



4.4 Power Spectral Density

Test Procedures

KDB 789033 – Section F (Method SA-2, Maximum Power Spectral Density)
KDB 662911 D01, D02 (Multiple Transmitter Output)
ANSI C63.10-2013 – Section 12.5

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

Test Settings :

Center frequency = the highest, middle and the lowest channels

- a) RBW = 1 MHz, 500 KHz (UNII 3)
- b) VBW = 3 MHz, 1.5 MHz (UNII 3)
- c) Sweep time = auto
- d) Detector = power averaging (rms)
- e) Trace mode = Average at least 100
- f) Duty cycle factor = $10\log(1/x)$

Test mode	Duty Cycle Factor (dB)
802.11a	0.09
802.11n_HT20	0.10
802.11n_HT40	0.22
802.11ac_VHT20	0.20
802.11ac_VHT40	0.40
802.11ac_VHT80	2.35



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Limit

Operating Mode	Mode	ANT Configuration	ANT Gain (dBi)	Band	Limit (dBm)
SISO	802.11a/n/ac/ax	ANT L, ANT R	0.82, 0.43	UNII 1	11.00
				UNII 2A	11.00
			1.04, 1.20	UNII 2C	11.00
				UNII 3	30.00
MIMO (2Tx)	802.11n/ac/ax	ANT L + ANT R	3.64	UNII 1	11.00
				UNII 2A	11.00
			4.13	UNII 2C	11.00
				UNII 3	30.00

Note :

Per KDB 662911, the MIMO directional gain is calculated using the following formula, Where G_N is the gain of the nth antenna and N_{ANT} , the total number of antennas used.

$$\text{Directional gain} = 10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N_{ANT}] \text{ dBi}$$

Test Data

ANT L(SISO)

Test Mode	Frequency (MHz)	Measured Power Density (dBm)	Duty cycle Factor (dB)	Result Power Density (dBm)	Limit (dBm)	Margin (dB)
802.11a	5 180	5.33	0.09	5.42	11.00	5.58
	5 200	8.70	0.09	8.79	11.00	2.21
	5 240	8.52	0.09	8.61	11.00	2.39
	5 260	9.22	0.09	9.31	11.00	1.69
	5 300	9.07	0.09	9.16	11.00	1.84
	5 320	7.37	0.09	7.46	11.00	3.54
	5 500	4.52	0.09	4.61	11.00	6.39
	5 600	8.70	0.09	8.79	11.00	2.21
	5 700	4.35	0.09	4.44	11.00	6.56
	5 720	7.25	0.09	7.34	11.00	3.66
	5 745	4.52	0.09	4.61	30.00	25.39
	5 785	4.33	0.09	4.42	30.00	25.58
	5 825	5.33	0.09	5.42	11.00	5.58
802.11n _HT20	5 180	2.68	0.10	2.78	11.00	8.22
	5 200	2.48	0.10	2.58	11.00	8.42
	5 240	2.86	0.10	2.96	11.00	8.04
	5 260	6.20	0.10	6.30	11.00	4.70
	5 300	6.31	0.10	6.41	11.00	4.59
	5 320	5.83	0.10	5.93	11.00	5.07
	5 500	3.25	0.10	3.35	11.00	7.65
	5 600	7.69	0.10	7.79	11.00	3.21
	5 700	1.95	0.10	2.05	11.00	8.95
	5 720	6.28	0.10	6.38	11.00	4.62
	5 745	3.56	0.10	3.66	30.00	26.34
	5 785	3.37	0.10	3.47	30.00	26.53
	5 825	4.69	0.10	4.79	30.00	25.21
802.11ac _VHT20	5 180	3.02	0.20	3.22	11.00	7.78
	5 200	3.70	0.20	3.90	11.00	7.10
	5 240	3.06	0.20	3.26	11.00	7.74
	5 260	7.63	0.20	7.83	11.00	3.17
	5 300	7.08	0.20	7.28	11.00	3.72
	5 320	7.45	0.20	7.65	11.00	3.35
	5 500	4.32	0.20	4.52	11.00	6.48



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	5 600	7.68	0.20	7.88	11.00	3.12
	5 700	3.09	0.20	3.29	11.00	7.71
	5 720	6.14	0.20	6.34	11.00	4.66
	5 745	3.75	0.20	3.95	30.00	26.05
	5 785	3.91	0.20	4.11	30.00	25.89
	5 825	4.71	0.20	4.91	30.00	25.09
802.11n _HT40	5 190	-3.12	0.22	-2.90	11.00	13.90
	5 230	2.28	0.22	2.50	11.00	8.50
	5 270	4.77	0.22	4.99	11.00	6.01
	5 310	-0.97	0.22	-0.75	11.00	11.75
	5 510	-4.78	0.22	-4.56	11.00	15.56
	5 590	5.23	0.22	5.45	11.00	5.55
	5 670	0.25	0.22	0.47	11.00	10.53
	5 710	3.79	0.22	4.01	11.00	6.99
	5 755	-0.45	0.22	-0.23	30.00	30.23
5 795	-0.20	0.22	0.02	30.00	29.98	
802.11ac _VHT40	5 190	-1.57	0.40	-1.17	11.00	12.17
	5 230	2.17	0.40	2.57	11.00	8.43
	5 270	4.71	0.40	5.11	11.00	5.89
	5 310	-0.94	0.40	-0.54	11.00	11.54
	5 510	-3.15	0.40	-2.75	11.00	13.75
	5 590	5.36	0.40	5.76	11.00	5.24
	5 670	2.27	0.40	2.67	11.00	8.33
	5 710	3.61	0.40	4.01	11.00	6.99
	5 755	-0.46	0.40	-0.06	30.00	30.06
5 795	-0.34	0.40	0.06	30.00	29.94	
802.11ac _VHT80	5 210	-8.82	2.35	-6.47	11.00	17.47
	5 290	-6.77	2.35	-4.42	11.00	15.42
	5 530	-7.99	2.35	-5.64	11.00	16.64
	5 610	-0.40	2.35	1.95	11.00	9.05
	5 690	-1.68	2.35	0.67	11.00	10.33
	5 775	-6.99	2.35	-4.64	30.00	34.64
Measurement uncertainty		± 1.5 dB				



ANT R(SISO)

Test Mode	Frequency (MHz)	Measured Power Density (dBm)	Duty cycle Factor (dB)	Result Power Density (dBm)	Limit (dBm)	Margin (dB)
802.11a	5 180	7.09	0.09	7.18	11.00	3.82
	5 200	6.98	0.09	7.07	11.00	3.93
	5 240	6.50	0.09	6.59	11.00	4.41
	5 260	7.17	0.09	7.26	11.00	3.74
	5 300	7.47	0.09	7.56	11.00	3.44
	5 320	7.35	0.09	7.44	11.00	3.56
	5 500	6.58	0.09	6.67	11.00	4.33
	5 600	7.81	0.09	7.90	11.00	3.10
	5 700	5.89	0.09	5.98	11.00	5.02
	5 720	8.08	0.09	8.17	11.00	2.83
	5 745	5.00	0.09	5.09	30.00	24.91
	5 785	5.24	0.09	5.33	30.00	24.67
	5 825	5.06	0.09	5.15	30.00	24.85
802.11n _HT20	5 180	1.95	0.10	2.05	11.00	8.95
	5 200	1.70	0.10	1.80	11.00	9.20
	5 240	1.86	0.10	1.96	11.00	9.04
	5 260	5.70	0.10	5.80	11.00	5.20
	5 300	5.93	0.10	6.03	11.00	4.97
	5 320	5.67	0.10	5.77	11.00	5.23
	5 500	3.18	0.10	3.28	11.00	7.72
	5 600	5.57	0.10	5.67	11.00	5.33
	5 700	1.23	0.10	1.33	11.00	9.67
	5 720	5.99	0.10	6.09	11.00	4.91
	5 745	4.66	0.10	4.76	30.00	25.24
	5 785	4.54	0.10	4.64	30.00	25.36
	5 825	4.37	0.10	4.47	30.00	25.53
802.11ac _VHT20	5 180	2.26	0.20	2.46	11.00	8.54
	5 200	2.28	0.20	2.48	11.00	8.52
	5 240	2.12	0.20	2.32	11.00	8.68
	5 260	6.22	0.20	6.42	11.00	4.58
	5 300	6.49	0.20	6.69	11.00	4.31
	5 320	6.99	0.20	7.19	11.00	3.81
	5 500	4.32	0.20	4.52	11.00	6.48
	5 600	5.87	0.20	6.07	11.00	4.93



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	5 700	2.19	0.20	2.39	11.00	8.61
	5 720	5.88	0.20	6.08	11.00	4.92
	5 745	4.35	0.20	4.55	30.00	25.45
	5 785	4.71	0.20	4.91	30.00	25.09
	5 825	4.25	0.20	4.45	30.00	25.55
802.11n _HT40	5 190	-3.95	0.22	-3.73	11.00	14.73
	5 230	1.28	0.22	1.50	11.00	9.50
	5 270	4.01	0.22	4.23	11.00	6.77
	5 310	-1.61	0.22	-1.39	11.00	12.39
	5 510	-4.43	0.22	-4.21	11.00	15.21
	5 590	3.27	0.22	3.49	11.00	7.51
	5 670	-0.79	0.22	-0.57	11.00	11.57
	5 710	3.10	0.22	3.32	11.00	7.68
	5 755	0.60	0.22	0.82	30.00	29.18
	5 795	0.80	0.22	1.02	30.00	28.98
802.11ac _VHT40	5 190	-2.90	0.40	-2.50	11.00	13.50
	5 230	1.00	0.40	1.40	11.00	9.60
	5 270	3.81	0.40	4.21	11.00	6.79
	5 310	-1.41	0.40	-1.01	11.00	12.01
	5 510	-3.10	0.40	-2.70	11.00	13.70
	5 590	2.95	0.40	3.35	11.00	7.65
	5 670	1.22	0.40	1.62	11.00	9.38
	5 710	2.80	0.40	3.20	11.00	7.80
	5 755	0.22	0.40	0.62	30.00	29.38
	5 795	0.44	0.40	0.84	30.00	29.16
802.11ac _VHT80	5 210	-9.64	2.35	-7.29	11.00	18.29
	5 290	-6.22	2.35	-3.87	11.00	14.87
	5 530	-8.33	2.35	-5.98	11.00	16.98
	5 610	-2.65	2.35	-0.30	11.00	11.30
	5 690	-2.66	2.35	-0.31	11.00	11.31
	5 775	-6.18	2.35	-3.83	30.00	33.83
Measurement uncertainty		± 1.5 dB				



ANT L + ANT R(MIMO)

Test Mode	Frequency (MHz)	Measured Power Density (dBm)	Duty cycle Factor (dB)	Result Power Density (dBm)	Limit (dBm)	Margin (dB)
802.11n _HT20	5 180	5.34	0.10	5.44	11.00	5.56
	5 200	5.12	0.10	5.22	11.00	5.78
	5 240	5.40	0.10	5.50	11.00	5.50
	5 260	8.97	0.10	9.07	11.00	1.93
	5 300	9.13	0.10	9.23	11.00	1.77
	5 320	8.76	0.10	8.86	11.00	2.14
	5 500	6.23	0.10	6.33	11.00	4.67
	5 600	9.77	0.10	9.87	11.00	1.13
	5 700	4.62	0.10	4.72	11.00	6.28
	5 720	9.15	0.10	9.25	11.00	1.75
	5 745	7.16	0.10	7.26	30.00	22.74
	5 785	7.00	0.10	7.10	30.00	22.90
	5 825	7.54	0.10	7.64	30.00	22.36
802.11ac _VHT20	5 180	5.67	0.20	5.87	11.00	5.13
	5 200	6.06	0.20	6.26	11.00	4.74
	5 240	5.63	0.20	5.83	11.00	5.17
	5 260	9.99	0.20	10.19	11.00	0.81
	5 300	9.81	0.20	10.01	11.00	0.99
	5 320	10.24	0.20	10.44	11.00	0.56
	5 500	7.33	0.20	7.53	11.00	3.47
	5 600	9.88	0.20	10.08	11.00	0.92
	5 700	5.67	0.20	5.87	11.00	5.13
	5 720	9.02	0.20	9.22	11.00	1.78
	5 745	7.07	0.20	7.27	30.00	22.73
	5 785	7.34	0.20	7.54	30.00	22.46
	5 825	7.50	0.20	7.70	30.00	22.30
802.11n _HT40	5 190	-0.50	0.22	-0.28	11.00	11.28
	5 230	4.82	0.22	5.04	11.00	5.96
	5 270	7.42	0.22	7.64	11.00	3.36
	5 310	1.73	0.22	1.95	11.00	9.05
	5 510	-1.59	0.22	-1.37	11.00	12.37
	5 590	7.37	0.22	7.59	11.00	3.41
	5 670	2.77	0.22	2.99	11.00	8.01
	5 710	6.47	0.22	6.69	11.00	4.31

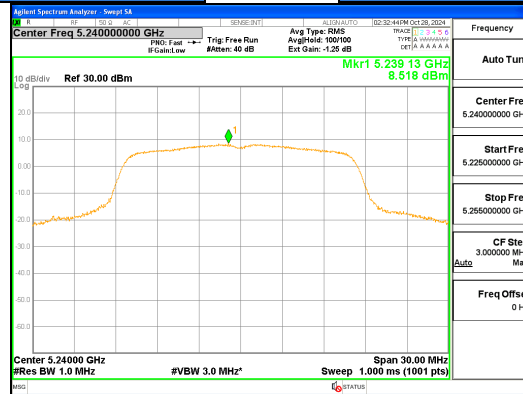
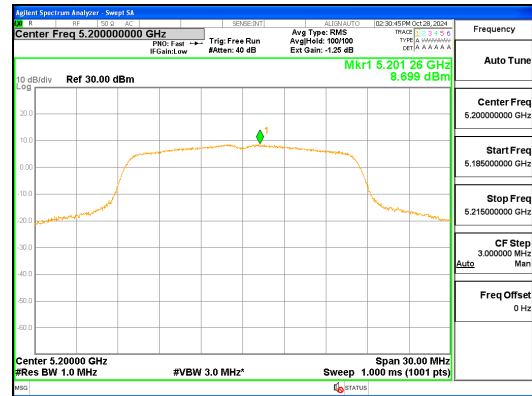
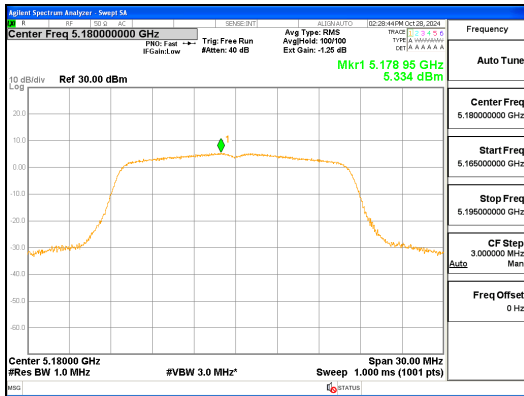


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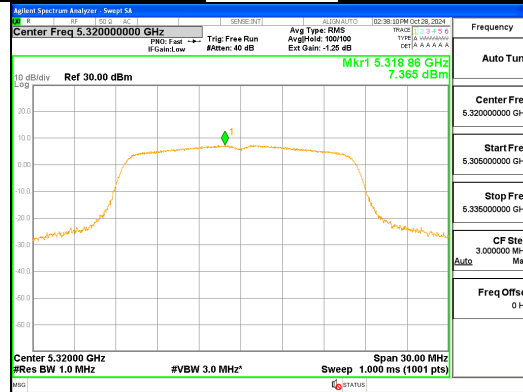
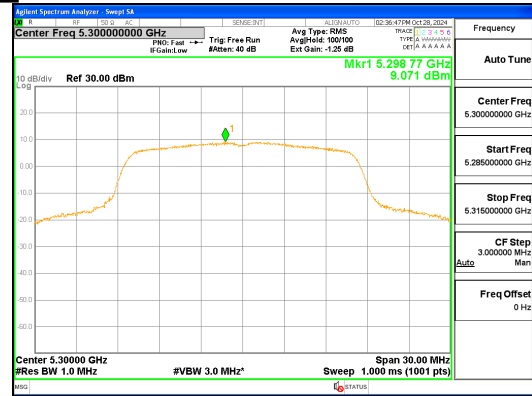
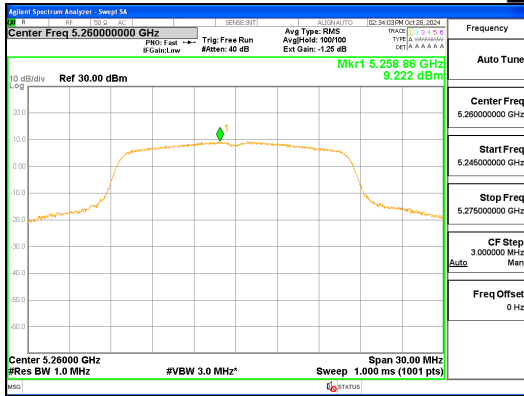
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	5 755	3.12	0.22	3.34	30.00	26.66
	5 795	3.34	0.22	3.56	30.00	26.44
802.11ac _VHT40	5 190	0.83	0.40	1.23	11.00	9.77
	5 230	4.63	0.40	5.03	11.00	5.97
	5 270	7.29	0.40	7.69	11.00	3.31
	5 310	1.84	0.40	2.24	11.00	8.76
	5 510	-0.11	0.40	0.29	11.00	10.71
	5 590	7.33	0.40	7.73	11.00	3.27
	5 670	4.79	0.40	5.19	11.00	5.81
	5 710	6.23	0.40	6.63	11.00	4.37
	5 755	2.90	0.40	3.30	30.00	26.70
	5 795	3.08	0.40	3.48	30.00	26.52
802.11ac _VHT80	5 210	-6.20	2.35	-3.85	11.00	14.85
	5 290	-3.48	2.35	-1.13	11.00	12.13
	5 530	-5.15	2.35	-2.80	11.00	13.80
	5 610	1.63	2.35	3.98	11.00	7.02
	5 690	0.87	2.35	3.22	11.00	7.78
	5 775	-3.56	2.35	-1.21	30.00	31.21
Measurement uncertainty		± 1.5 dB				

See next pages for actual measured spectrum plots.



ANT L_802.11a_UNII 1

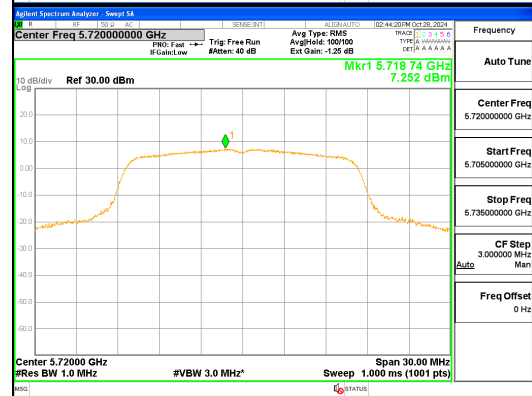
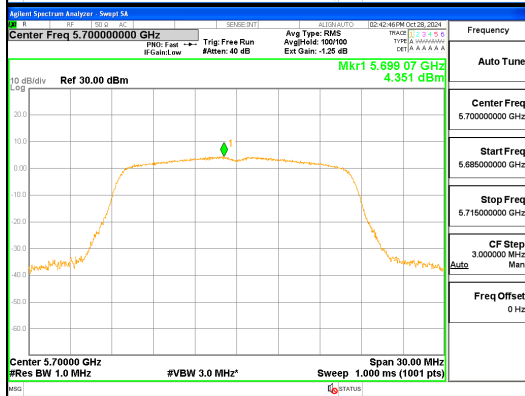
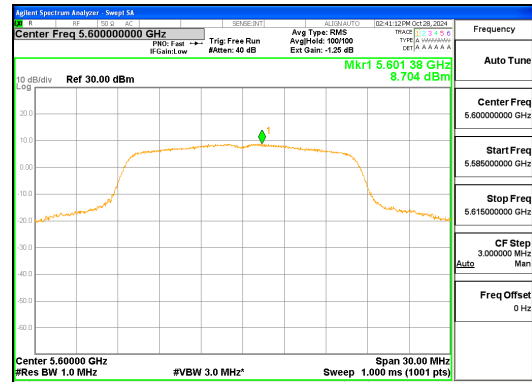
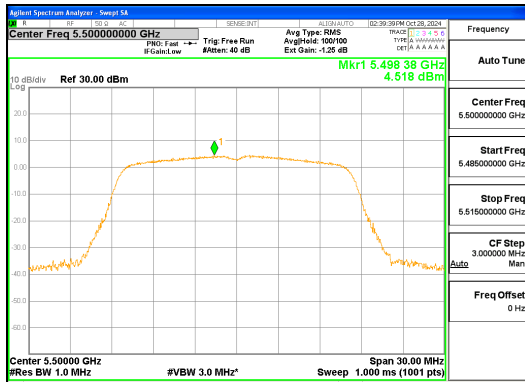


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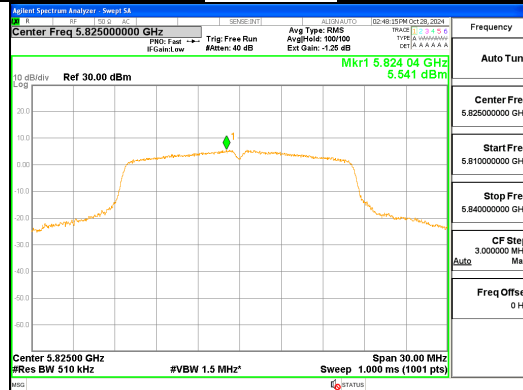
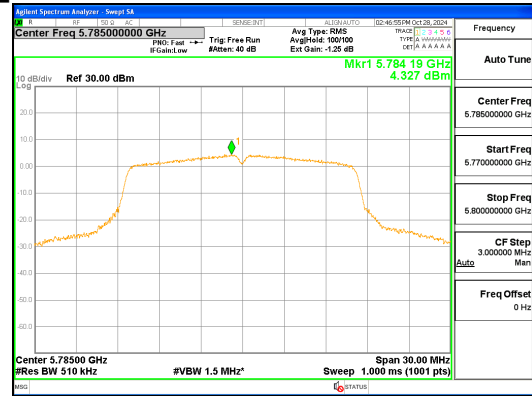
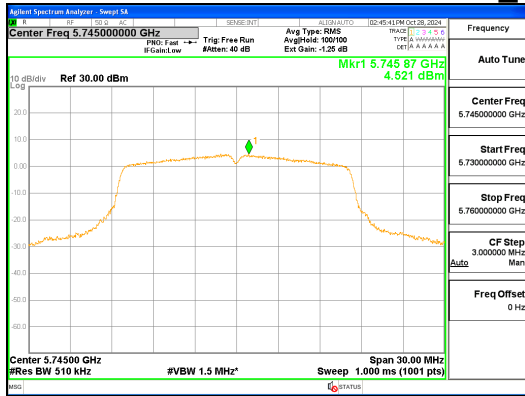


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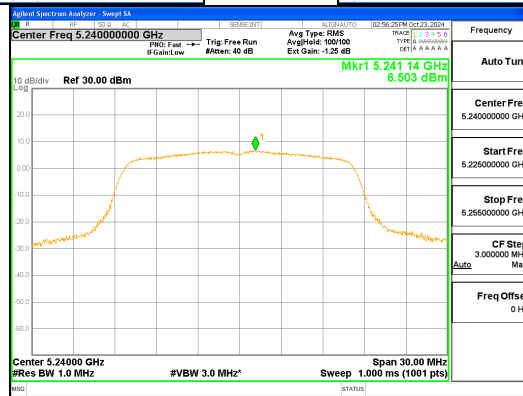
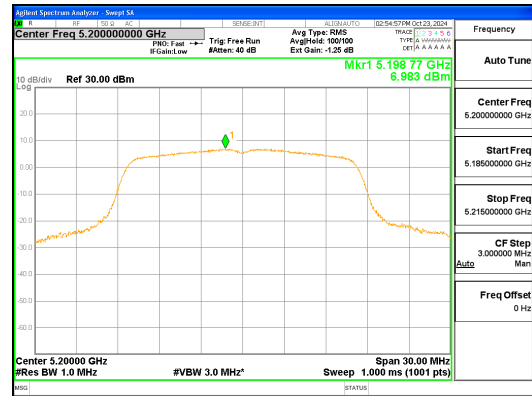
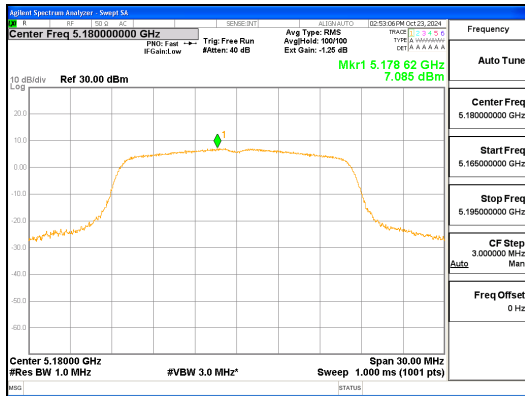
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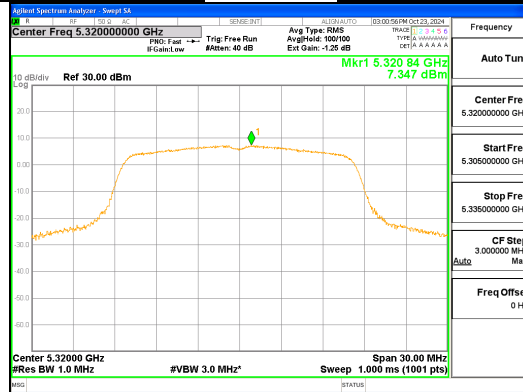
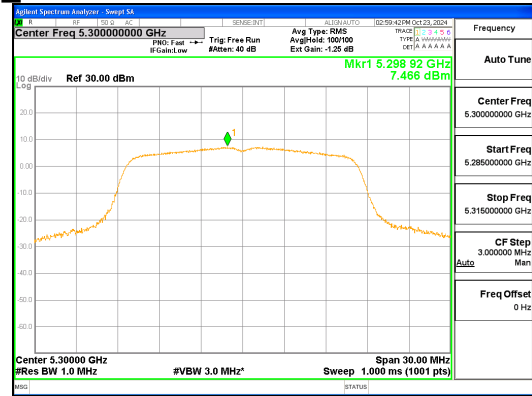
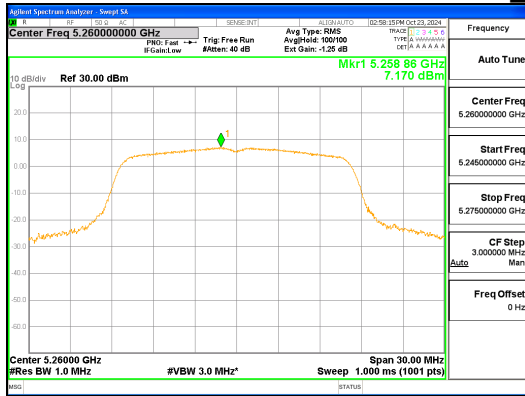
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ANT L_802.11a_UNII 3



ANT R_802.11a_UNII 1

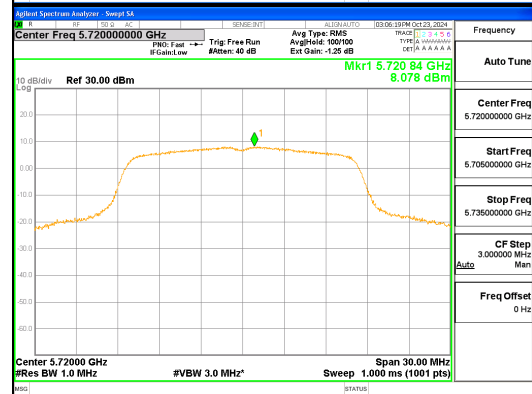
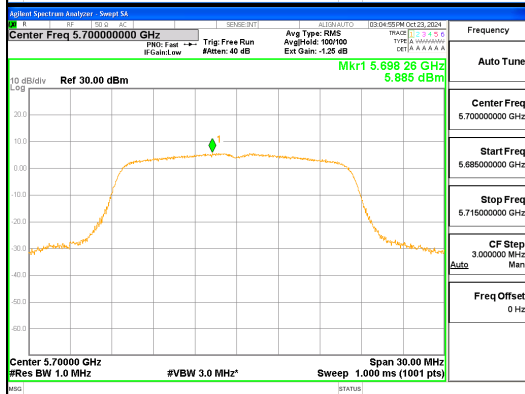
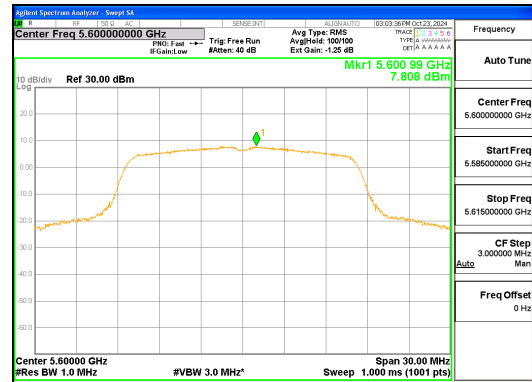
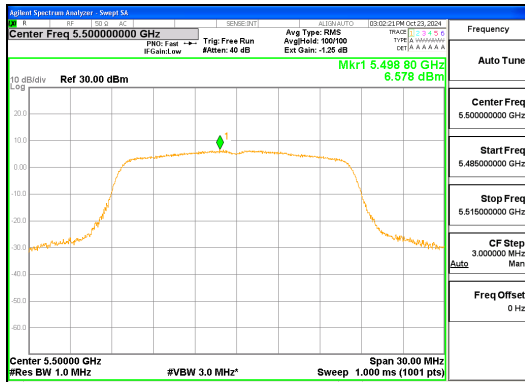


ANT R_802.11a_UNII 2A

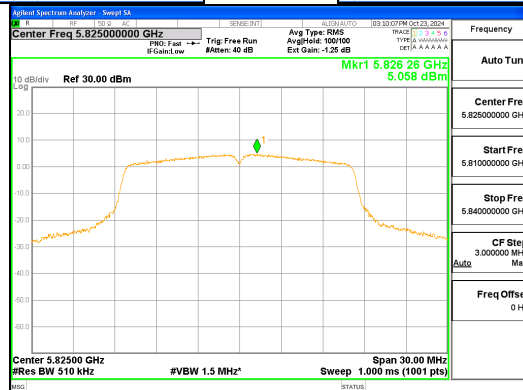
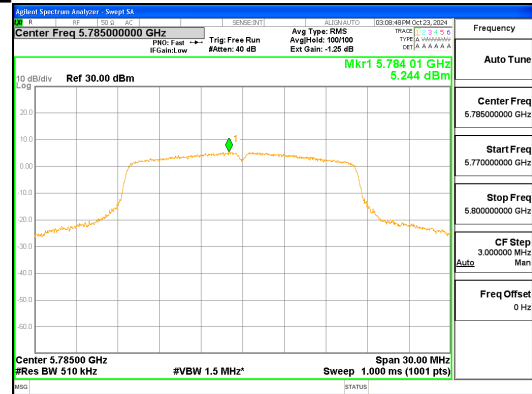
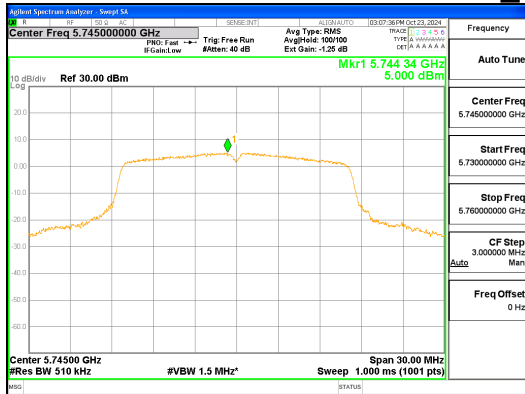


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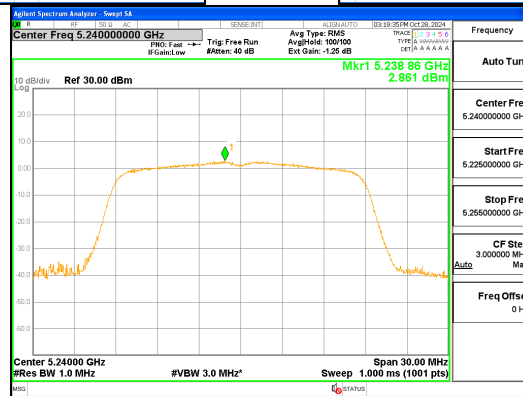
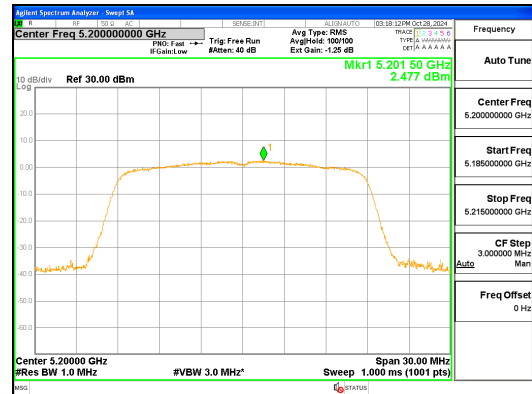
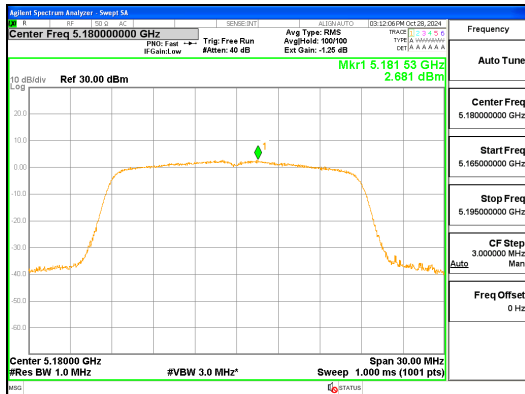
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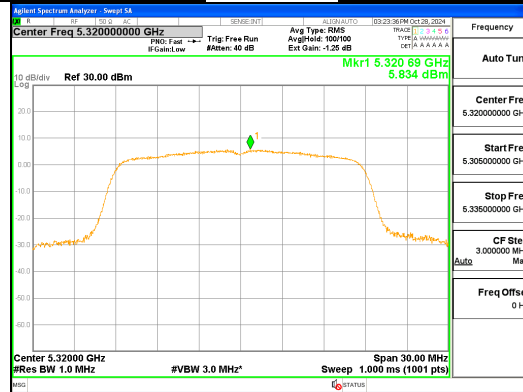
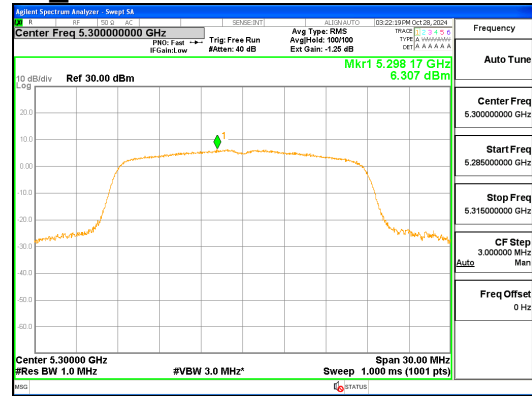
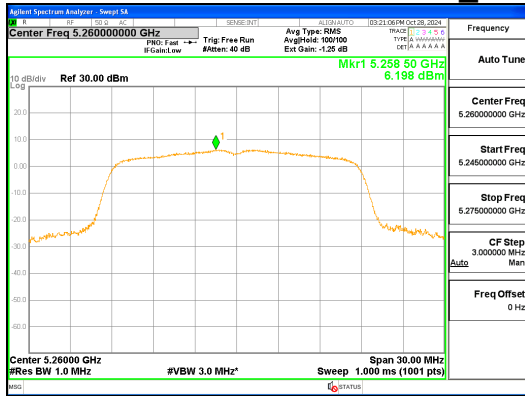
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ANT R_802.11a_UNII 3



ANT L_802.11n_HT20_UNII 1

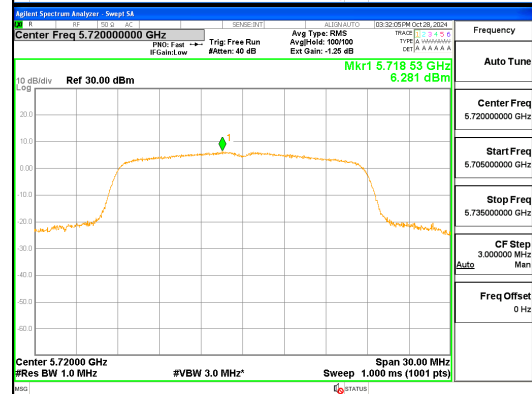
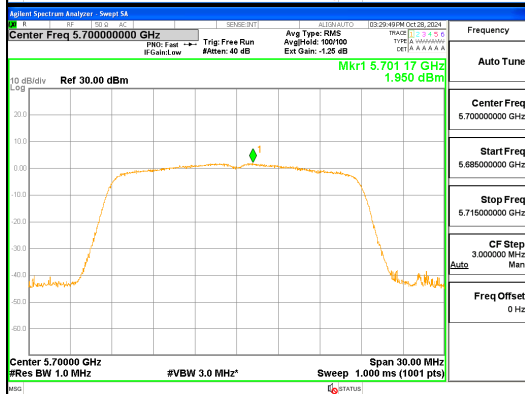
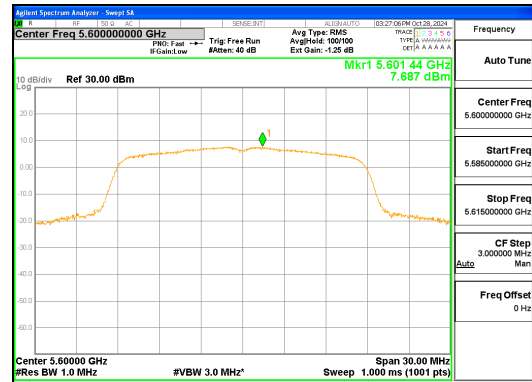
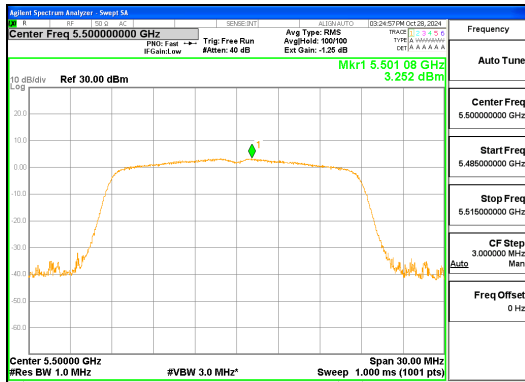


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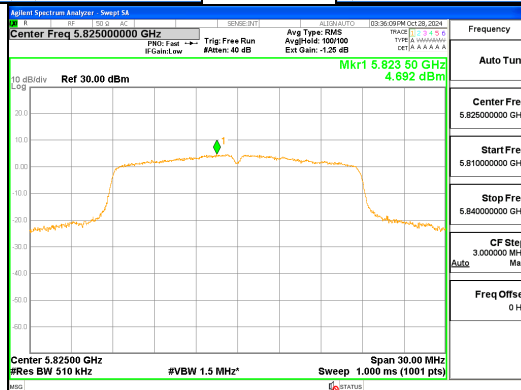
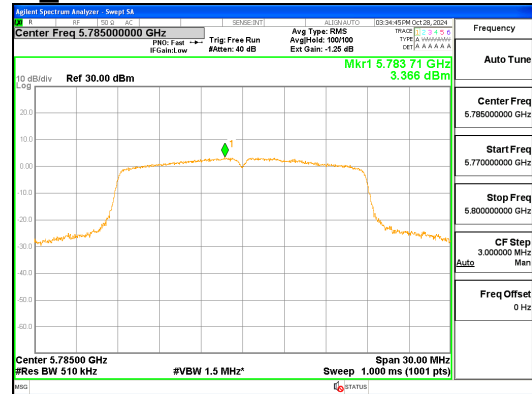
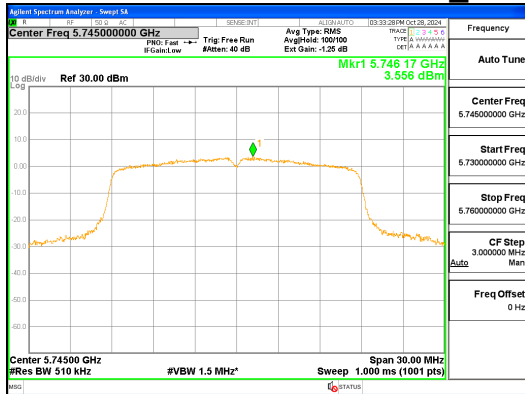


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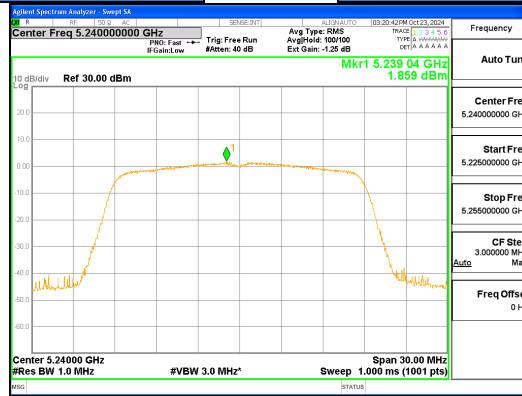
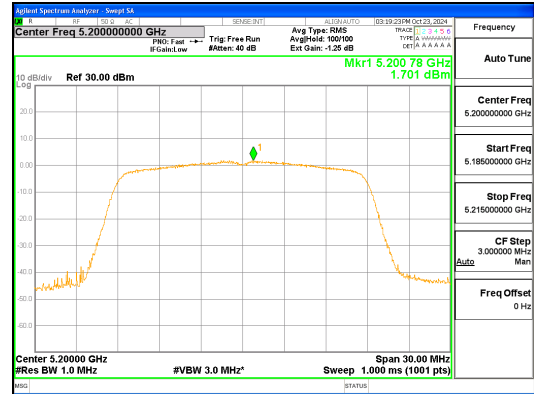
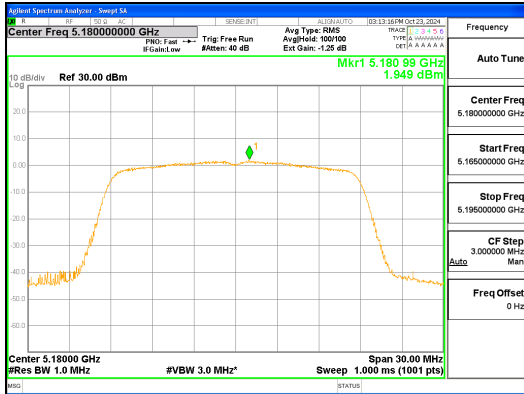
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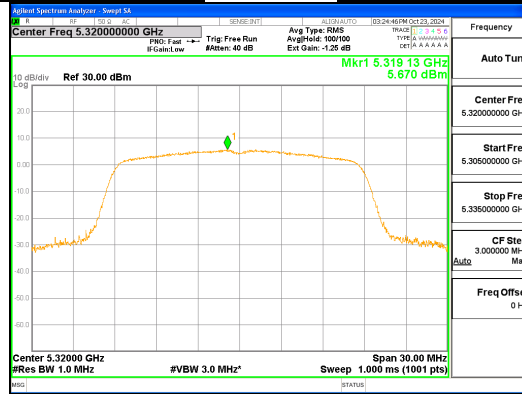
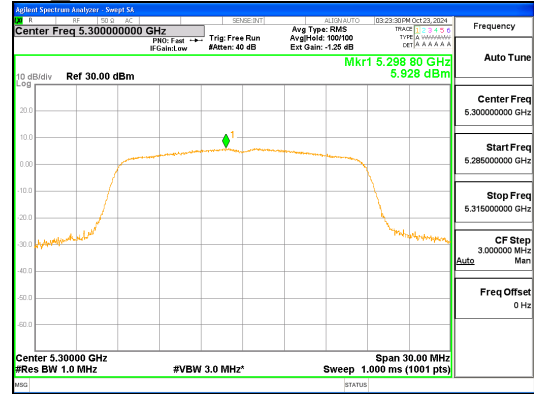
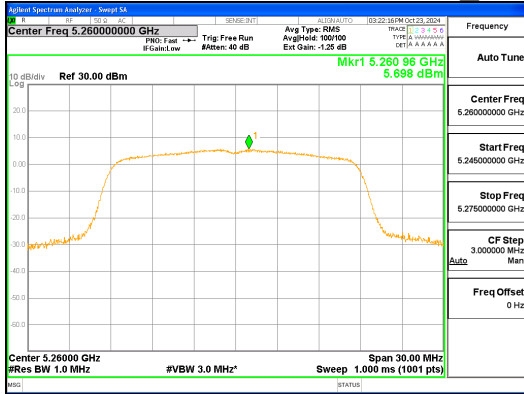
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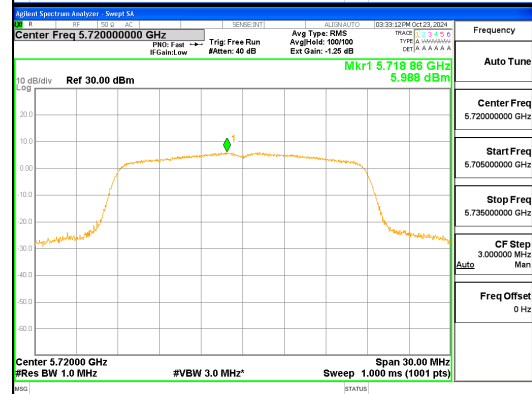
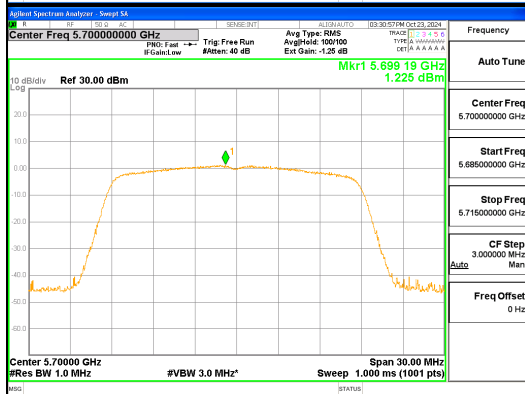
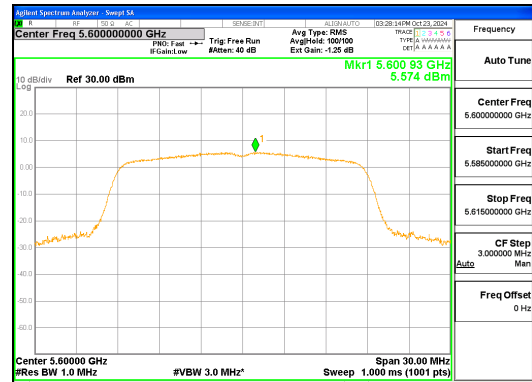
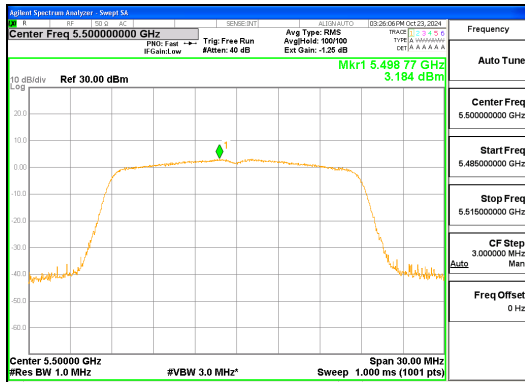
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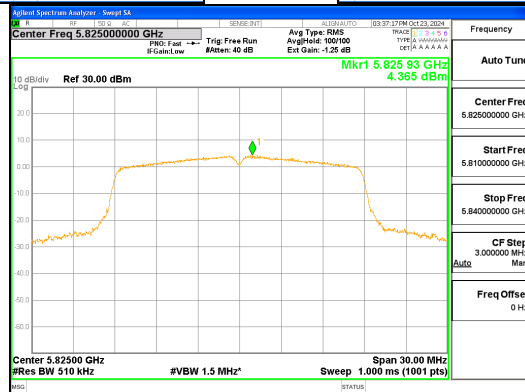
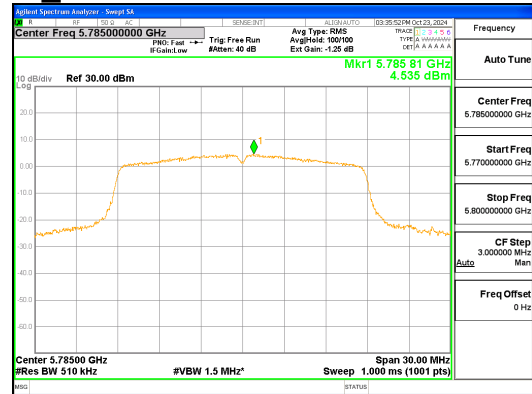
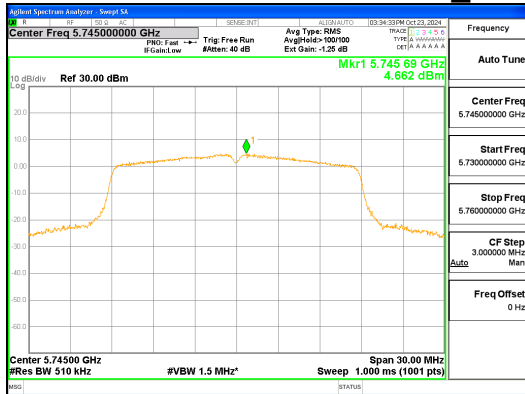
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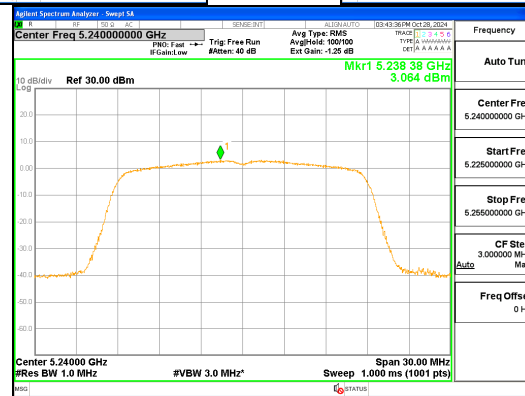
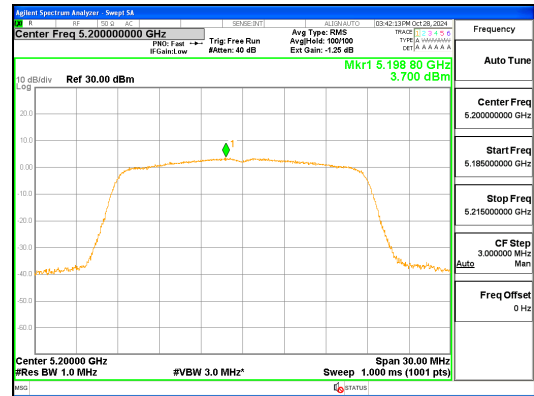
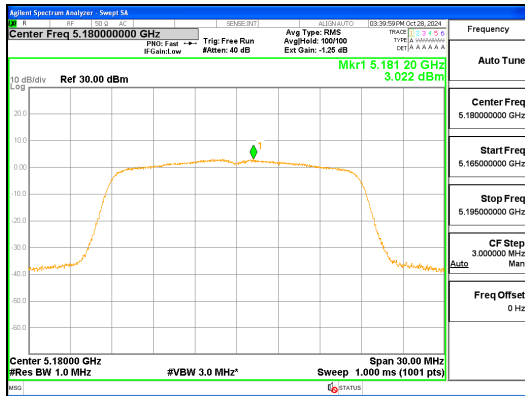
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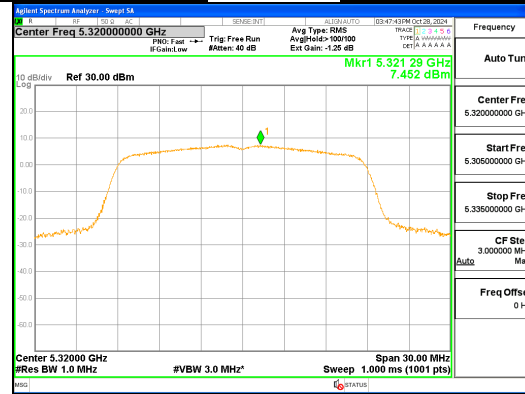
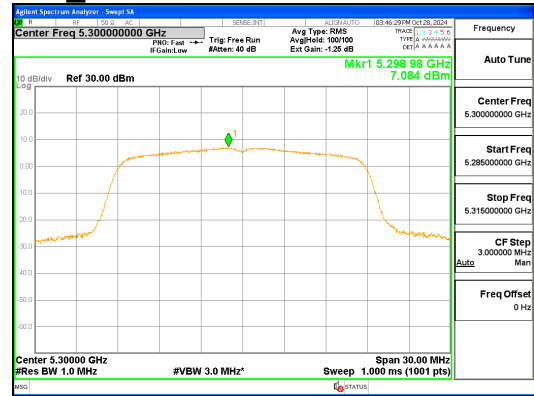
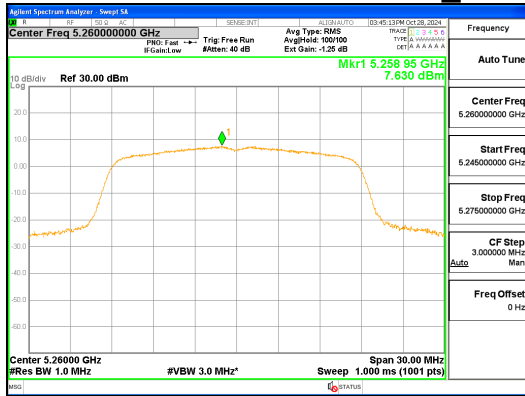
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ANT R_802.11n_HT20_UNII 3



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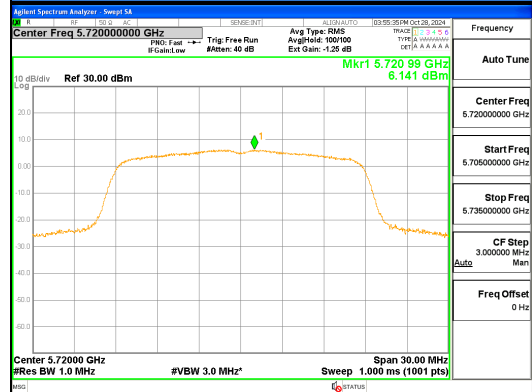
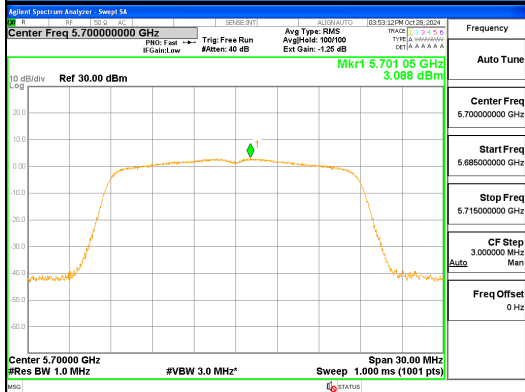
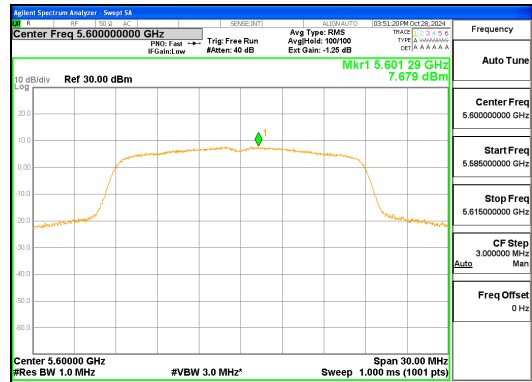
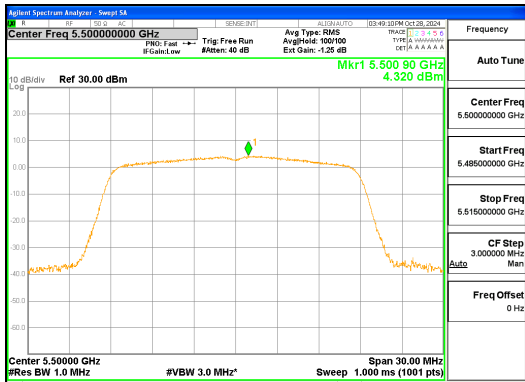


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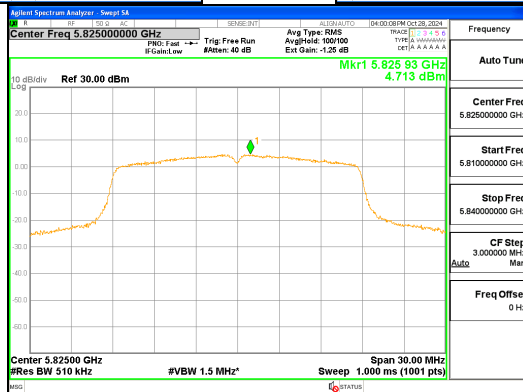
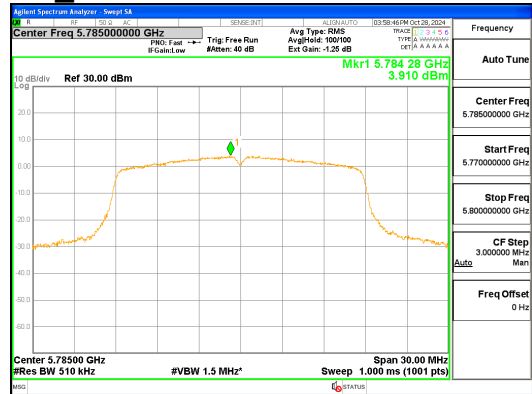
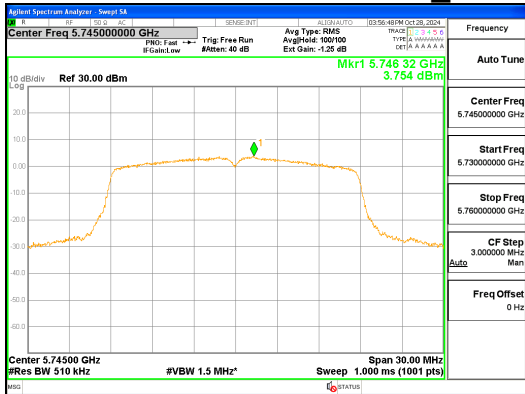


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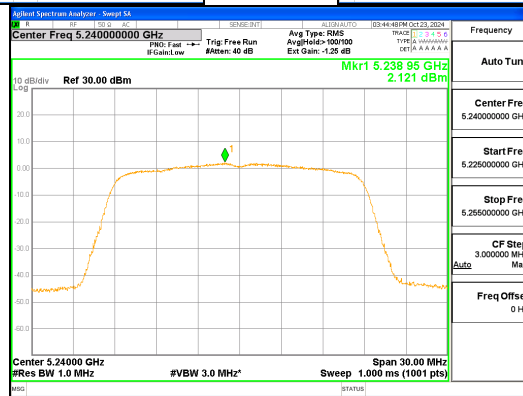
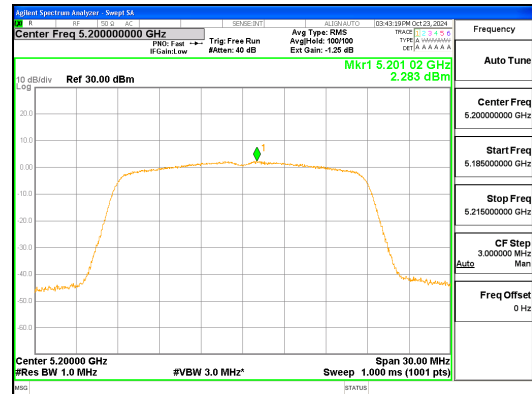
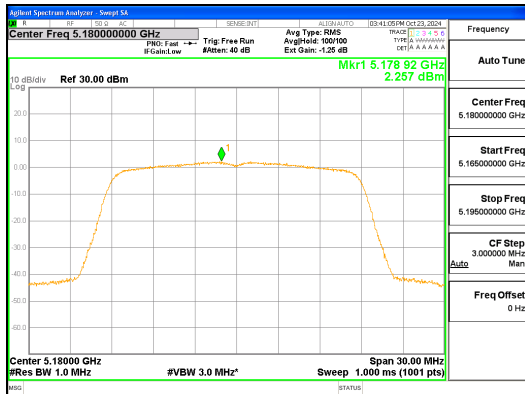
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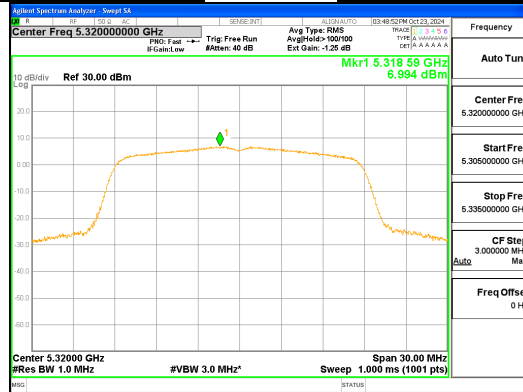
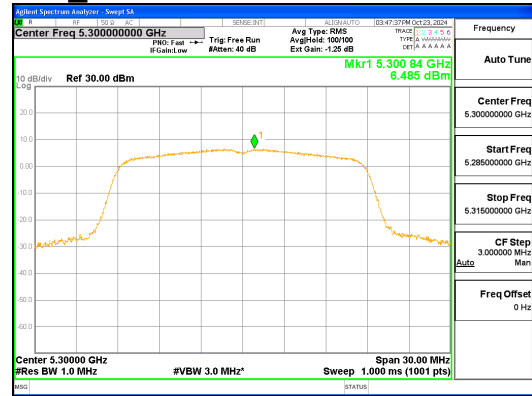
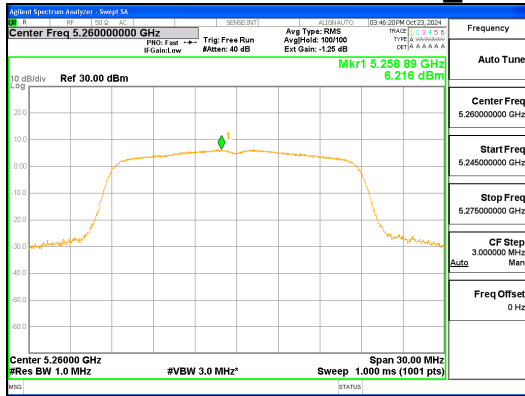
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ANT L_802.11ac_VHT20_UNII 3



ANT R_802.11ac_VHT20_UNII 1

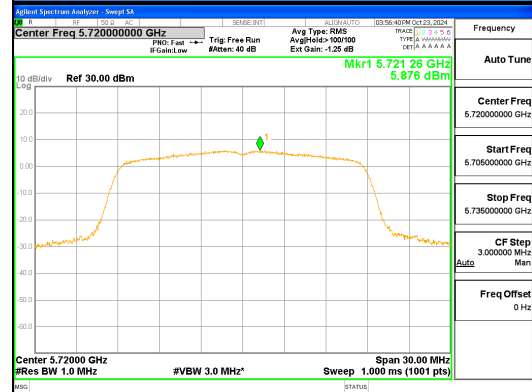
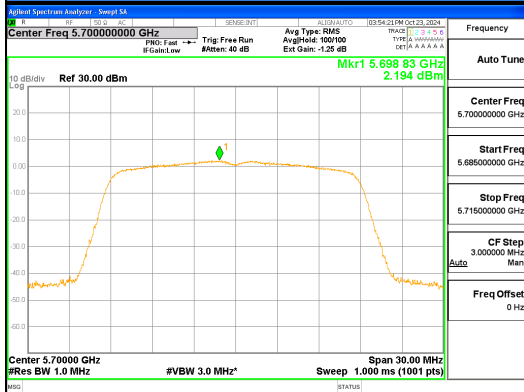
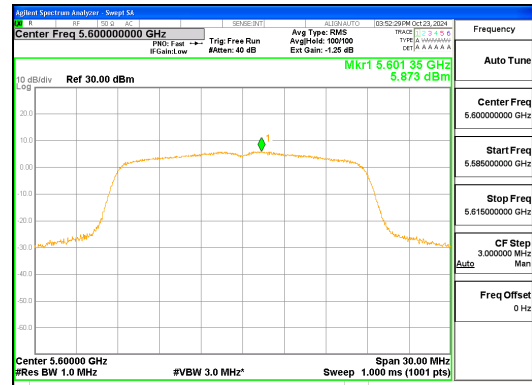
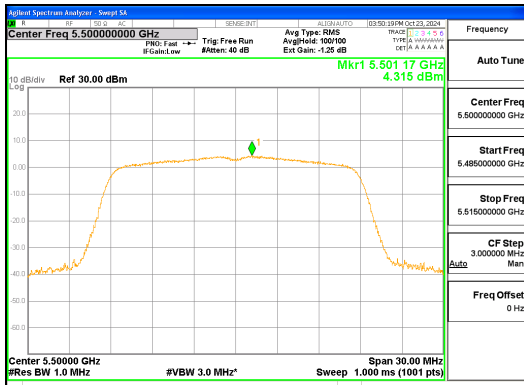


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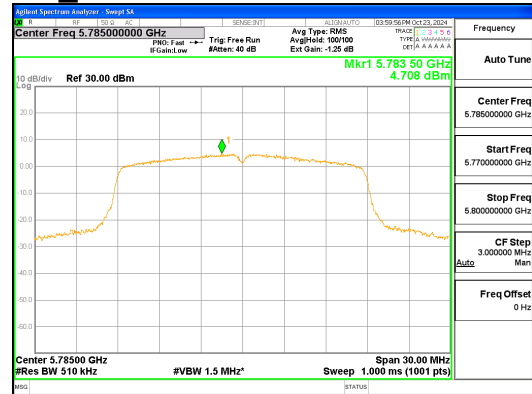
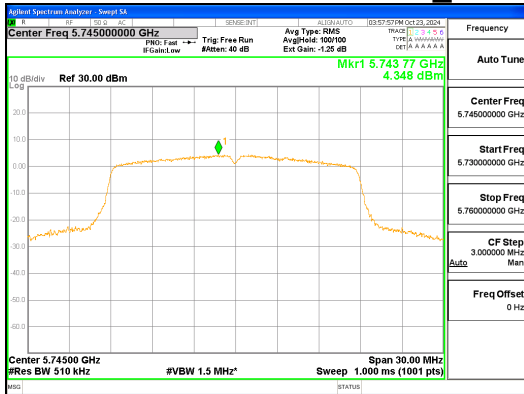


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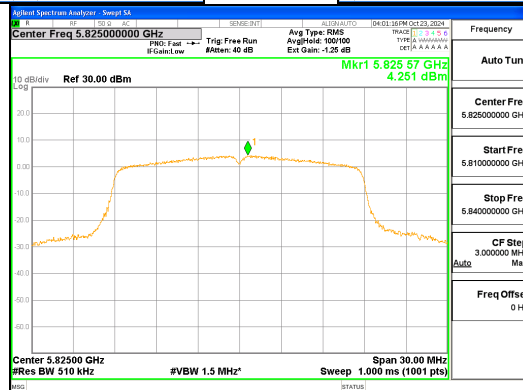
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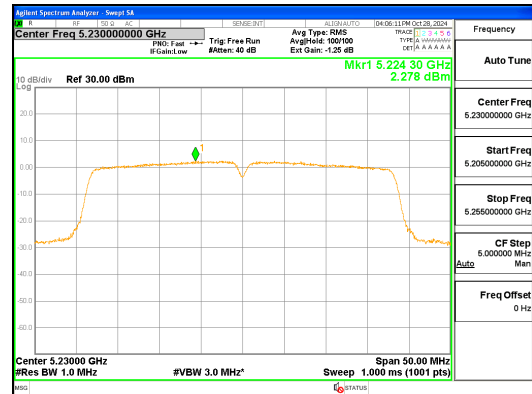
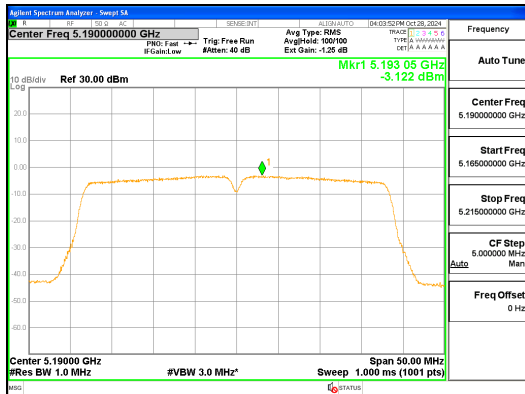


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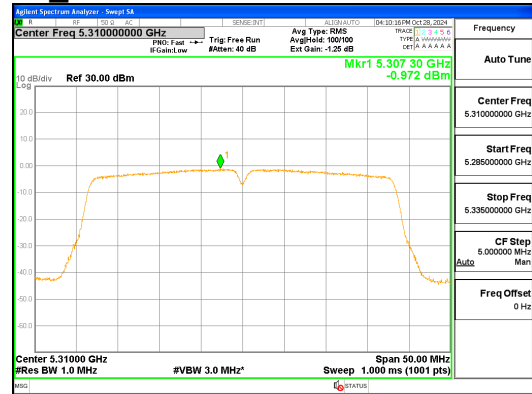
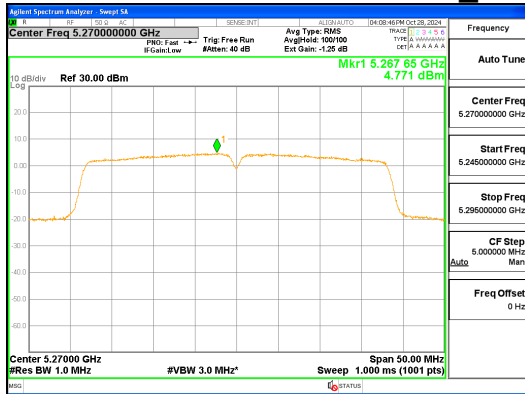


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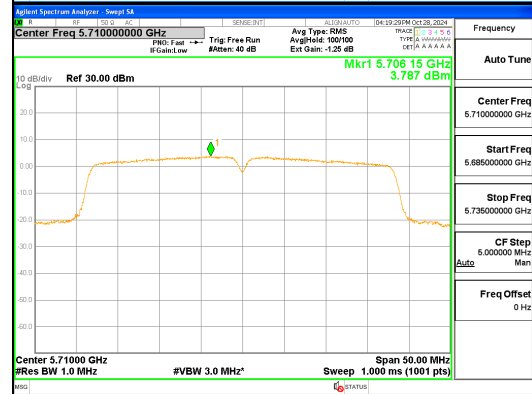
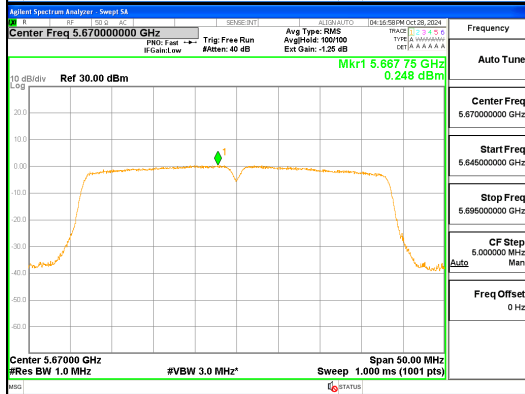
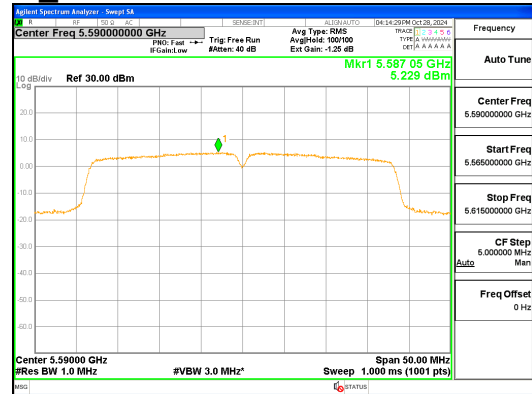
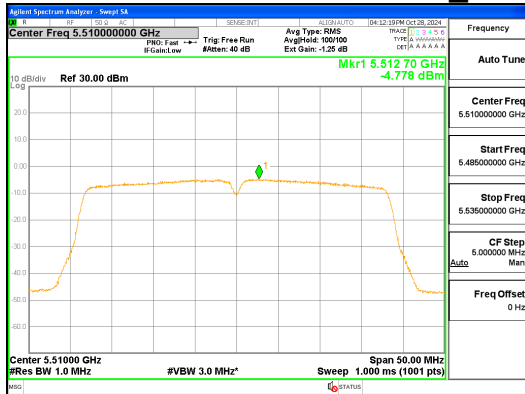




ANT L_802.11n_HT40_UNII 1



ANT L_802.11n_HT40_UNII 2A

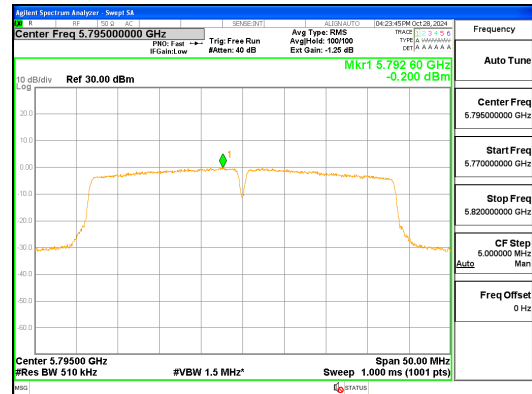
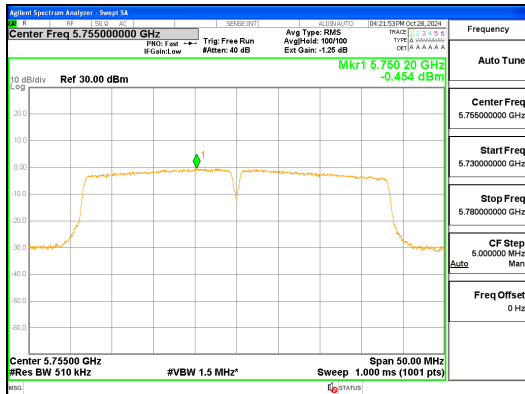


ANT L_802.11n_HT40_UNII 2C



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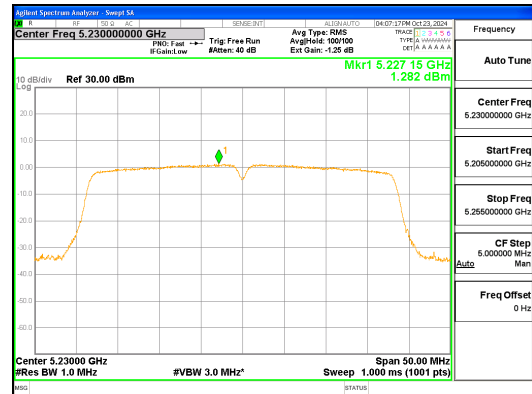
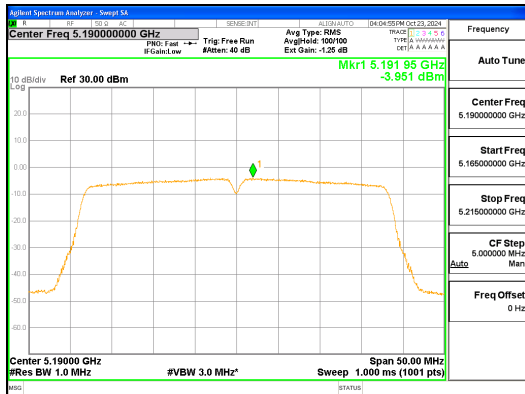


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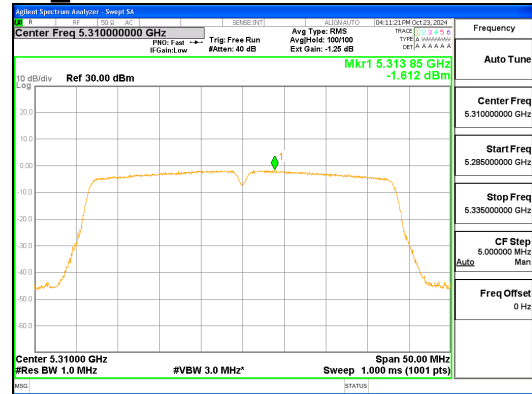
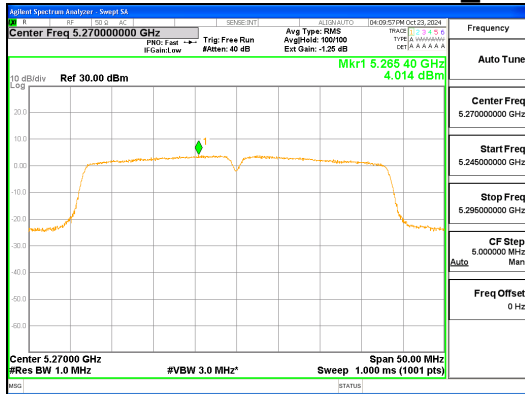


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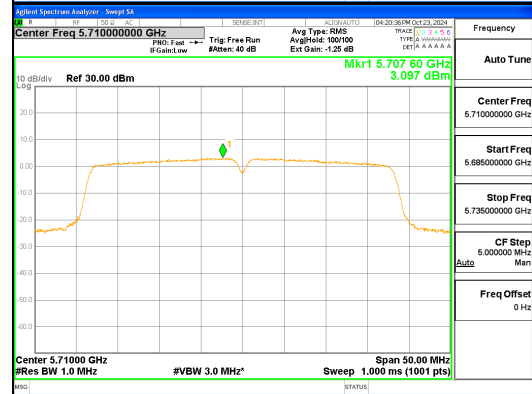
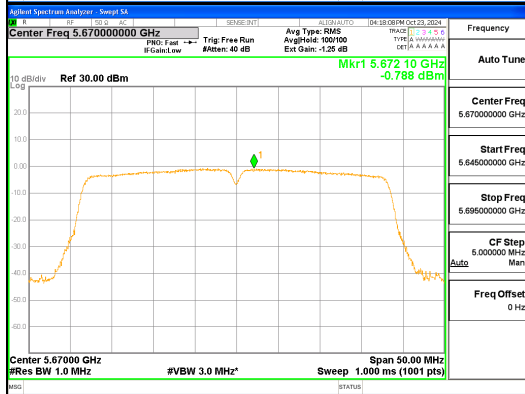
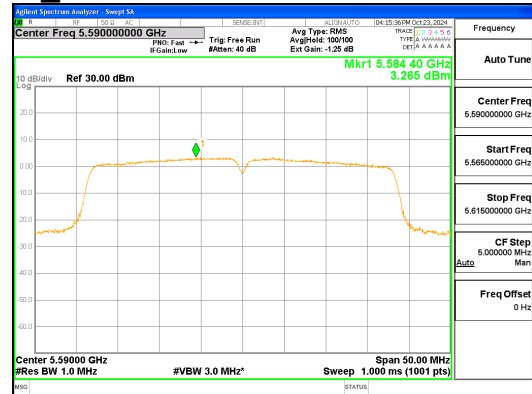
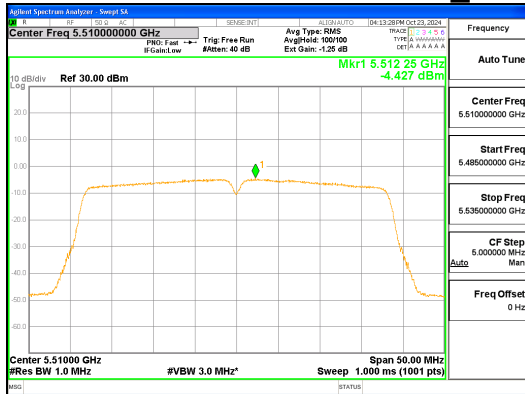
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ANT R_802.11n_HT40_UNII 1



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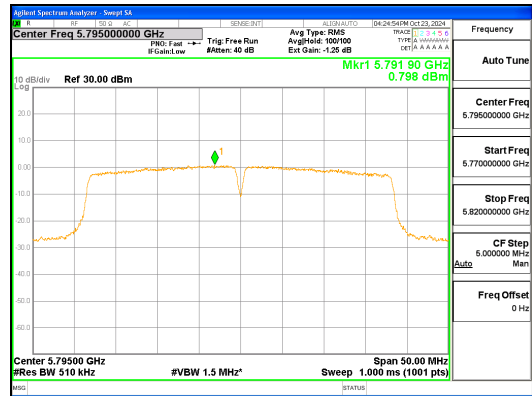
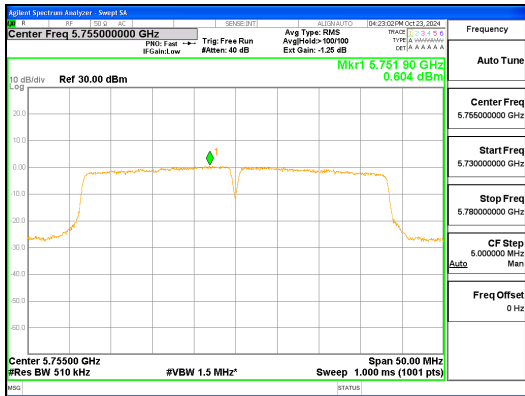


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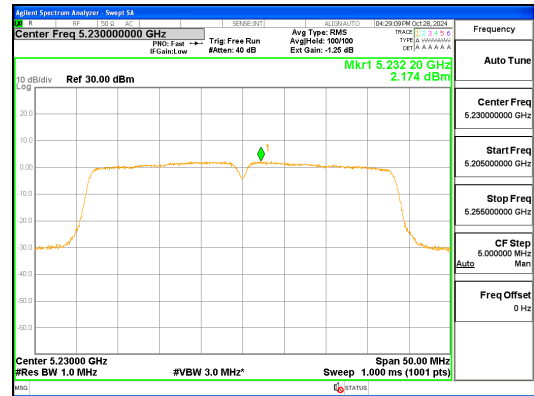
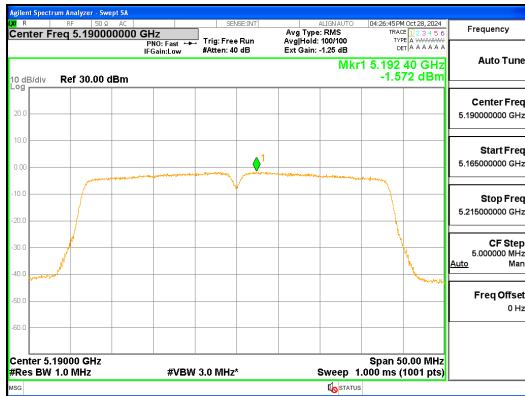


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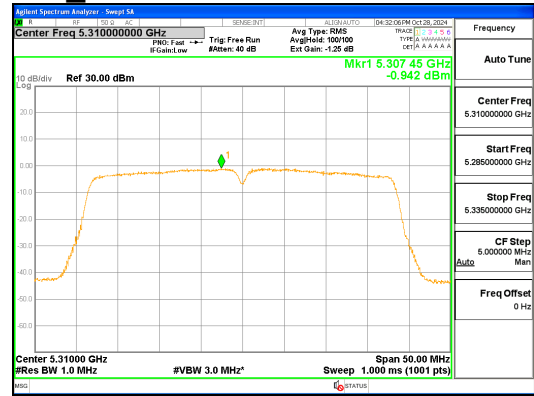
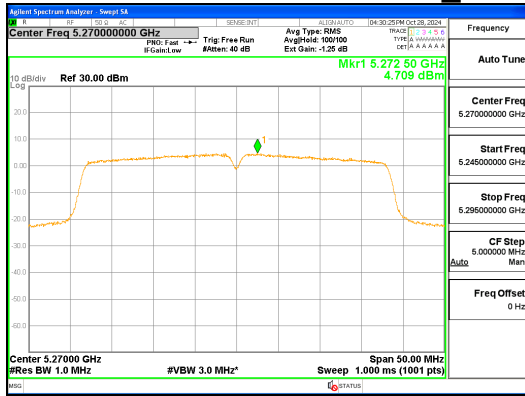
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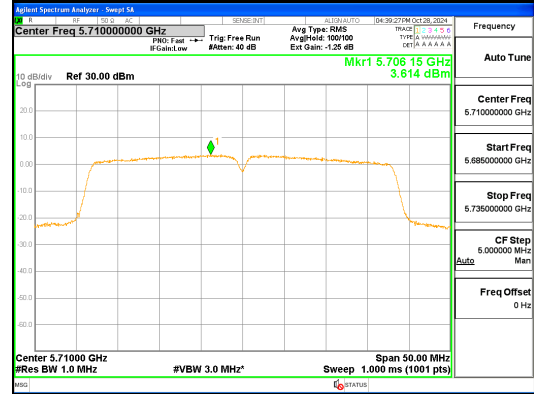
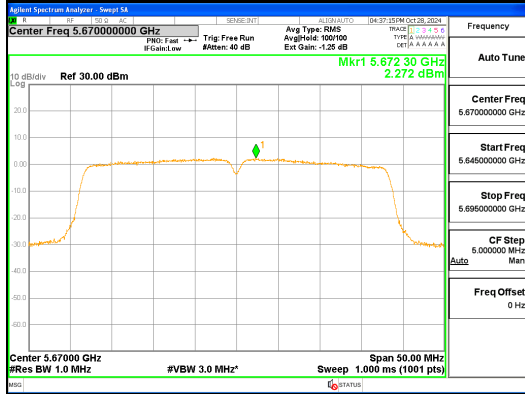
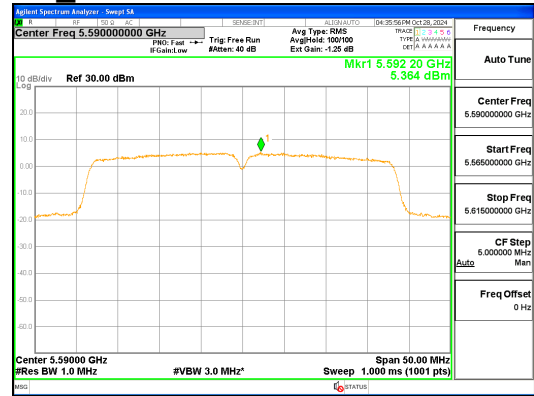
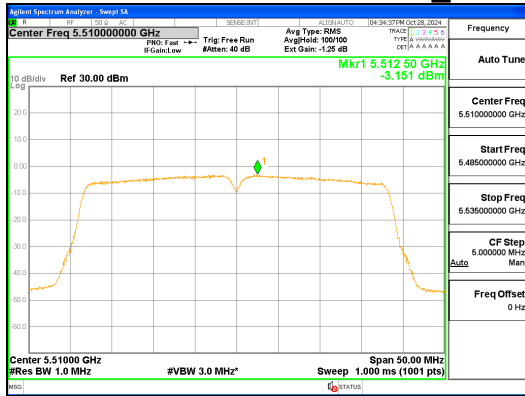
ANT_R_802.11n_HT40_UNII 3



ANT L_802.11ac_VHT40_UNII 1



ANT L_802.11ac_VHT40_UNII 2A

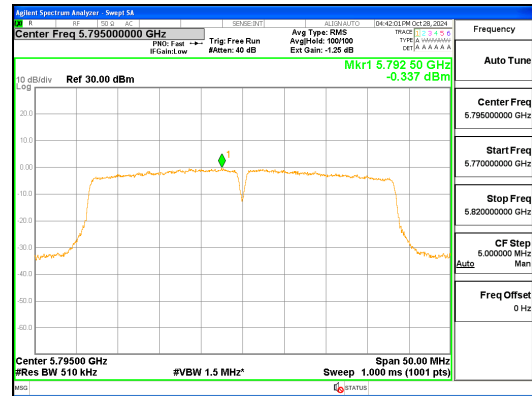
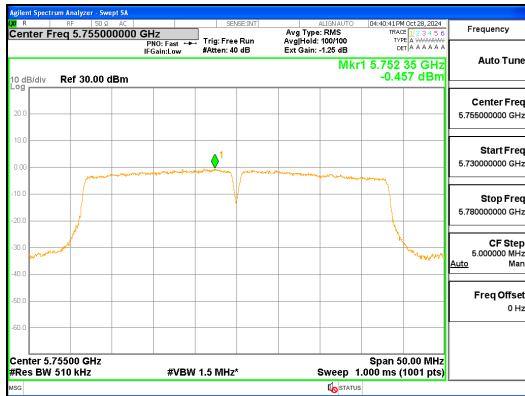


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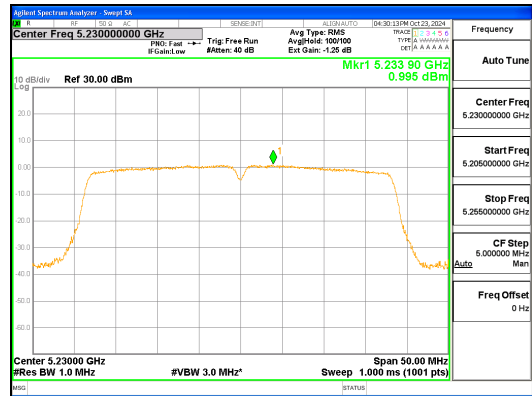
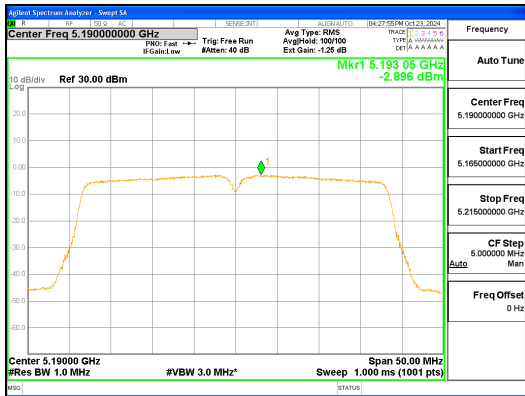


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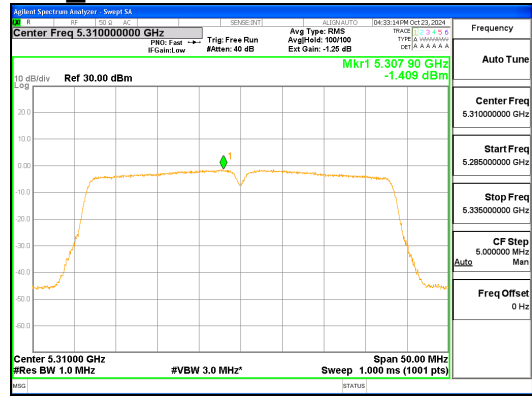
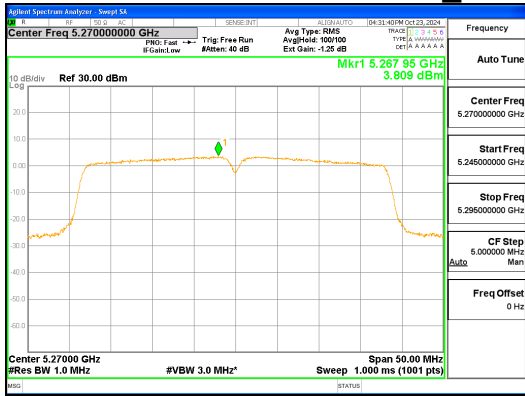
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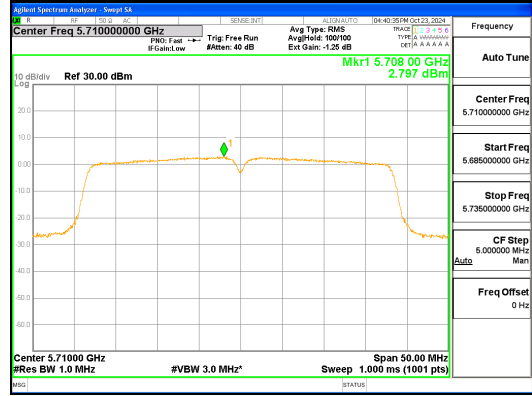
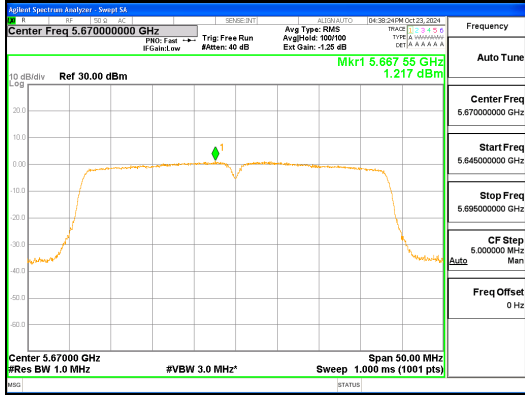
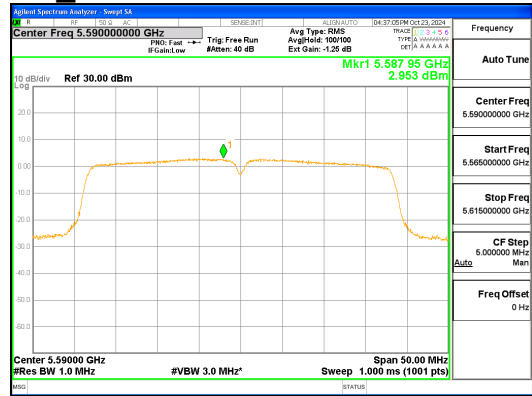
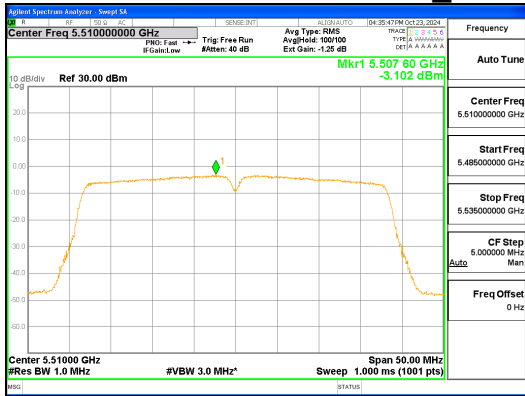
ANT L_802.11ac_VHT40_UNII 3



ANT R_802.11ac_VHT40_UNII 1



ANT R_802.11ac_VHT40_UNII 2A

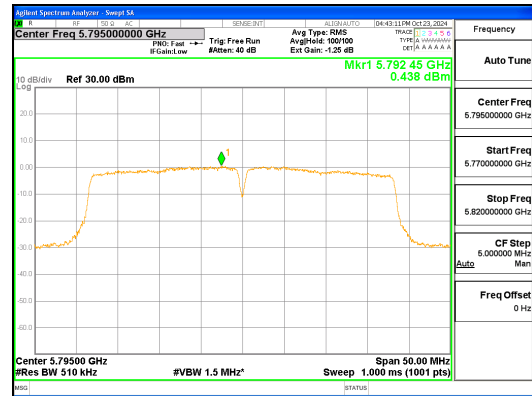
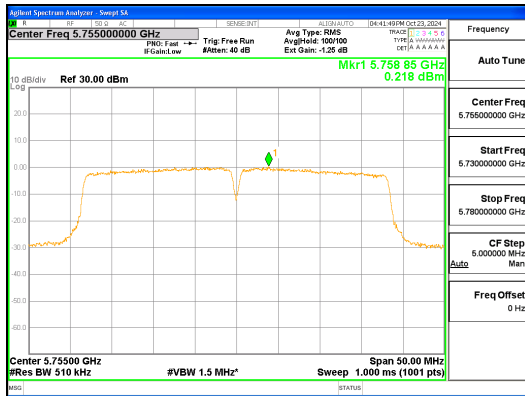


ANT R_802.11ac_VHT40_UNII 2C



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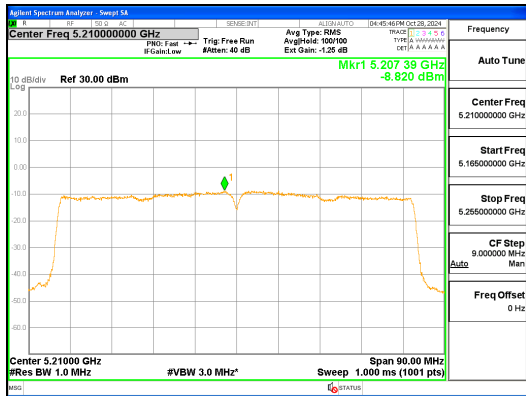


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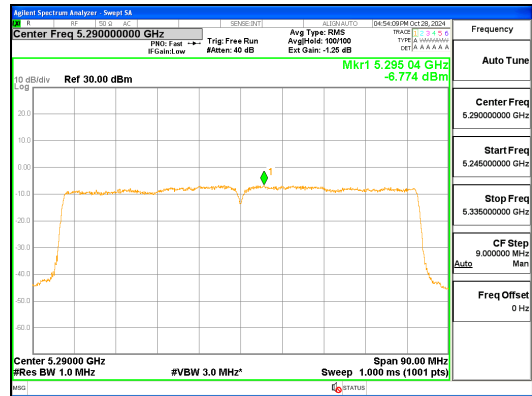


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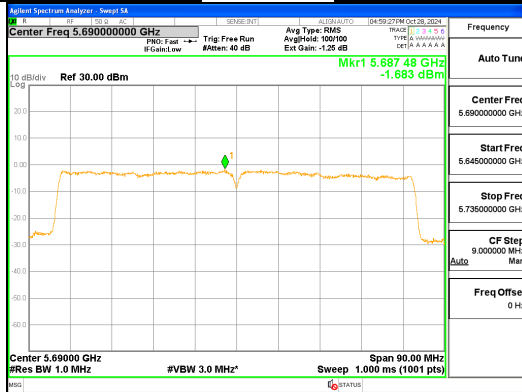
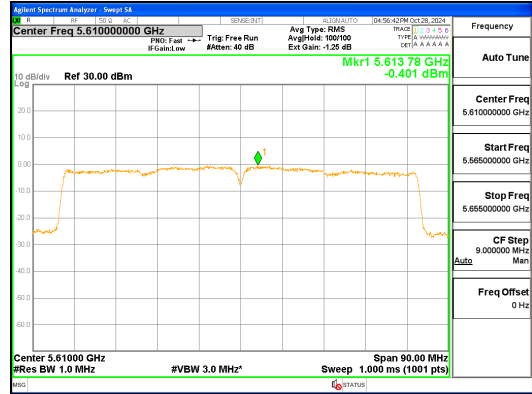
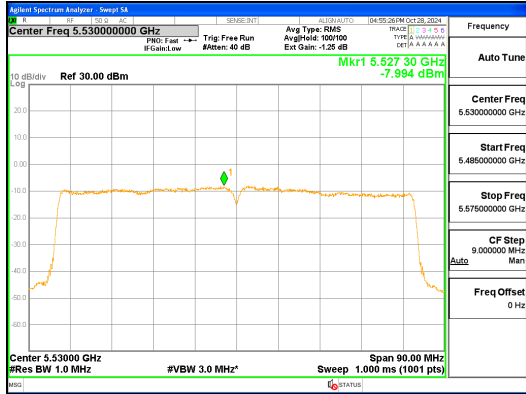
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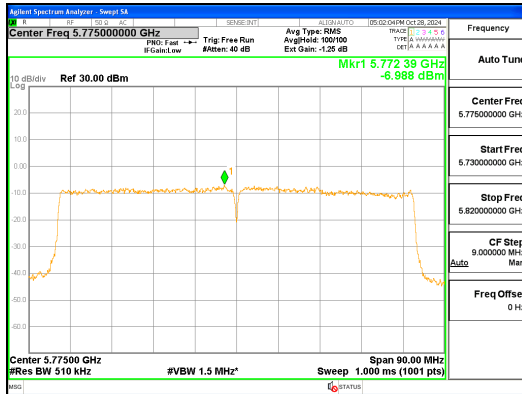
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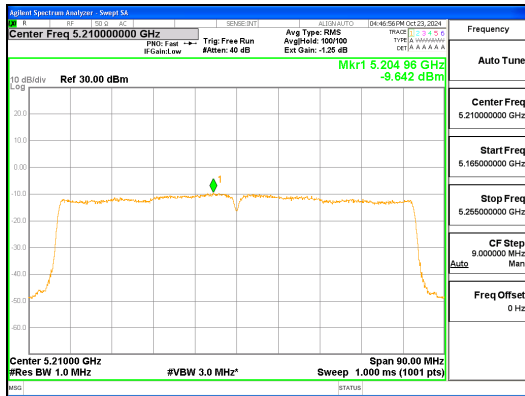
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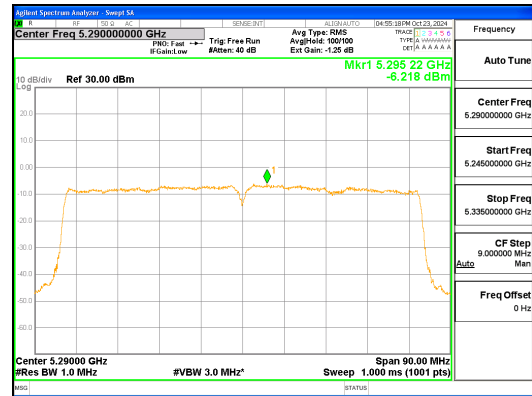
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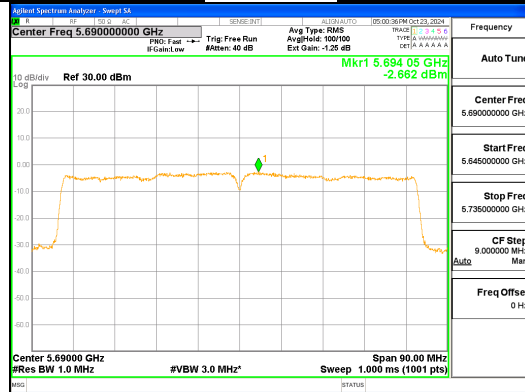
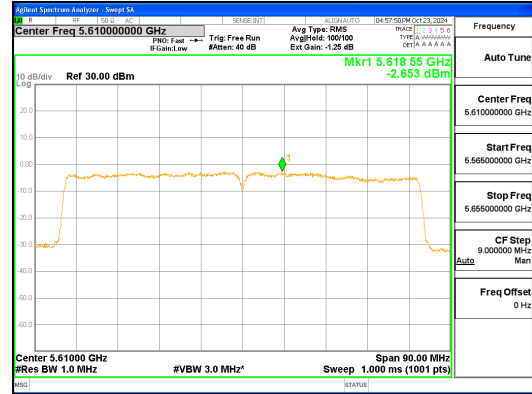
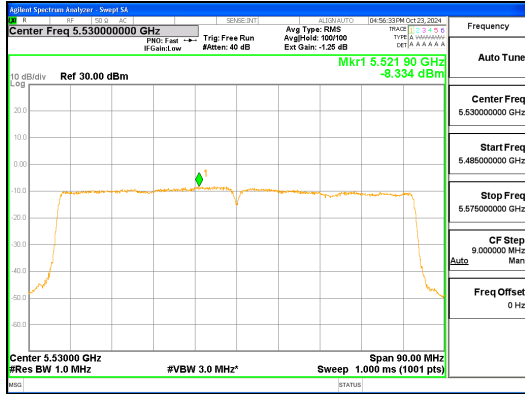
ANT L_802.11ac_VHT80_UNII 3



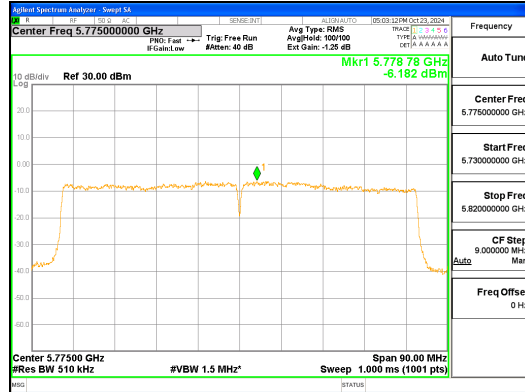
ANT R_802.11ac_VHT80_UNII 1



ANT R_802.11ac_VHT80_UNII 2A



ANT R_802.11ac_VHT80_UNII 2C



ANT R_802.11ac_VHT80_UNII 3



4.5 Frequency Stability

Test Procedures

KDB 789033 – Section A.3

The EUT was placed inside of an environmental chamber as the temperature in the chamber was varied between -20 °C and +50 °C (Declaration by the Manufacturer). The temperature was incremented by 10 °C intervals and the unit was allowed to stabilize at each temperature before each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel’s center frequency was recorded.

Data for the worst case channel is shown below.

Measured Frequency Error (kHz)						
Voltage (VDC)	Temperature (°C)	Test Frequency (MHz)				
		5 180	5 200	5 240	5 260	5 300
5.0	-10	12 190	12 686	13 781	12 493	13 390
5.0	0	-2 775	-2 574	-1 678	-3 243	-2 291
5.0	10	-15 700	-16 077	-15 800	-17 337	-17 282
5.0	20(Ref)	-26 750	-28 633	-28 893	-30 559	-30 228
5.0	30	-34 104	-32 893	-32 813	-33 612	-33 559
5.0	40	-31 029	-29 024	-29 182	-28 149	-28 593
5.0	50	-15 392	-9 746	-18 212	-14 919	-11 619
4.25	20(Ref)	-30 502	-30 009	-29 221	-31 151	-30 566
5.75	20(Ref)	-30 373	-30 407	-30 003	-31 109	-30 891



Measured Frequency Error (kHz)						
Voltage (VDC)	Temperature (°C)	Test Frequency (MHz)				
		5 320	5 500	5 600	5 700	5 720
5.0	-10	14 881	13 409	11 230	11 014	11 355
5.0	0	-1 348	-3 231	-6 548	-6 238	-6 049
5.0	10	-16 619	-18 251	-20 896	-21 622	-21 391
5.0	20(Ref)	-29 792	-32 204	-34 137	-34 408	-34 180
5.0	30	-33 406	-35 137	-35 717	-36 173	-36 413
5.0	40	-29 089	-29 385	-28 755	-29 128	-29 447
5.0	50	-16 292	-9 462	-6 460	-12 127	-11 498
4.25	20(Ref)	-29 973	-32 500	-34 202	-34 599	-34 524
5.75	20(Ref)	-30 446	-32 357	-34 218	-35 053	-33 422

Voltage (VDC)	Temperature (°C)	Test Frequency (MHz)		
		5 745	5 785	5 825
5.0	-10	12 053	11 246	10 819
5.0	0	-5 485	-6 257	-6 769
5.0	10	-20 807	-21 758	-22 512
5.0	20(Ref)	-34 230	-34 894	-35 603
5.0	30	-36 521	-36 770	-36 895
5.0	40	-29 980	-29 458	-29 321
5.0	50	-11 707	-6 875	-10 368
4.25	20(Ref)	-34 279	-34 970	-35 619
5.75	20(Ref)	-33 144	-33 785	-34 495

Note :

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature range as tested.



4.6 Unwanted Emissions

Test Location

- 10 m SAC (test distance : 10 m, 3 m)
 3 m SAC (test distance : 3 m)

Test Procedures

KDB 789033 - Section G
ANSI C63.10-2013 – Section 12.7

- 1) In the frequency range of 9 kHz to 30 MHz, magnetic field is measured with Loop Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- 2) In the frequency range above 30 MHz, Bi-Log Test Antenna(30 MHz to 1 GHz) and Horn Test Antenna(above 1 GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.

Test Settings:

Frequency Range = 9 kHz ~ 1 GHz

- a) RBW = 100 kHz for $f < 1$ GHz, 9 kHz for $f < 30$ MHz
b) VBW \geq RBW
c) Detector = CISPR Quasi-peak
d) Sweep time = auto couple

- Peak

Frequency Range = 1 GHz ~ 40 GHz

- a) RBW = 1 MHz
b) VBW $\geq 3 \times$ RBW
c) Detector = Peak
d) Sweep time = auto
e) Trace mode = max hold

- Average (duty cycle $\geq 98\%$)

Frequency Range = 1 GHz ~ 40 GHz

- a) RBW = 1 MHz
b) VBW $\geq 3 \times$ RBW
c) Detector = RMS
d) Sweep time = auto
e) Averaging type = power (i.e., RMS)
f) Trace mode = average (at least 100 traces)



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- Average (duty cycle < 98%)

Frequency Range = 1 GHz ~ 40 GHz

a) RBW = 1 MHz

b) VBW $\geq 3 \times$ RBW

c) Detector = RMS

d) Sweep time = auto

e) Averaging type = power (i.e., RMS)

f) Trace mode = average (at least 100 traces)

If power averaging (RMS) mode, then the applicable correction factor is $10 \log(1/x)$, where x is the duty cycle.

Test mode	Duty Cycle Factor (dB)
802.11a	0.09
802.11n_HT20	0.10
802.11n_HT40	0.22
802.11ac_VHT20	0.20
802.11ac_VHT40	0.40
802.11ac_VHT80	2.35



Limit

1. UNII 1, 2A : All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
2. UNII 2C : All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
3. UNII 3 : All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

* E.I.R.P -27 dBm/MHz
 $E[\text{dBuV/m}] = \text{EIRP}[\text{dBm}] + 95.2$, for $d = 3\text{m}$

4. Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209.
 - 15.209(a)

Frequency(MHz)	Field Strength uV/m@3m	Field Strength dBuV/m@3m	Deasurement Distance (meters)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705-30	30	-	30
30-88	100**	40	3
88-216	150**	43.5	3
216-960	200**	46	3
Above 960	500	54	3

** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.



5. FCC Part 15 § 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	MHz	GHz
0.09-0.11	8.37626-8.38675	73-74.6	399.9-410	2690-2900	10.6-12.7
¹ 0.495-0.505	8.41425-8.41475	74.8-75.2	608-614	3260-3267	13.25-13.4
2.1735-2.1905	12.29-12.293	108-121.94	960-1240	3332-3339	14.47-14.5
4.125-4.128	12.51975-12.52025	123-138	1300-1427	3345.8-3358	15.35-16.2
4.17725-4.17775	12.57675-12.57725	149.9-150.05	1435-1626.5	3600-4400	17.7-21.4
4.20725-4.20775	13.36-13.41	156.52475-156.52525	1645.5-1646.5	4500-5150	22.01-23.12
6.215-6.218	16.42-16.423	156.7-156.9	1660-1710	5350-5460	23.6-24
6.26775-6.26825	16.69475-16.69525	162.0125-167.17	1718.8-1722.2	7250-7750	31.2-31.8
6.31175-6.31225	16.80425-16.80475	167.72-173.2	2200-2300	8025-8500	36.43-36.5
8.291-8.294	25.5-25.67	240-285	2310-2390	9000-9200	² Above 38.6
8.362-8.366	37.5-38.25	322-335.4	2483.5-2500	9300-9500	

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

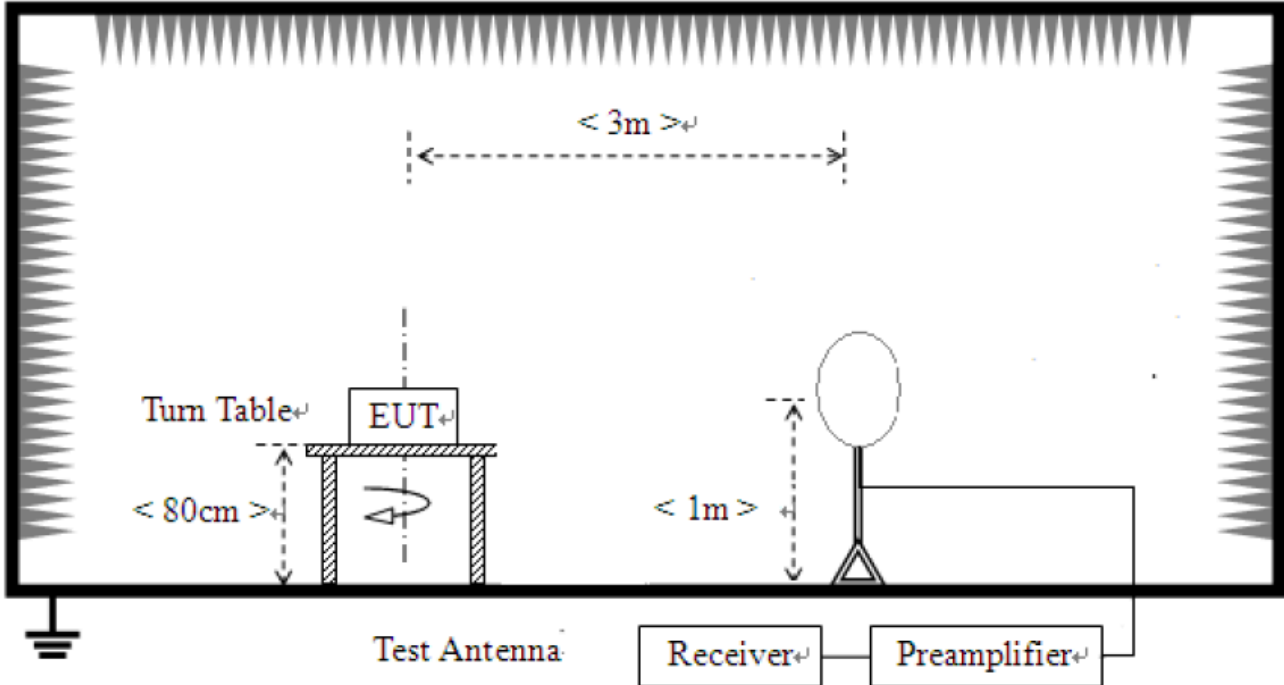
§ 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

Note :

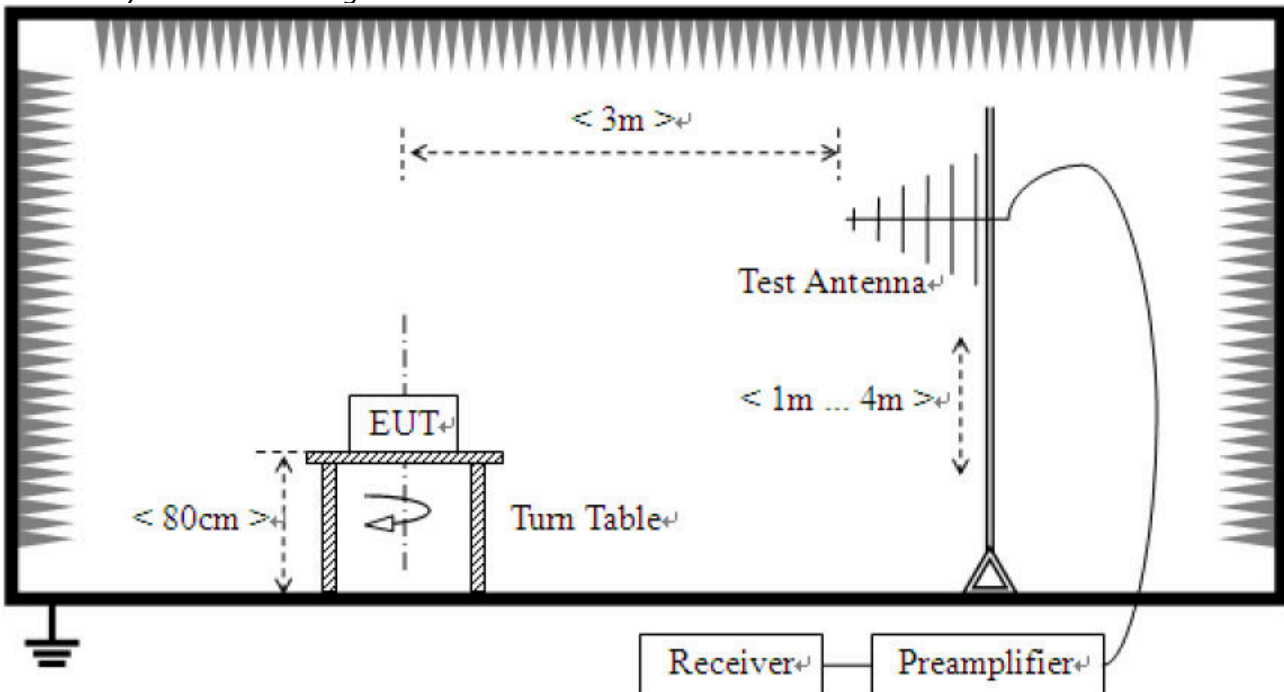
- 1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
- 2) For above 1 GHz, limit field strength of harmonics : 54 dBuV/m@3m (AV) and 74 dBuV/m@3m (PK)

Test Setup:

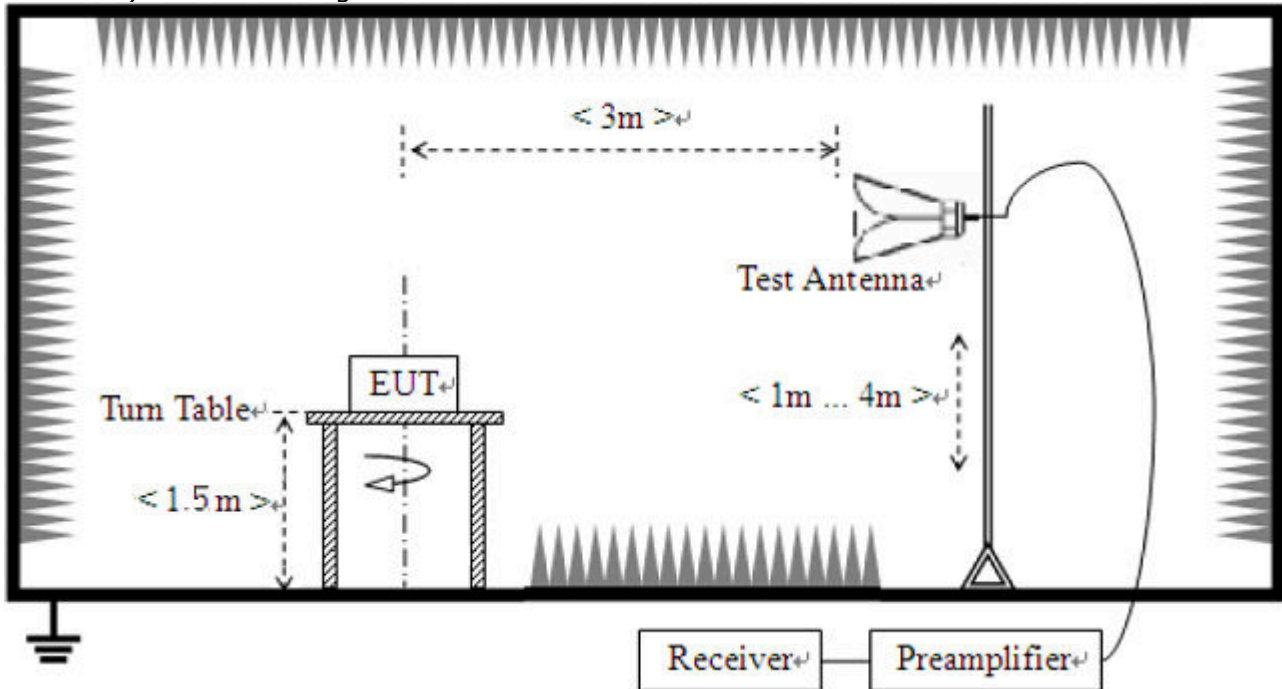
- 1) For field strength of emissions from 9 kHz to 30 MHz



- 2) For field strength of emissions from 30 MHz to 1 GHz



3) For field strength of emissions above 1 GHz



Test Mode

We have done all test mode.

The worst case antenna configuration and Test mode are determined to be as follows.

802.11a mode : ANT L, ANT R

802.11n mode : ANT L + ANT R (MIMO)

802.11ac mode : ANT L + ANT R (MIMO)

So the results are only attached worst cases.

Test Results

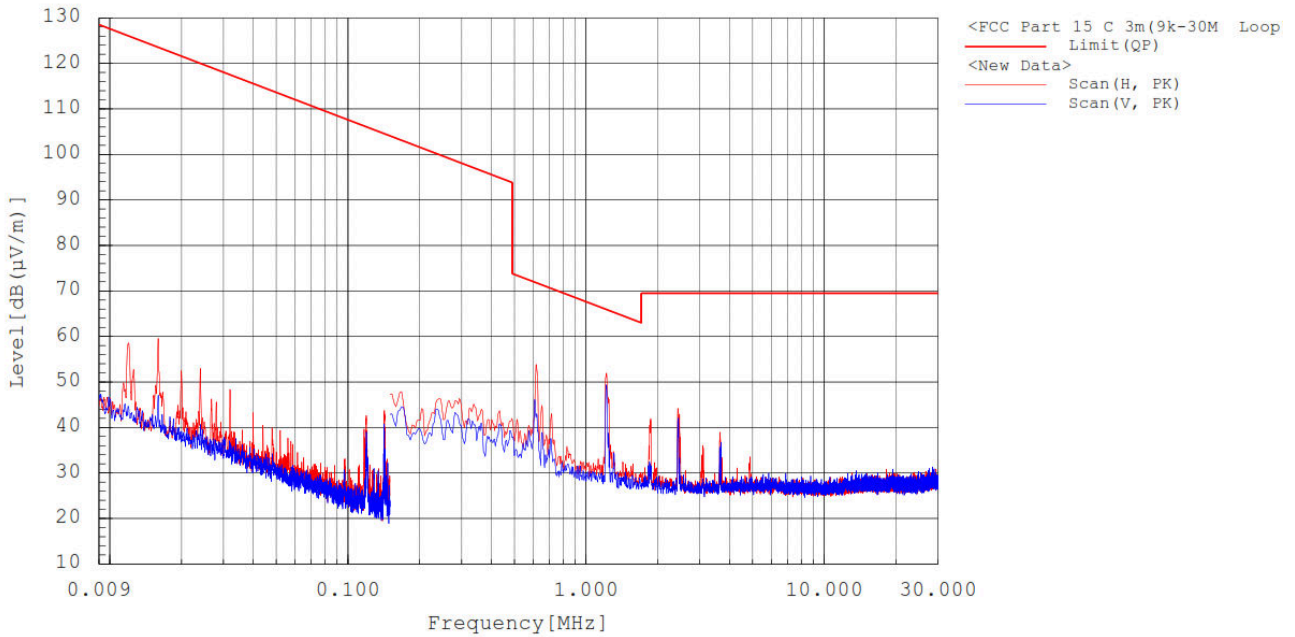
1) 9 kHz to 30 MHz

Test mode : Transmitter (Worst Case)

The requirements are:

Complies

Test Data



Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Level [dB(uV/m)]	Limit [dB(uV/m)]	Margin [dB]
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The emissions 9 kHz to 30 MHz were 20 dB lower than the limit.

Remark :

1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(Z axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. This data is the Peak(PK) value.