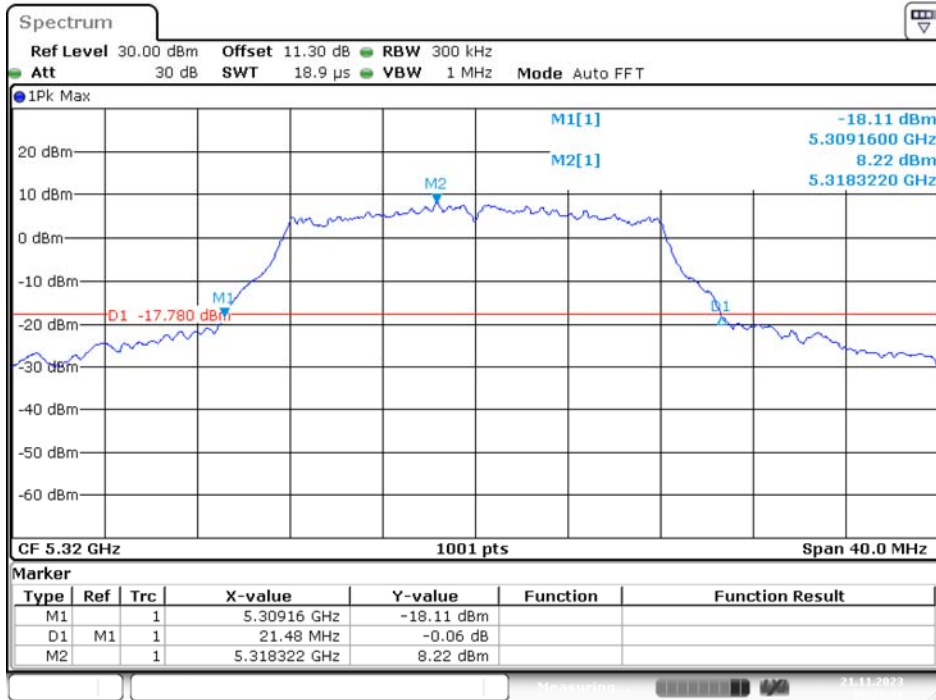
Date: 21.NOV.2023 16:23:22

IEEE 802.11ac VHT20 Mode / 5250 ~ 5350MHz

5260MHz

Marker						
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.24864 GHz	-18.18 dBm		
D1	M1	1	23.24 MHz	0.03 dB		
M2		1	5.260999 GHz	7.97 dBm		
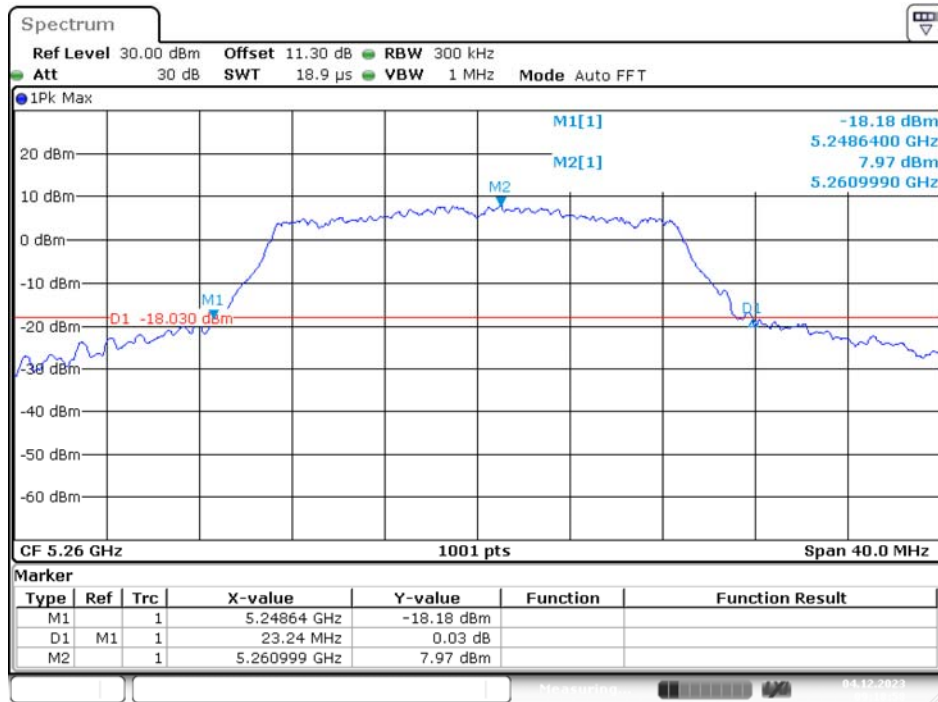
Date: 4.DEC.2023   09:18:59

5300MHz

Marker						
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.289 GHz	-18.14 dBm		
D1	M1	1	23.36 MHz	-0.15 dB		
M2		1	5.300839 GHz	8.10 dBm		
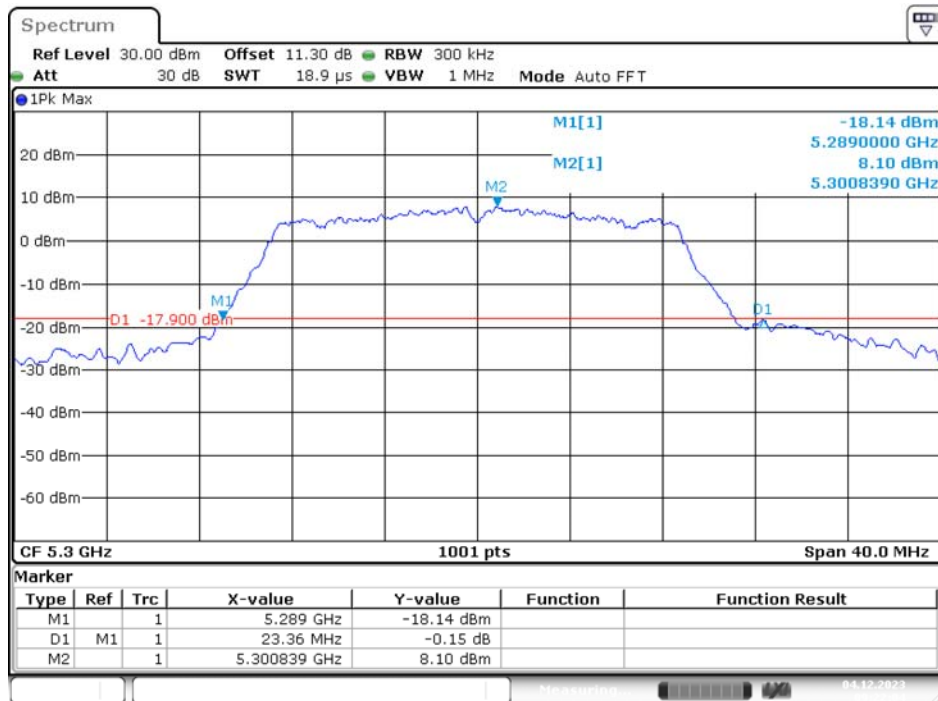
Date: 4.DEC.2023   09:22:04

5320MHz

Date: 4.DEC.2023 09:28:33
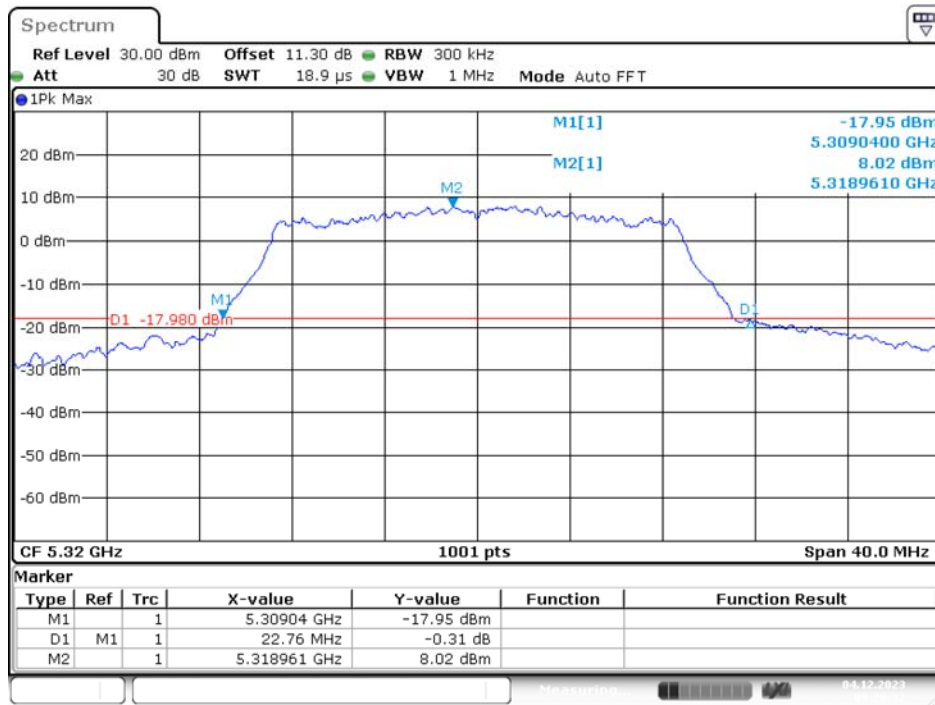
IEEE 802.11ac VHT40 Mode / 5250 ~ 5350MHz

5270MHz

Date: 4.DEC.2023 09:58:55
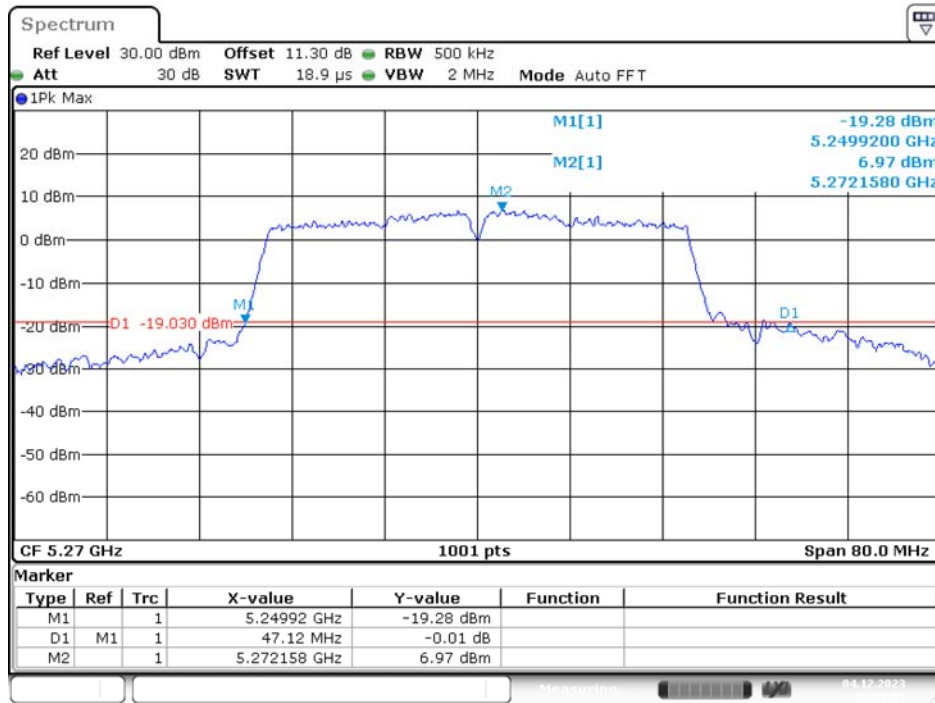
5310MHz
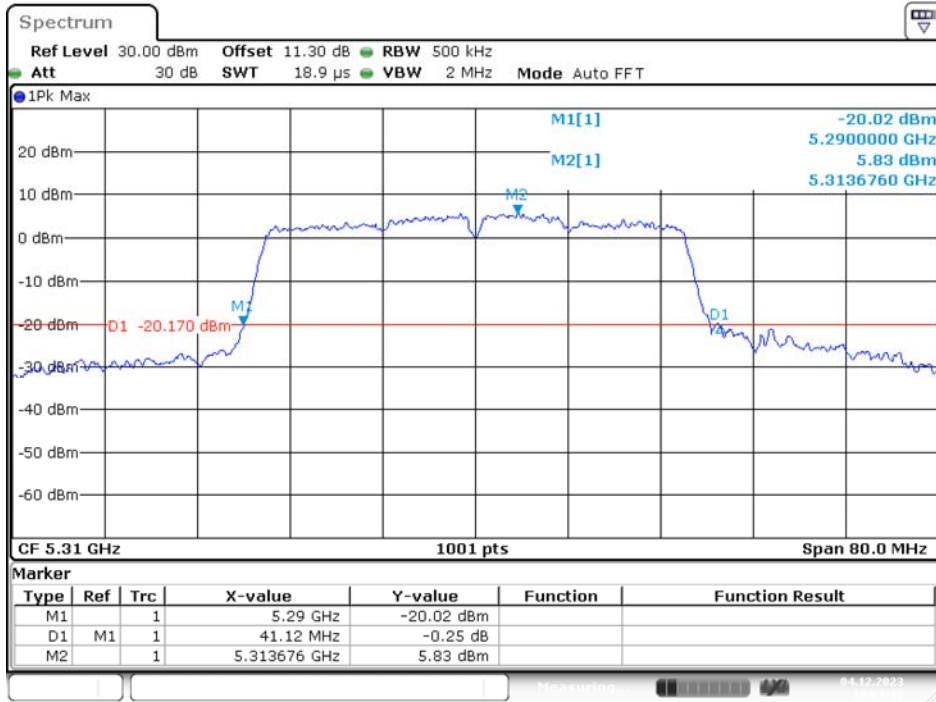
Date: 4.DEC.2023   10:01:13

IEEE 802.11ac VHT80 Mode / 5250 ~ 5350MHz

5290MHz
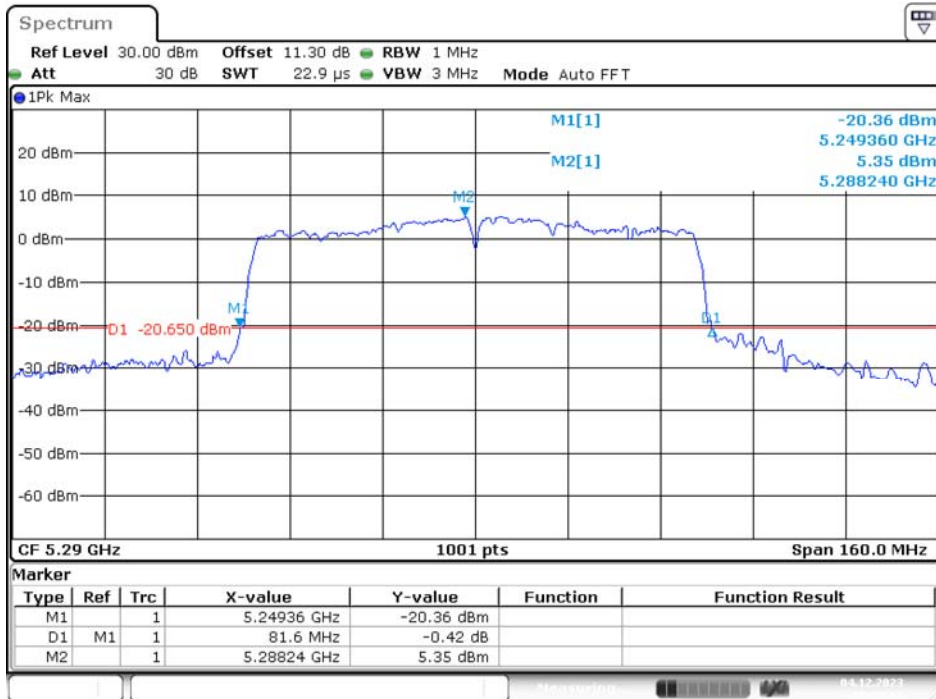
Date: 4.DEC.2023   10:21:48

UNII-2C Band III / BW 26dBc
IEEE 802.11a Mode / 5470 ~ 5725MHz
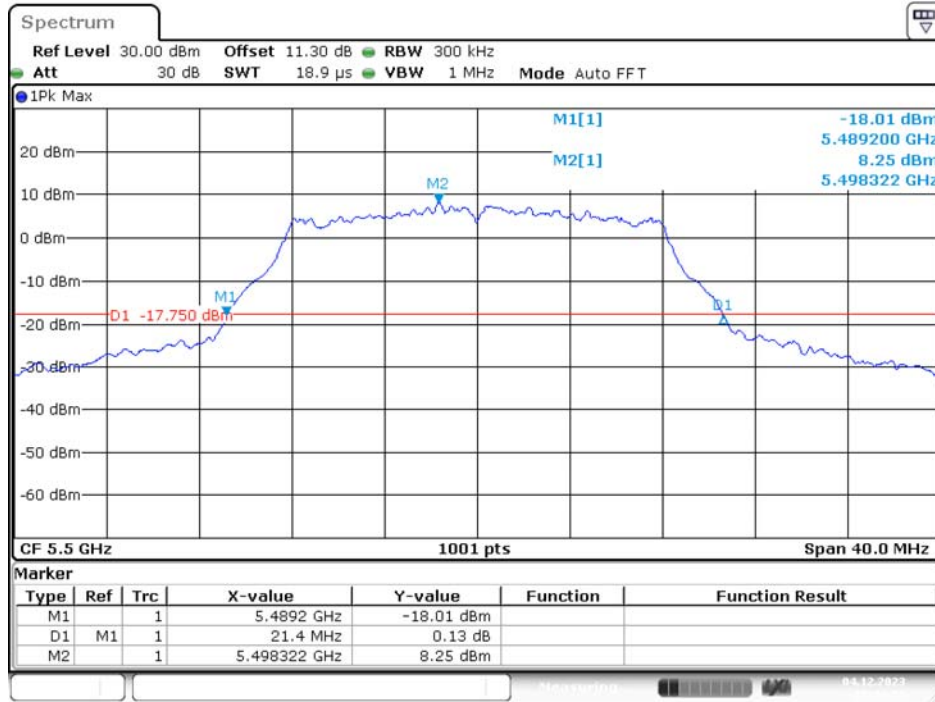
5500MHz

Date: 4.DEC.2023 10:44:52

5580MHz
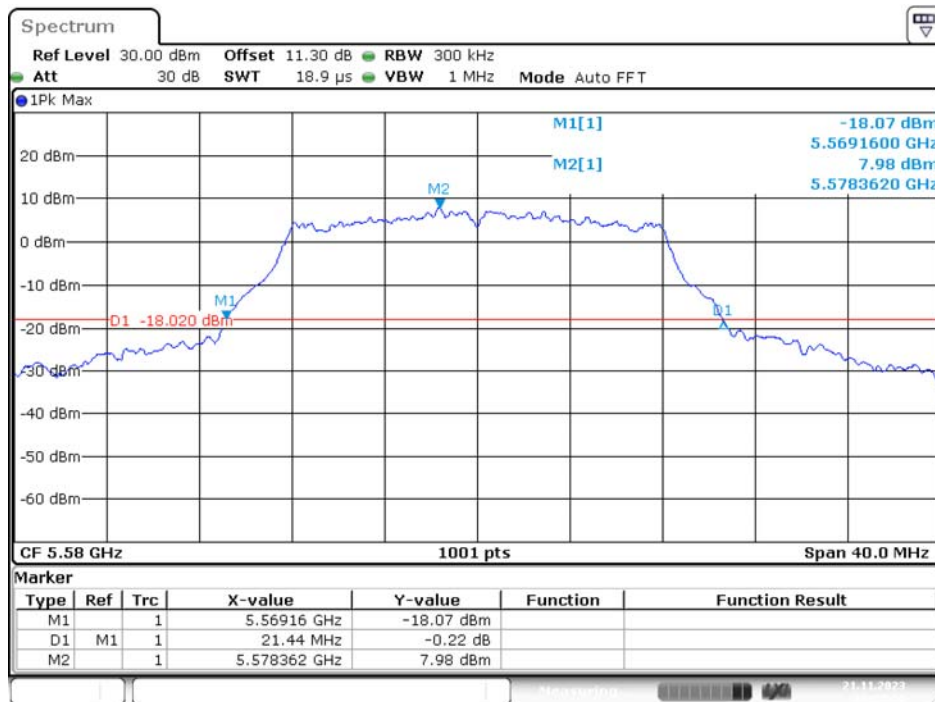
Date: 21.NOV.2023 16:27:30

5700MHz

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.68908 GHz	-18.87 dBm		
D1	M1	1	21.64 MHz	0.06 dB		
M2		1	5.698322 GHz	7.51 dBm		

Date: 21.NOV.2023 16:30:01

IEEE 802.11ac VHT20 Mode / 5470 ~ 5725MHz

5500MHz

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.48904 GHz	-18.29 dBm		
D1	M1	1	21.96 MHz	0.33 dB		
M2		1	5.500959 GHz	8.01 dBm		
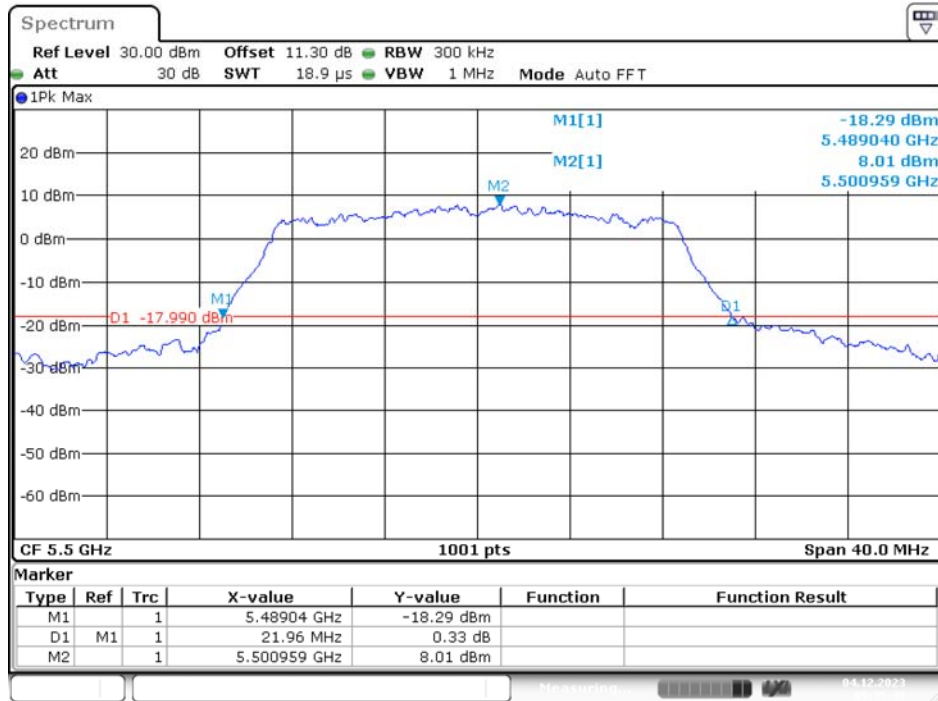
Date: 4.DEC.2023 09:35:41

5580MHz

Date: 4.DEC.2023 09:40:37

5700MHz
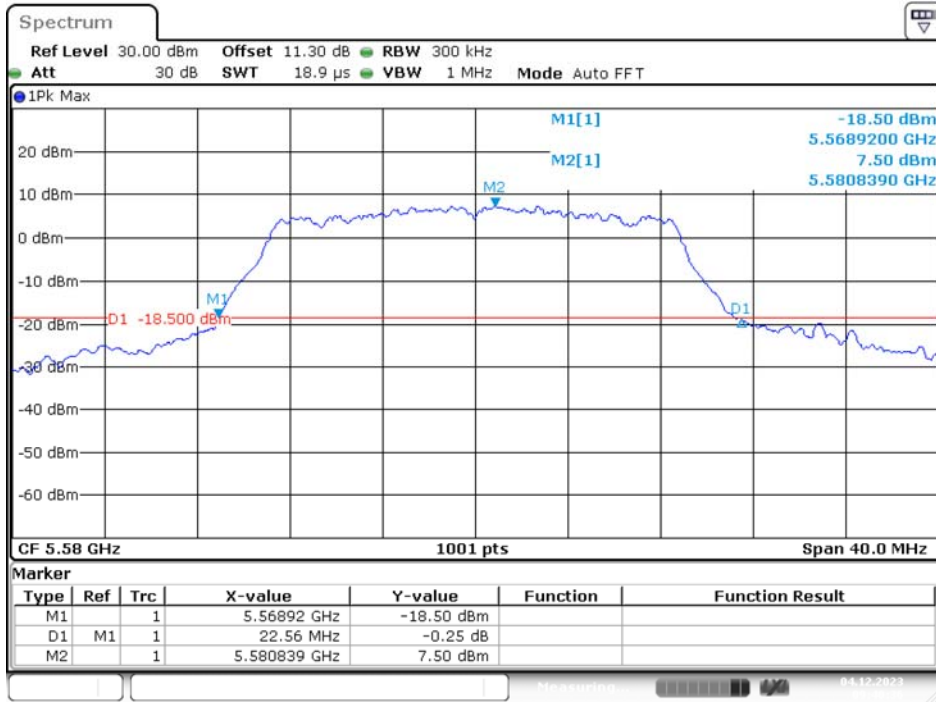
Date: 4.DEC.2023 09:42:19
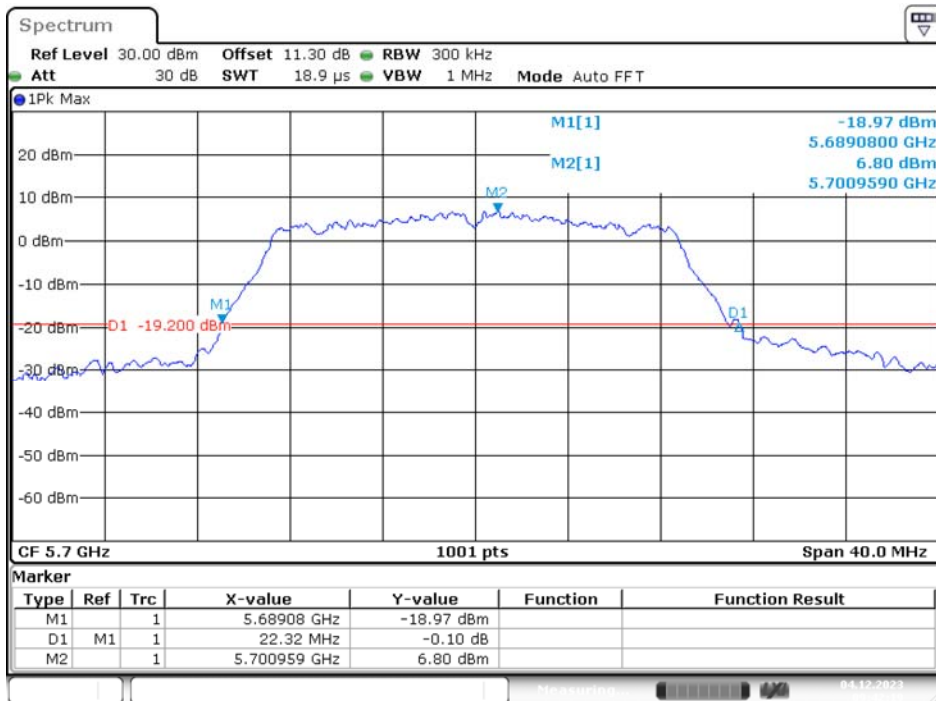
IEEE 802.11ac VHT40 Mode / 5470 ~ 5725MHz

5510MHz
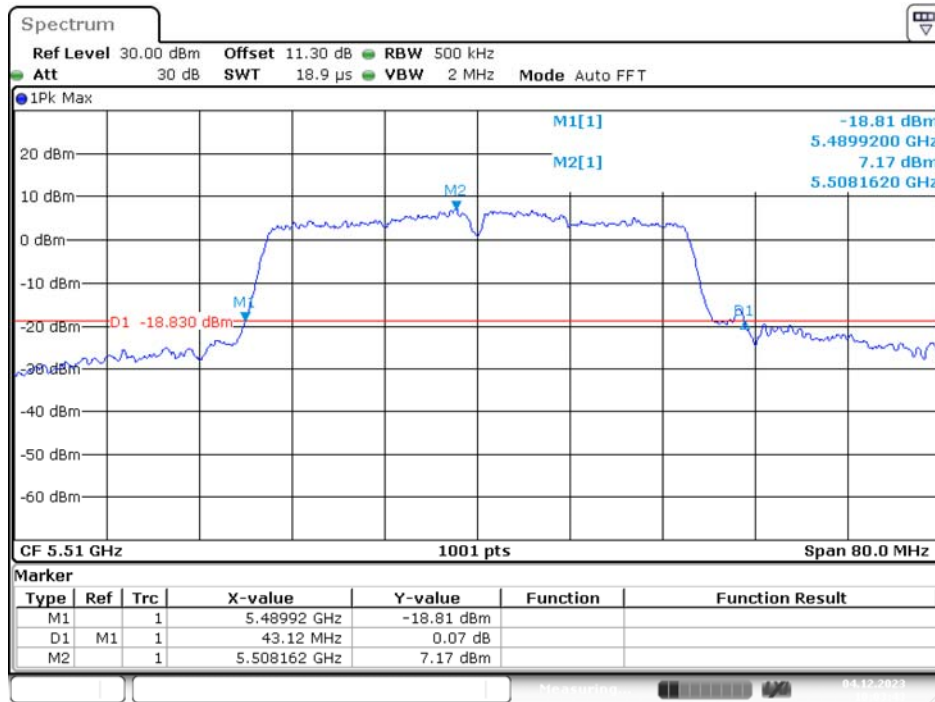
Date: 4.DEC.2023　10:03:43

5550MHz
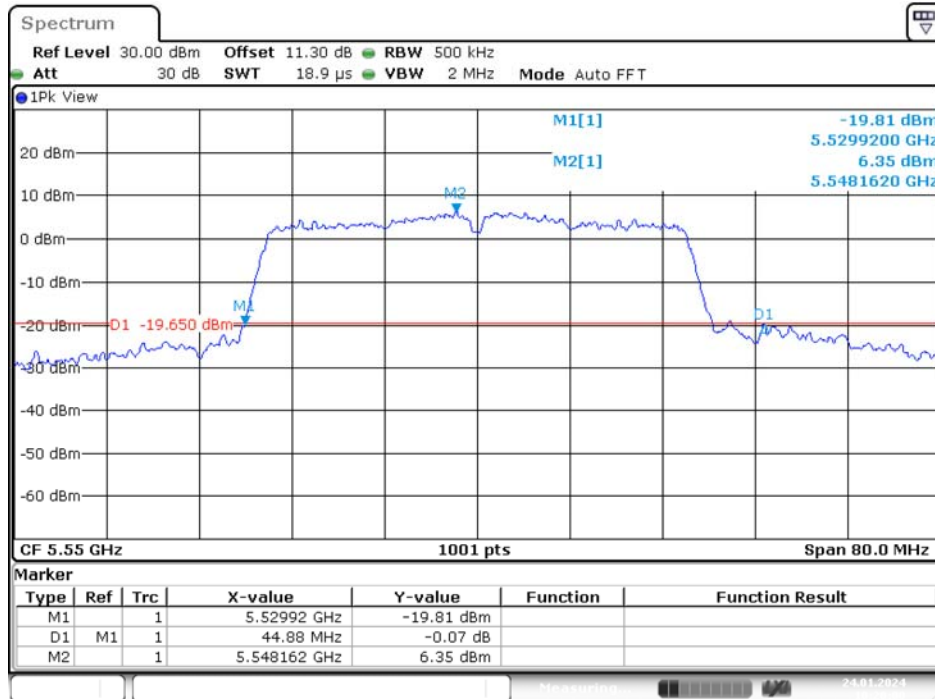
Date: 24.JAN.2024　10:20:00

5670MHz
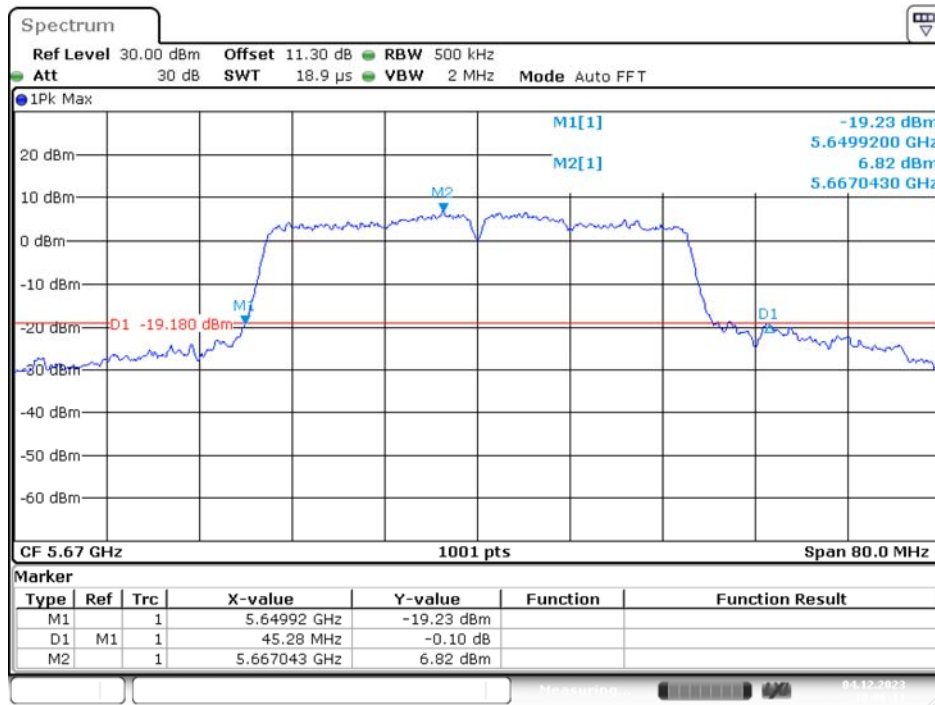
Date: 4.DEC.2023 10:06:12

IEEE 802.11ac VHT80 Mode / 5470 ~ 5725MHz
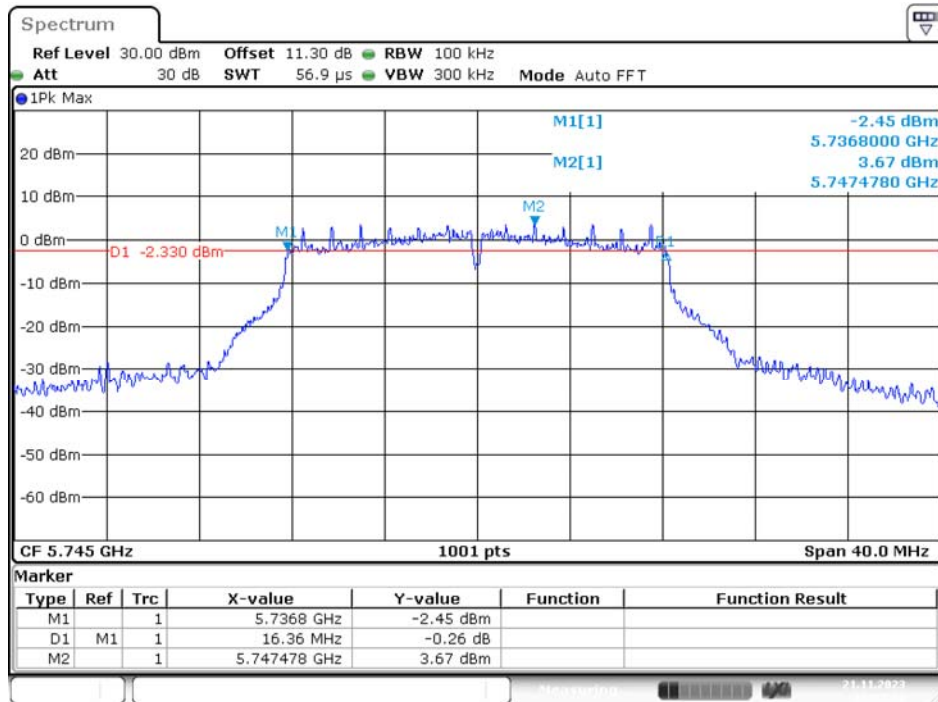
5530MHz
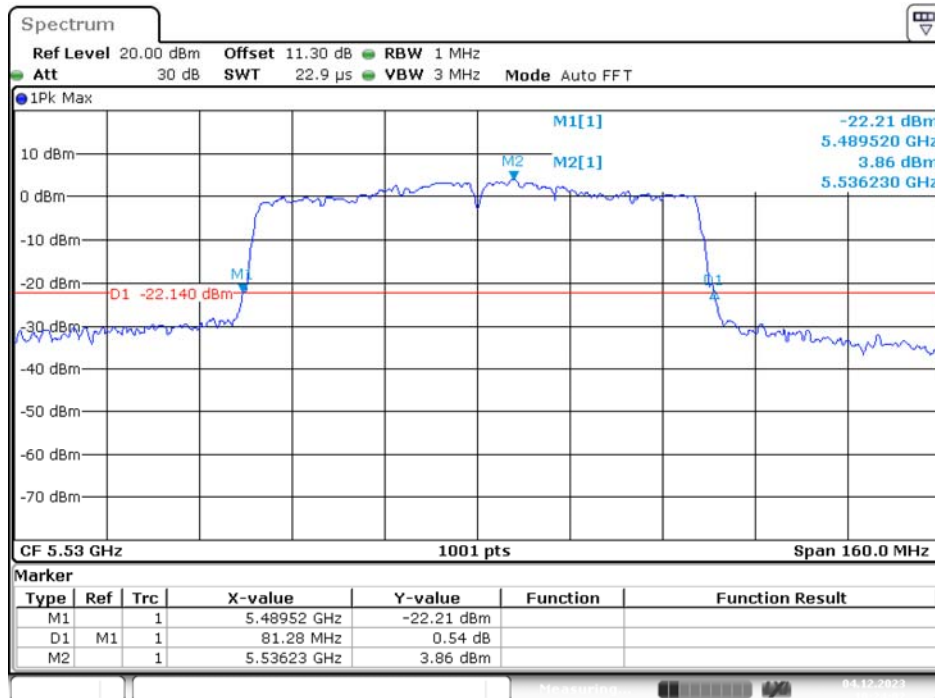
Date: 4.DEC.2023 10:24:02
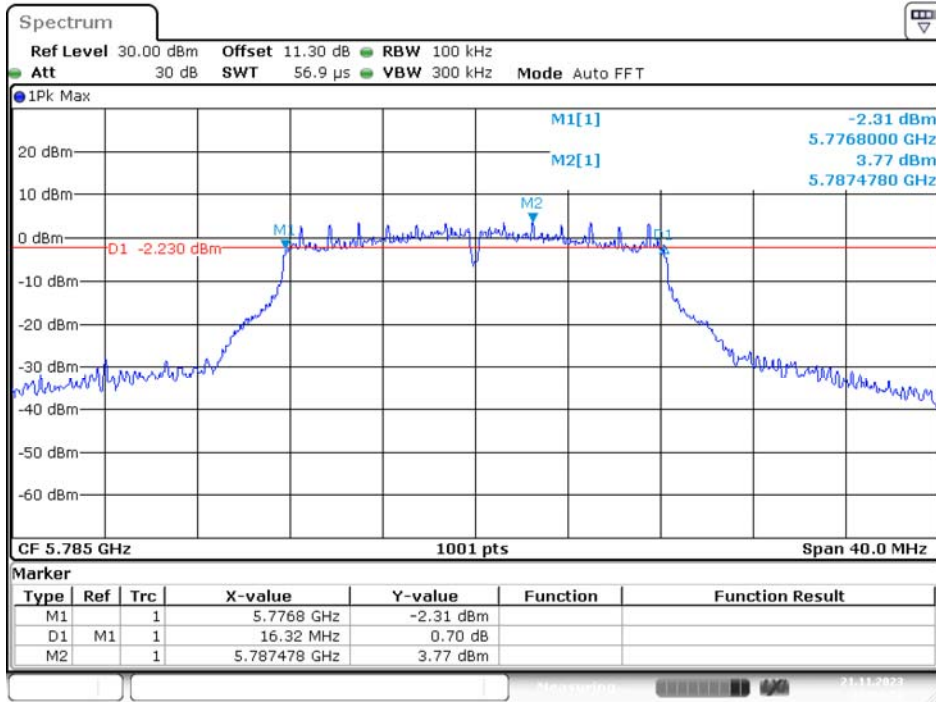
5610MHz
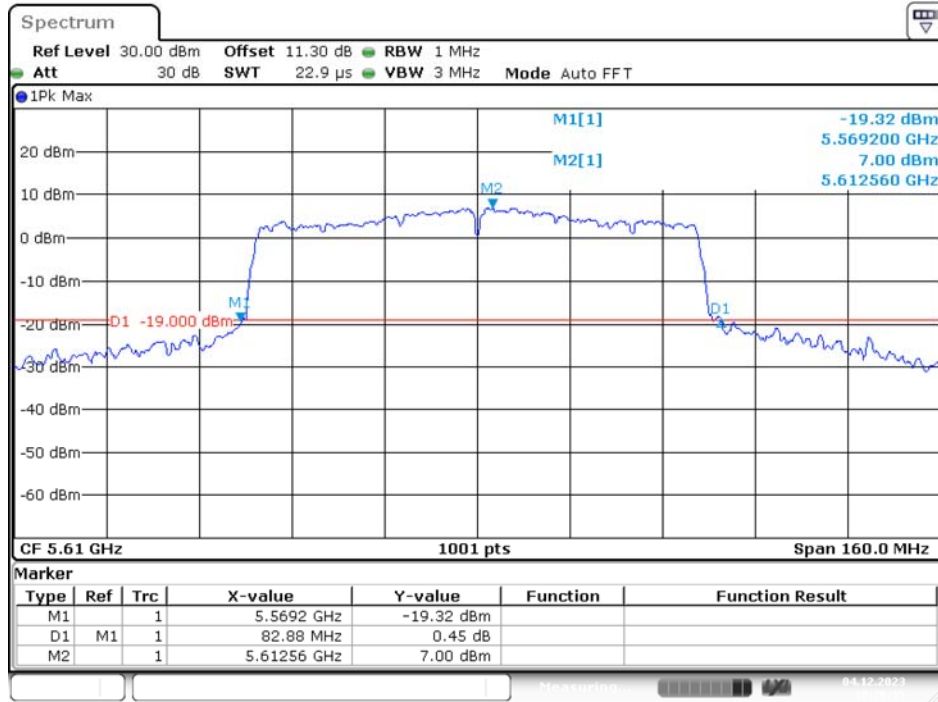
Date: 4.DEC.2023 10:26:15

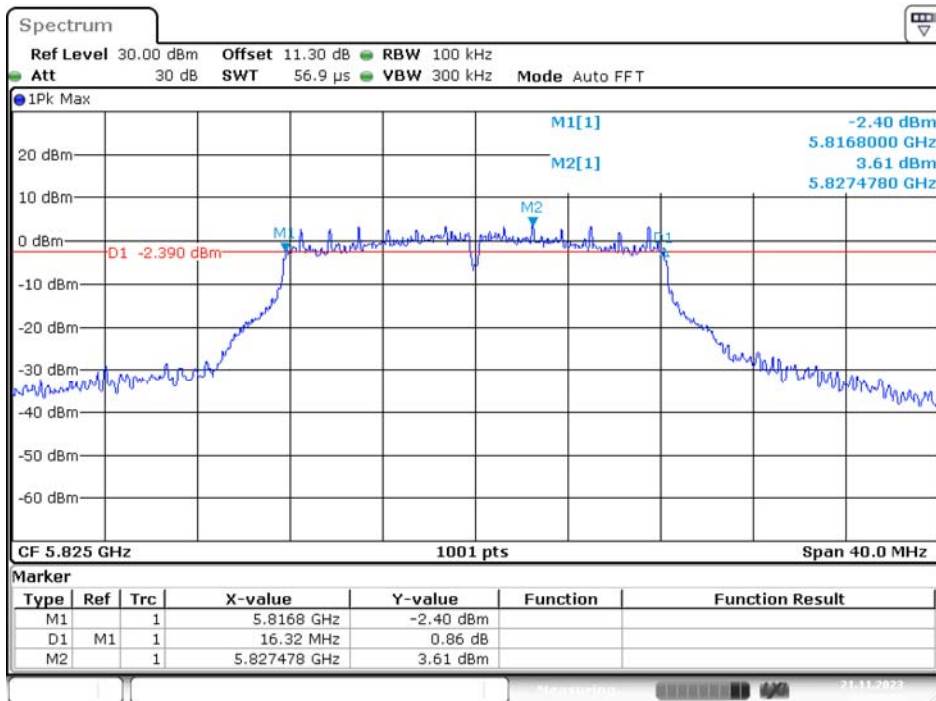**UNII-3 Band IV / BW 6dBc**
IEEE 802.11a Mode / 5725 ~ 5850MHz

5745MHz

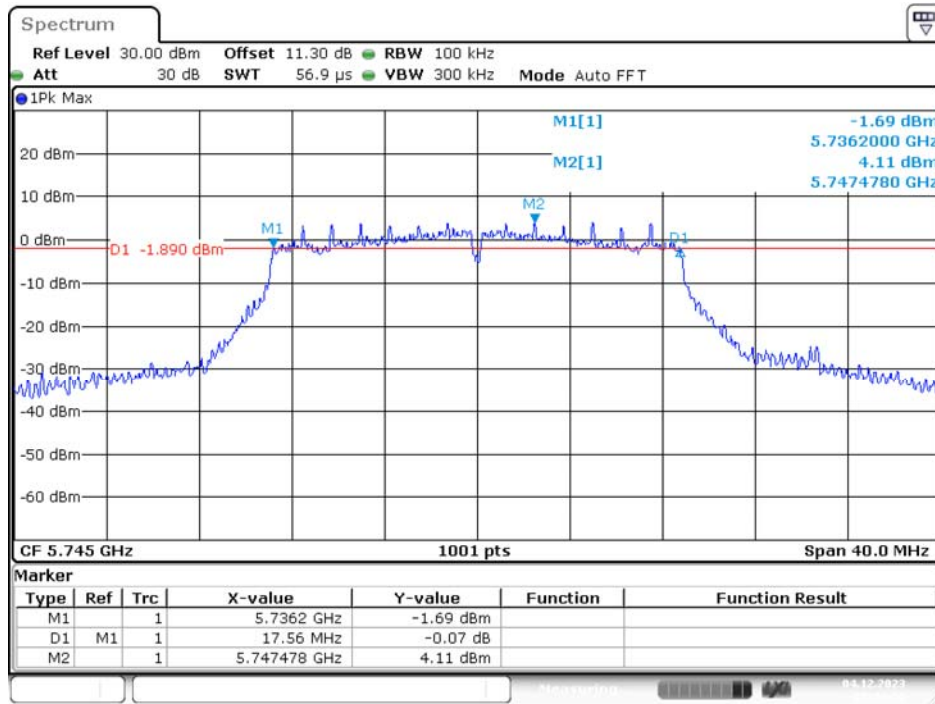
Date: 21.NOV.2023 16:32:33

5785MHz

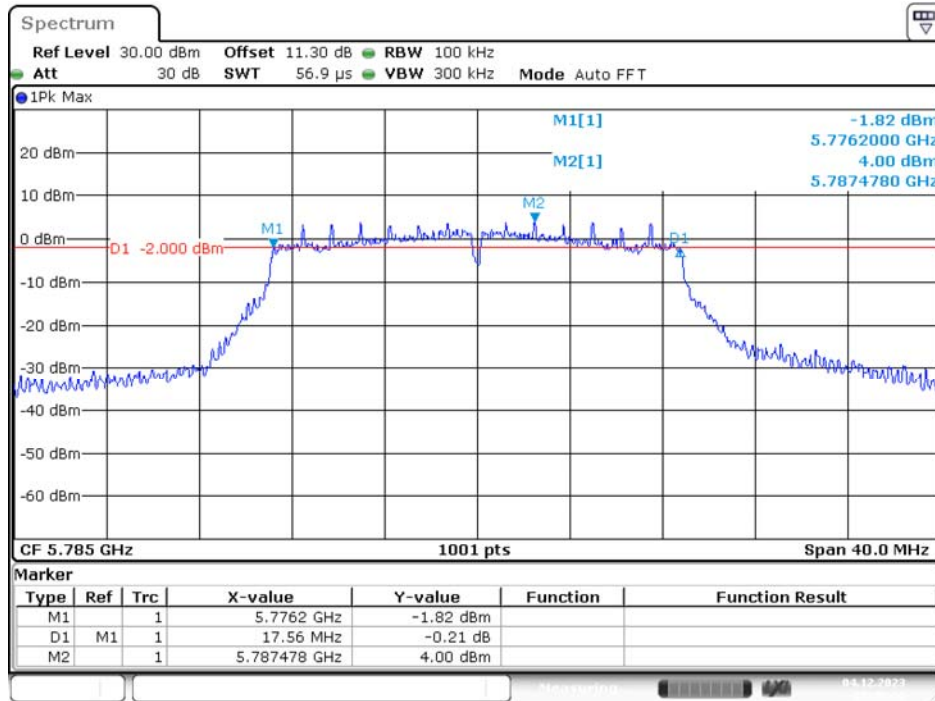Date: 21.NOV.2023 16:34:53

5825MHz

Date: 21.NOV.2023 16:36:58
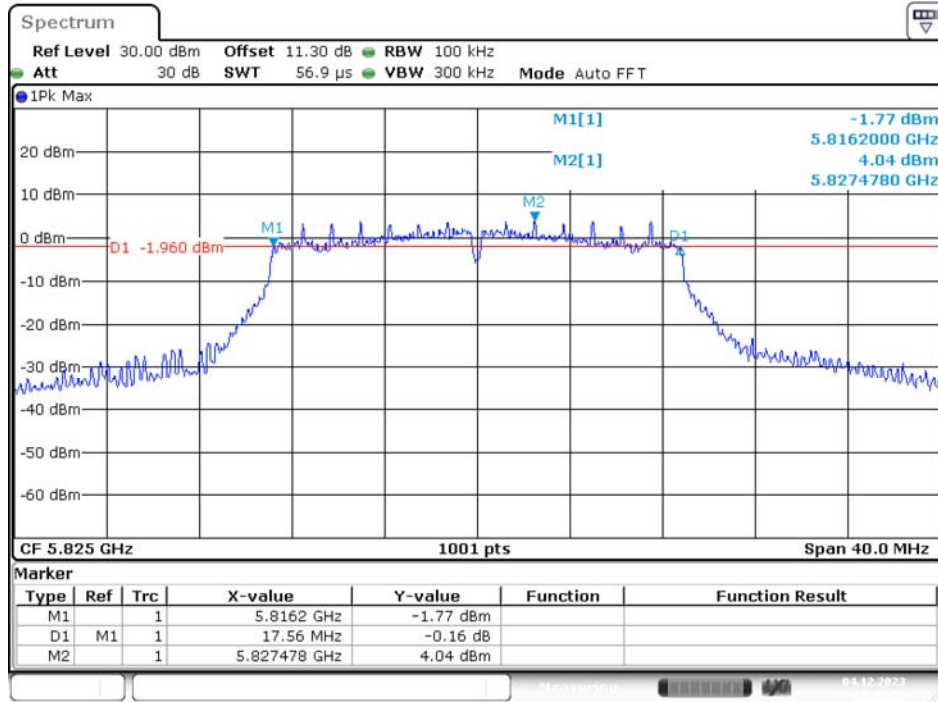
IEEE 802.11ac VHT20 Mode / 5725 ~ 5850MHz

5745MHz

Date: 4.DEC.2023   09:44:36

5785MHz

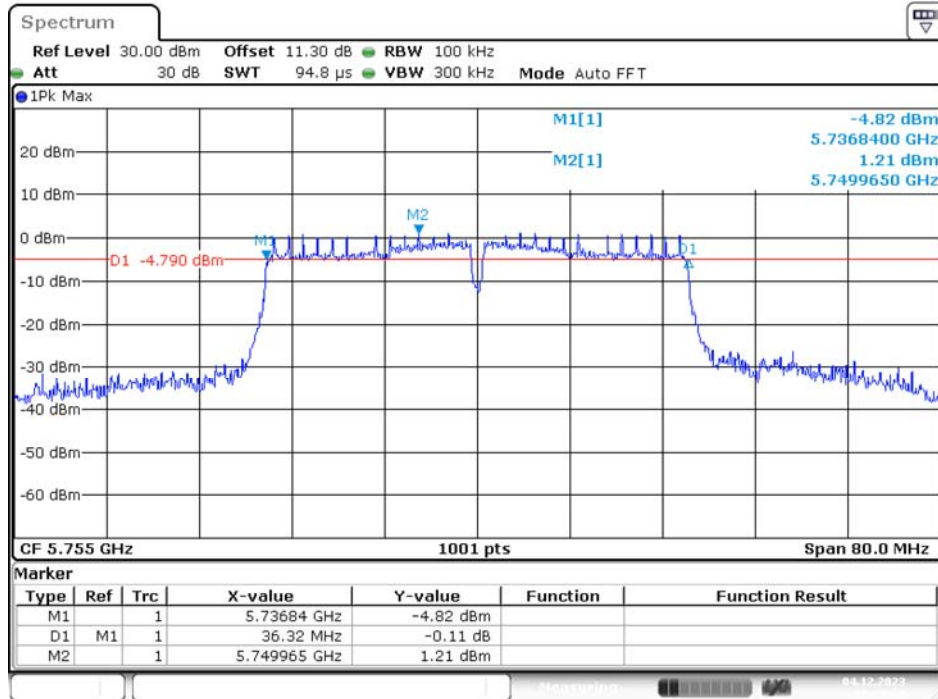Date: 4.DEC.2023   09:46:41

5825MHz
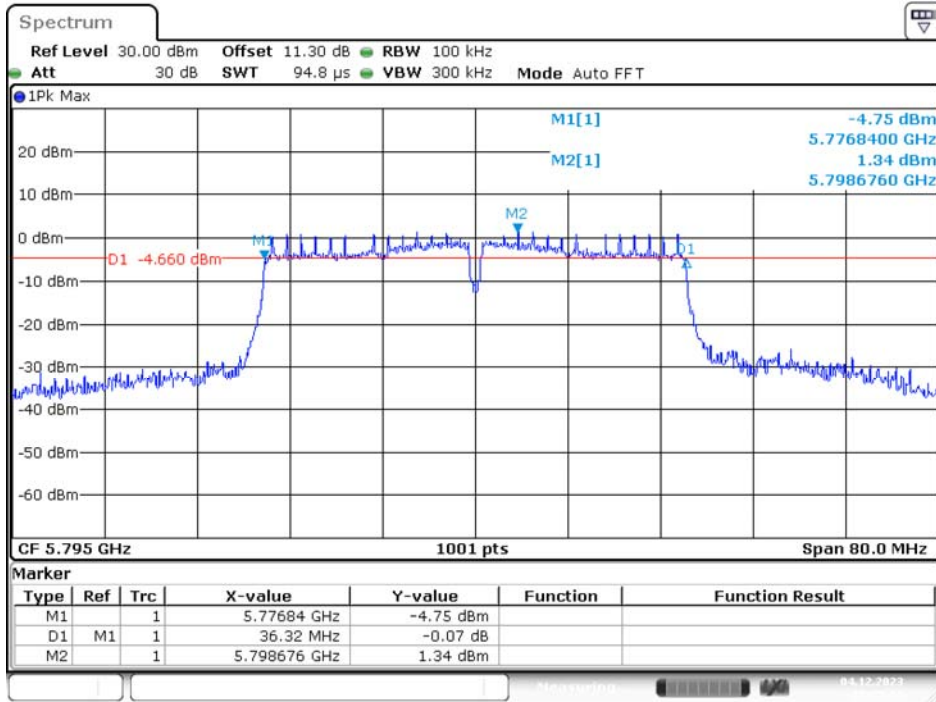

Date: 4.DEC.2023 09:48:57

IEEE 802.11ac VHT40 Mode / 5725 ~ 5850MHz

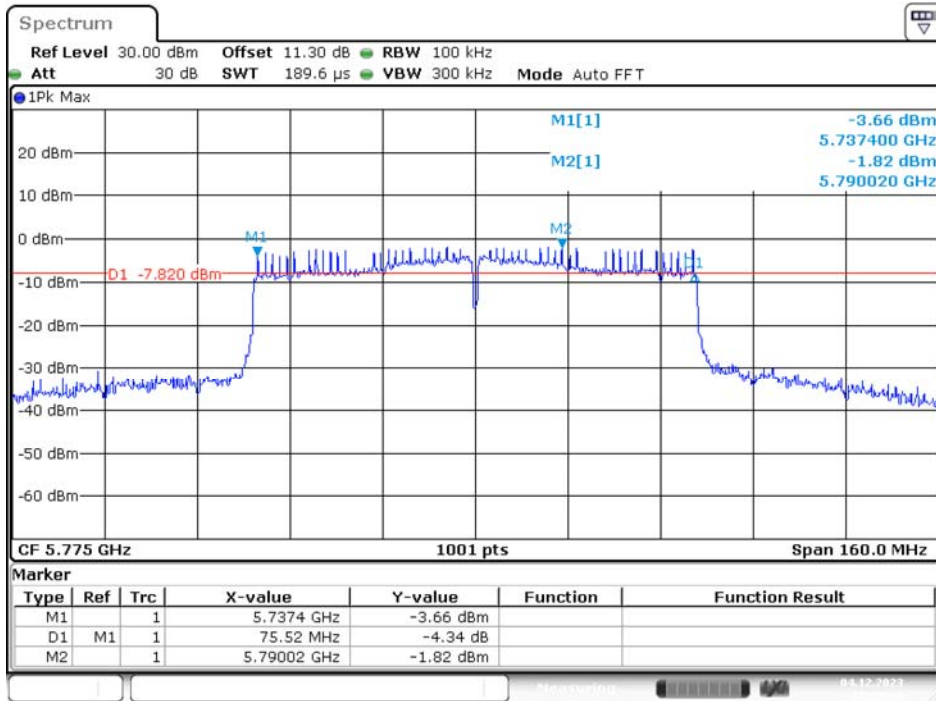## 5755MHz

Date: 4.DEC.2023 10:12:39

5795MHz

Date: 4.DEC.2023 10:15:02
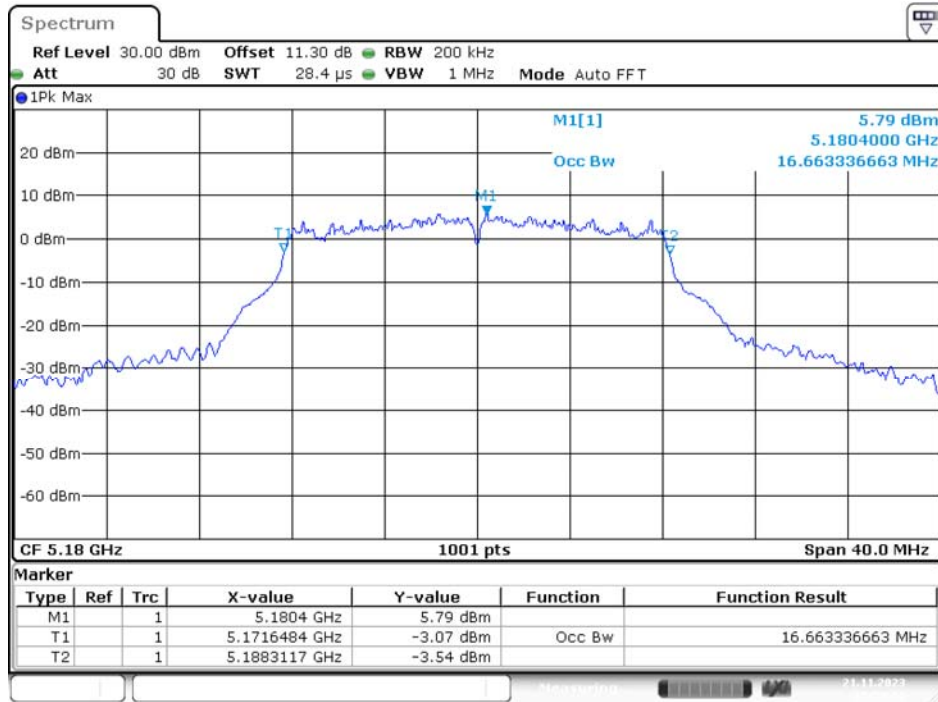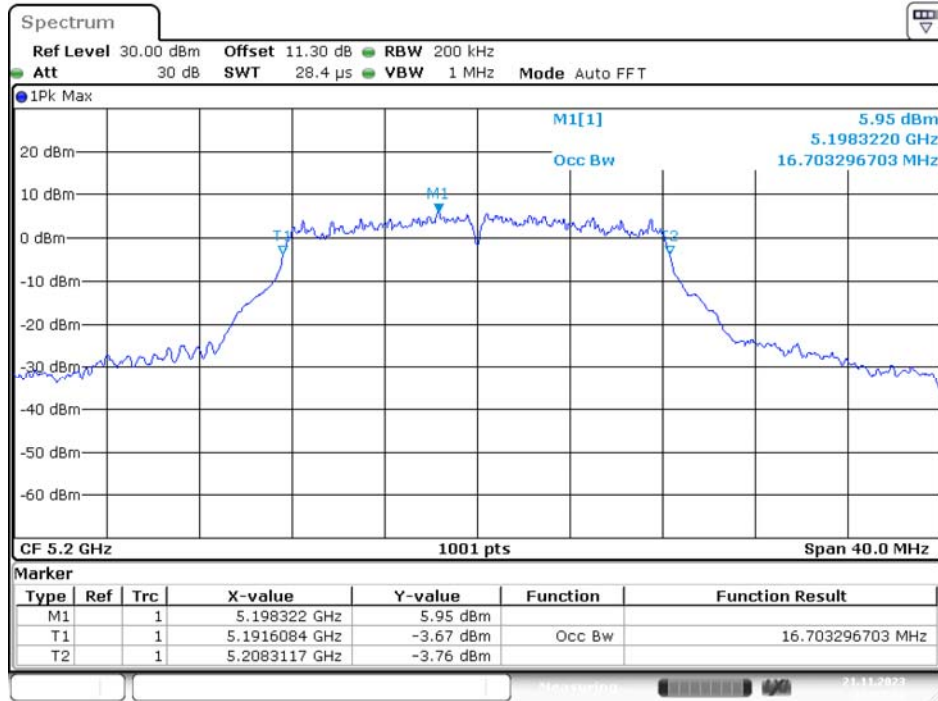
IEEE 802.11ac VHT80 Mode / 5725 ~ 5850MHz

5775MHz

Date: 4.DEC.2023 10:28:50

UNII-1 Band I / OBW 99%
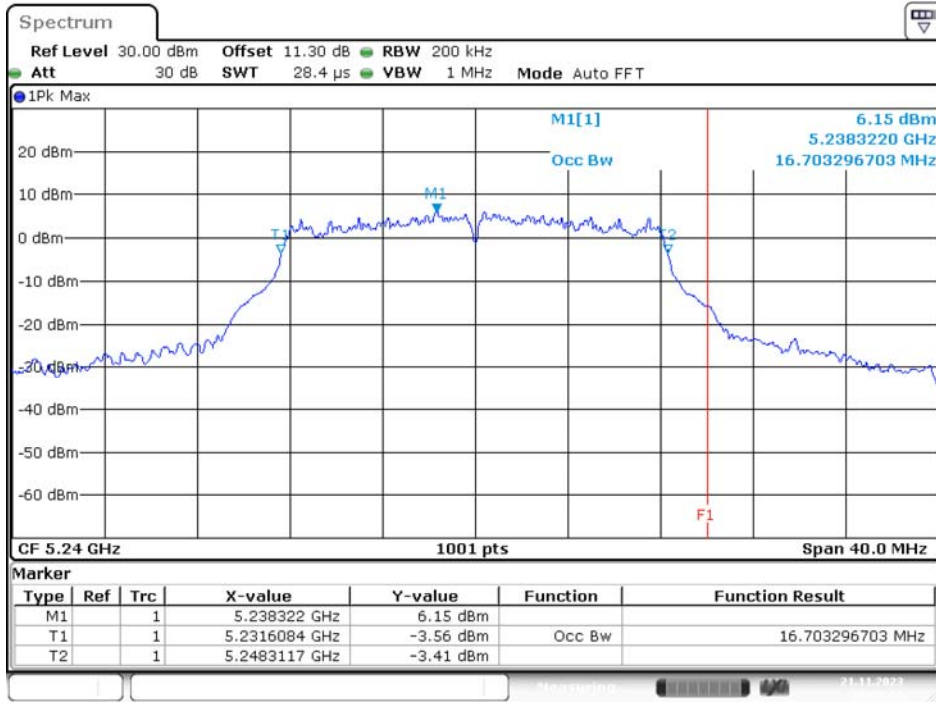**IEEE 802.11a Mode / 5150 ~ 5250MHz**

5180MHz

Date: 21.NOV.2023   15:58:18

5200MHz

Date: 21.NOV.2023   16:13:33

5240MHz

Spectrum						
Ref Level 30.00 dBm	Offset 11.30 dB ● RBW 200 kHz					
● Att 30 dB	SWT 28.4 µs ● VBW 1 MHz	Mode Auto FFT				

● 1Pk Max

M1[1]   6.15 dBm
                         5.2383220 GHz
Occ Bw   16.703296703 MHz

CF 5.24 GHz   1001 pts   Span 40.0 MHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.238322 GHz	6.15 dBm		
T1		1	5.2316084 GHz	-3.56 dBm	Occ Bw	16.703296703 MHz
T2		1	5.2483117 GHz	-3.41 dBm		

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IEEE 802.11ac VHT20 Mode / 5150 ~ 5250MHz

5180MHz

Spectrum						
Ref Level 30.00 dBm	Offset 11.30 dB ● RBW 200 kHz					
● Att 30 dB	SWT 28.4 µs ● VBW 1 MHz	Mode Auto FFT				

● 1Pk Max

M1[1]   6.16 dBm
                         5.1789210 GHz
Occ Bw   17.942057942 MHz

CF 5.18 GHz   1001 pts   Span 40.0 MHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.178921 GHz	6.16 dBm		
T1		1	5.171009 GHz	-2.62 dBm	Occ Bw	17.942057942 MHz
T2		1	5.188951 GHz	-3.12 dBm		
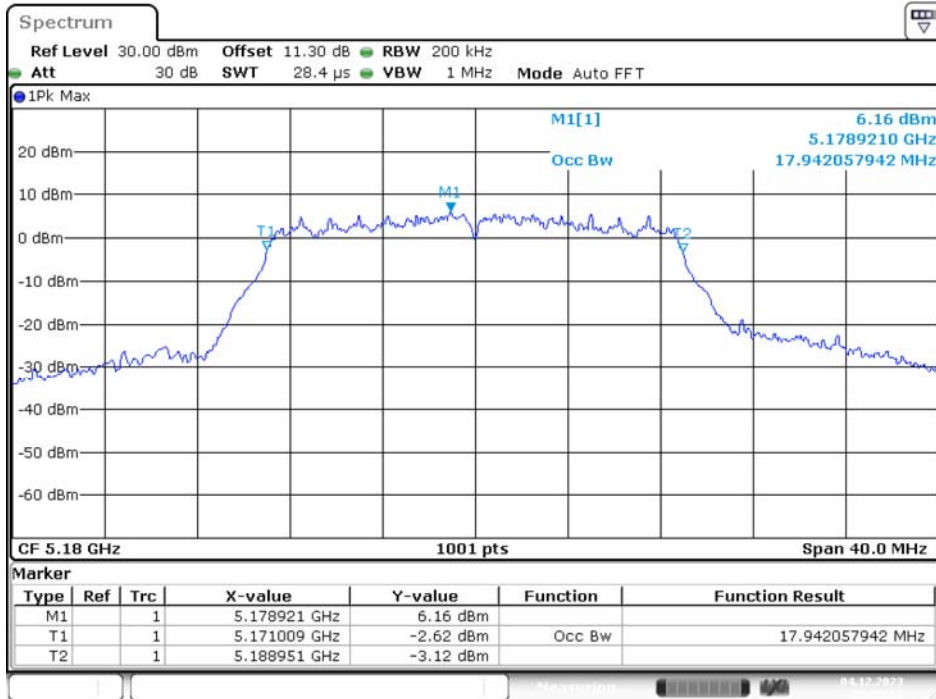
Date: 4.DEC.2023   09:11:13

5200MHz
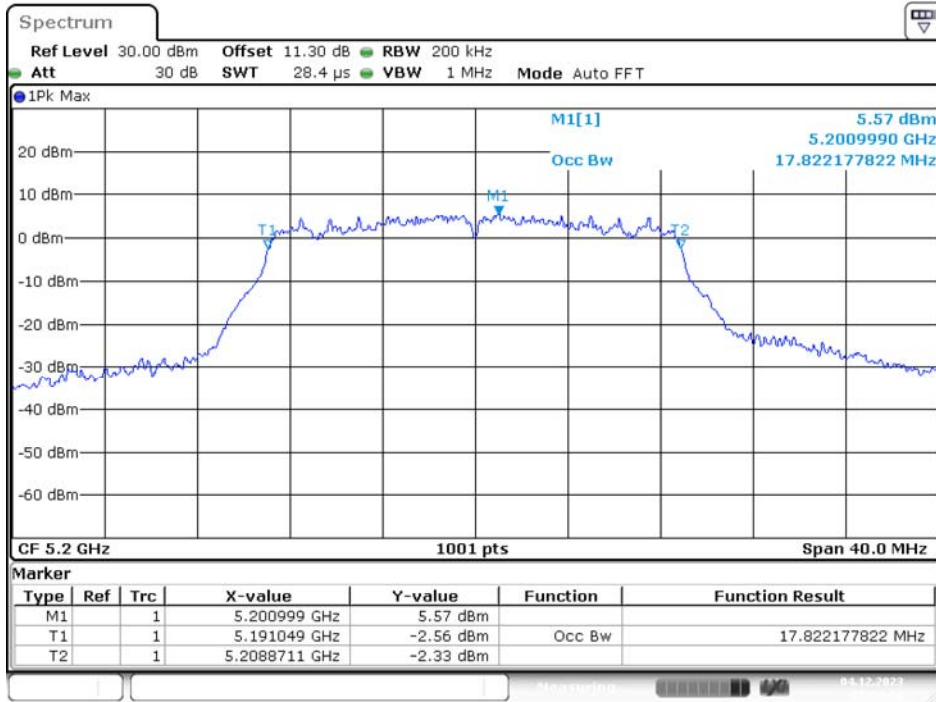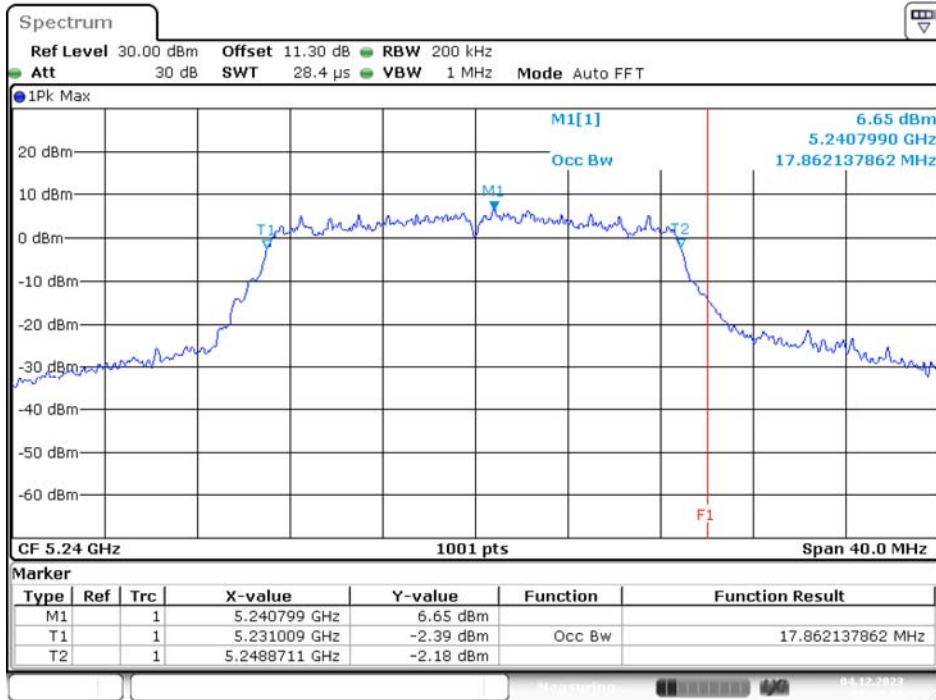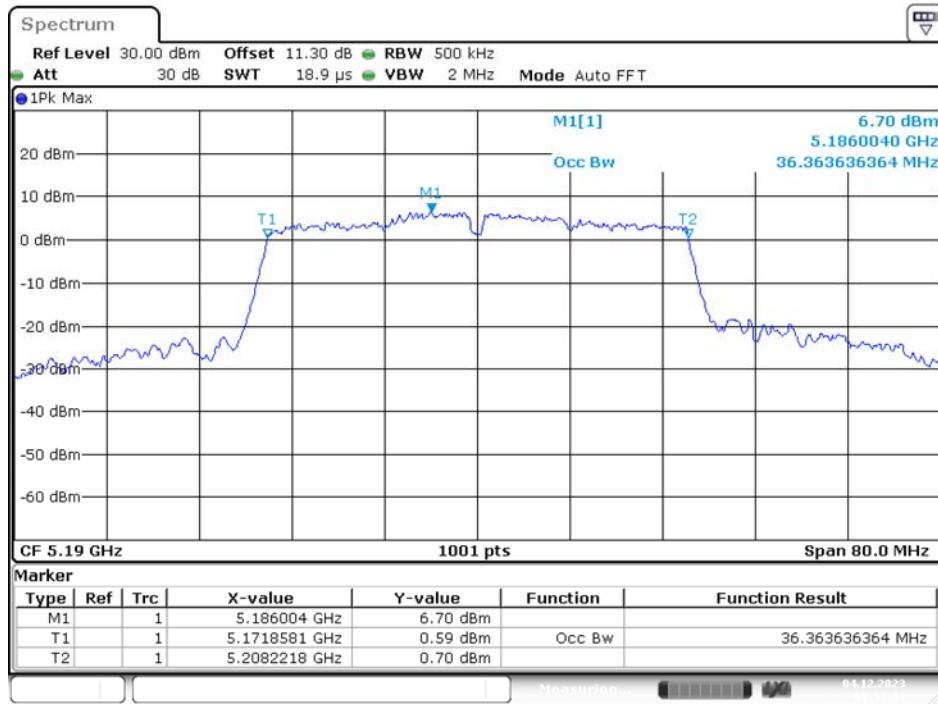

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5240MHz

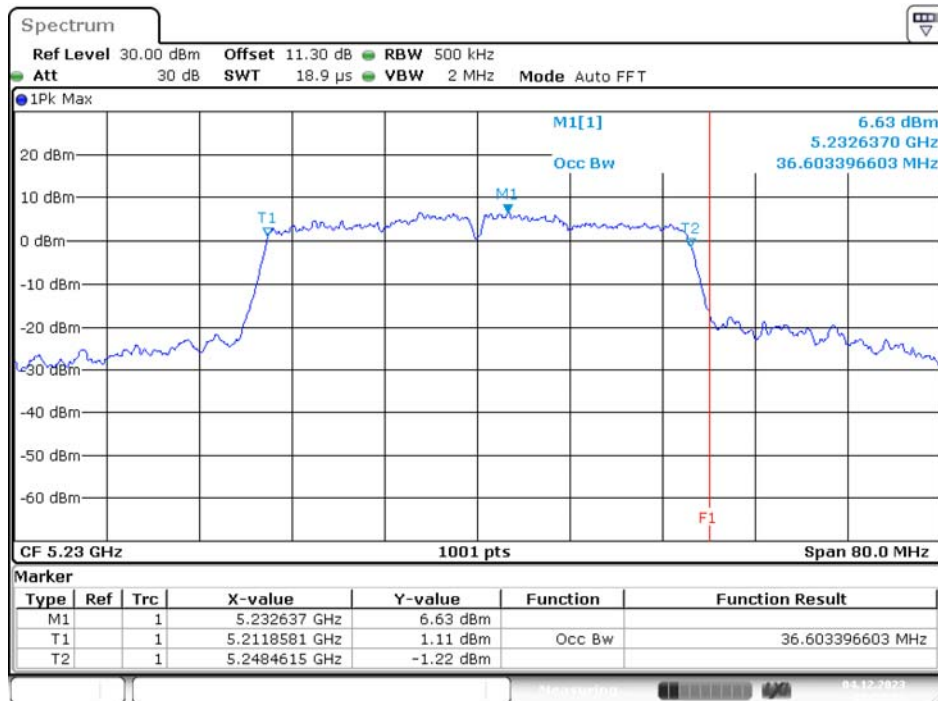Date: 4.DEC.2023   09:17:17

IEEE 802.11ac VHT40 Mode / 5150 ~ 5250MHz
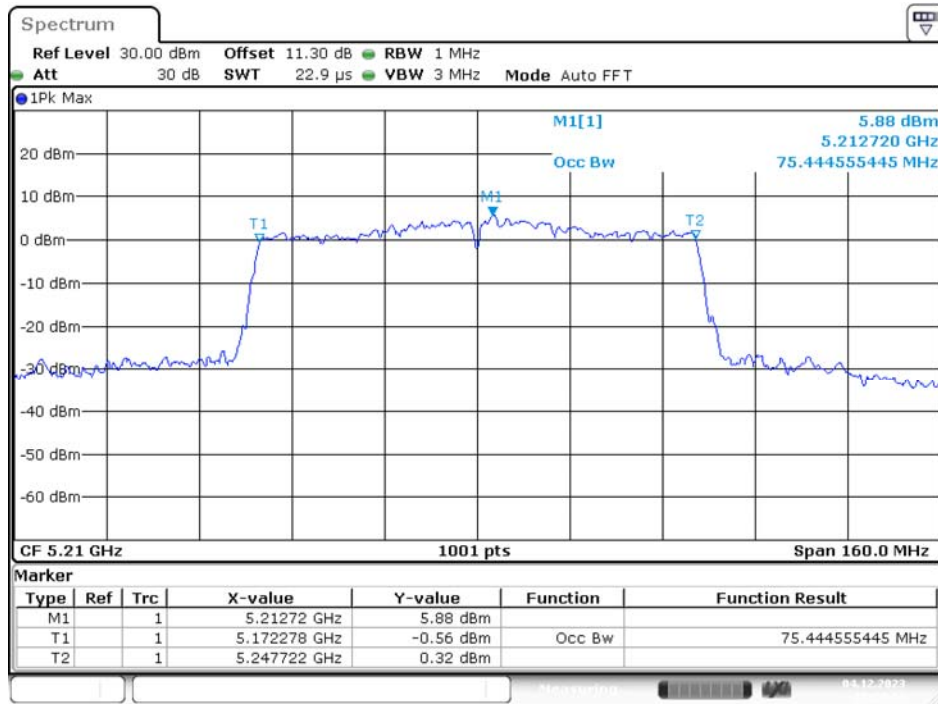
5190MHz

Date: 4.DEC.2023 09:53:41

5230MHz

Date: 4.DEC.2023 09:57:23

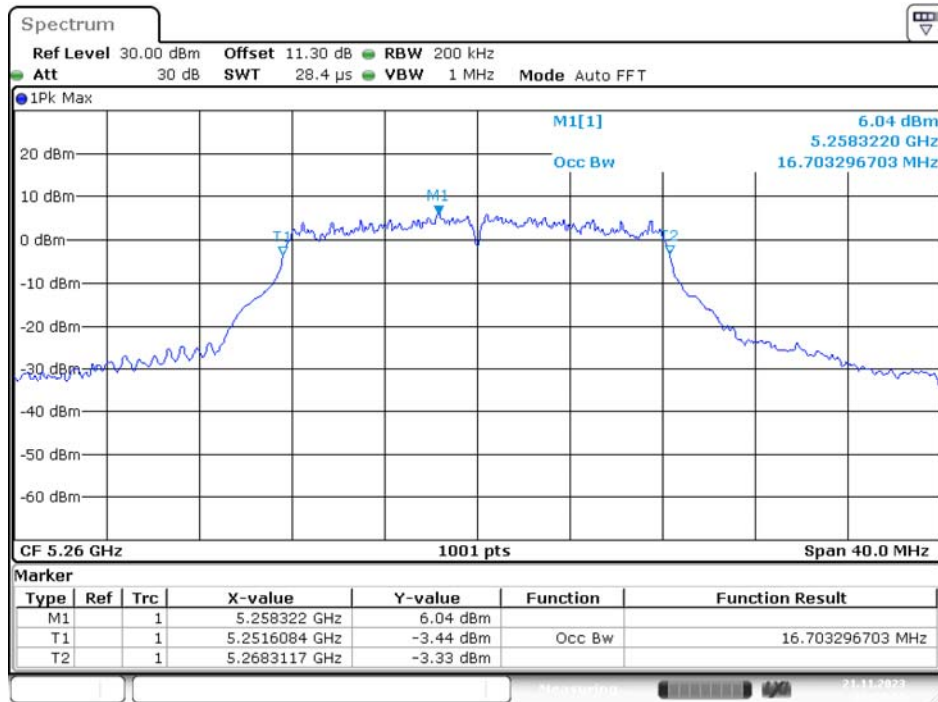## IEEE 802.11ac VHT80 Mode / 5150 ~ 5250MHz

5210MHz

Date: 4.DEC.2023 10:20:13

UNII-2A Band II / OBW 99%
IEEE 802.11a Mode / 5250 ~ 5350MHz

5260MHz

Date: 21.NOV.2023 16:20:22