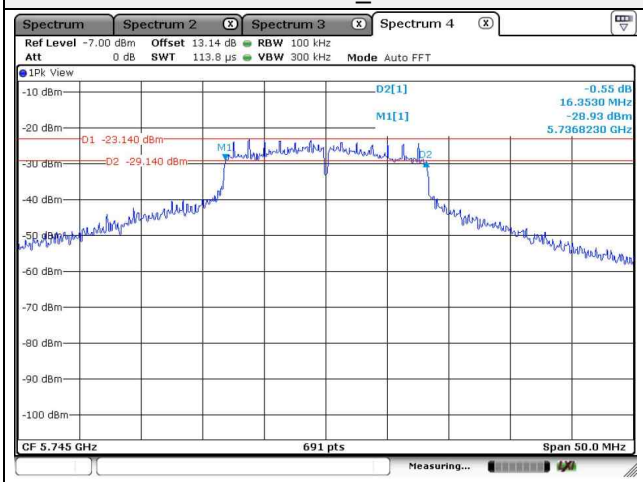
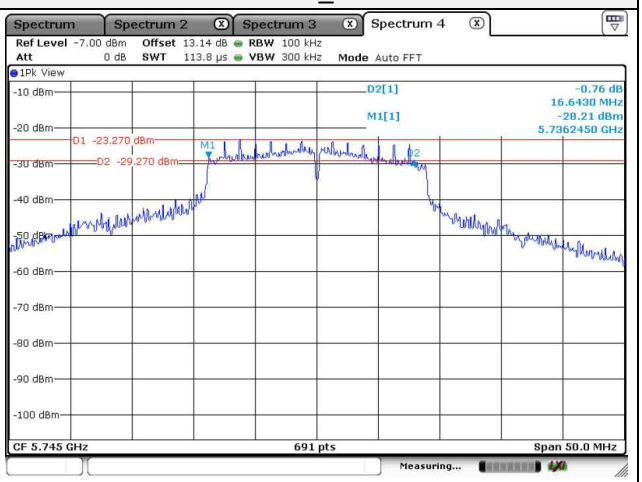
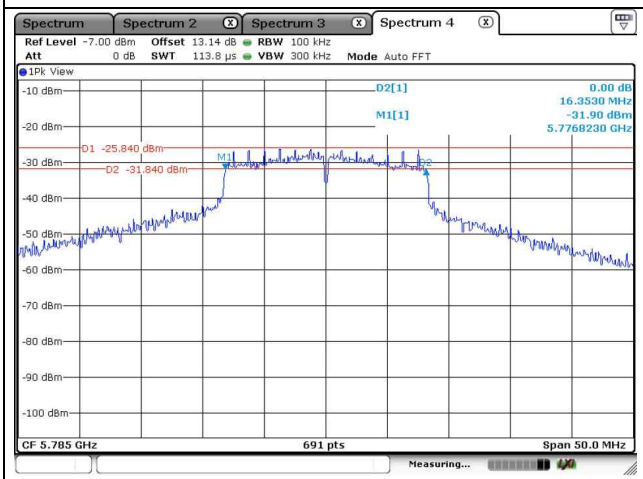
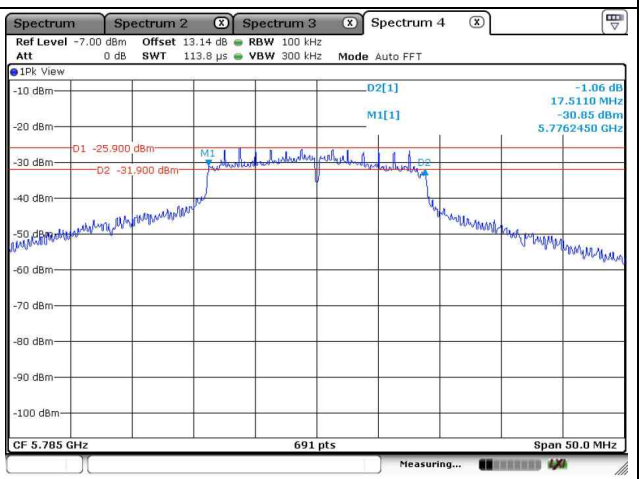
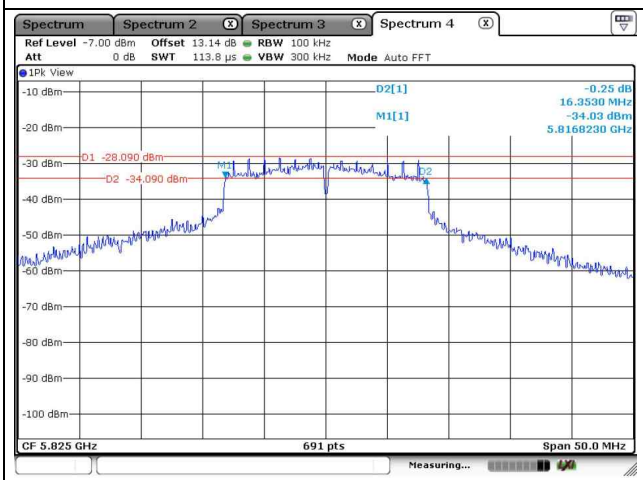
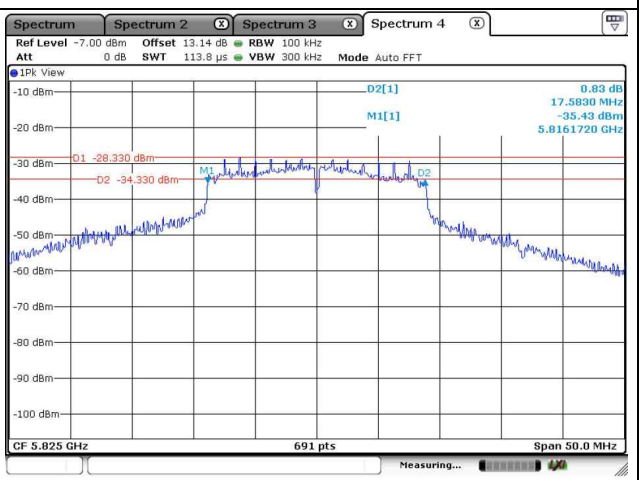
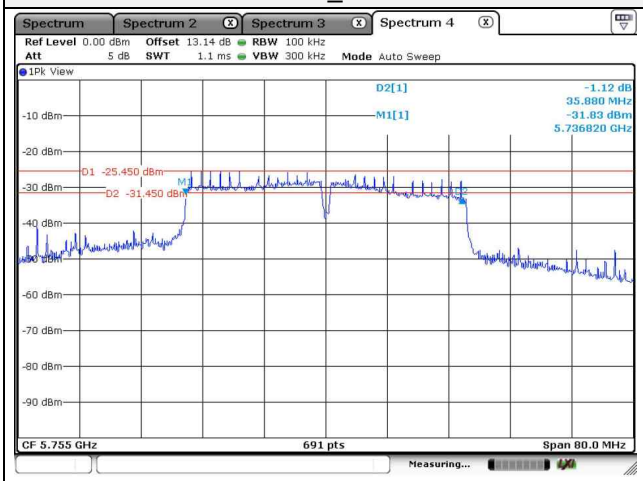
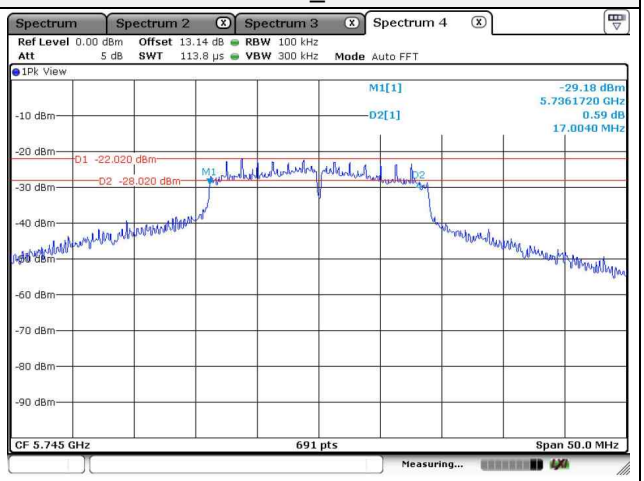
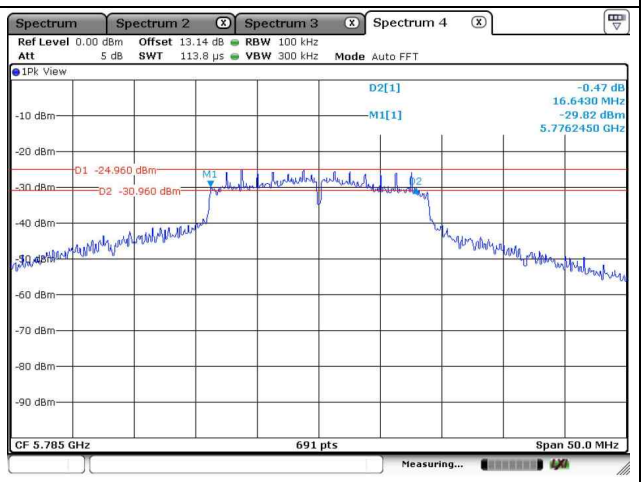
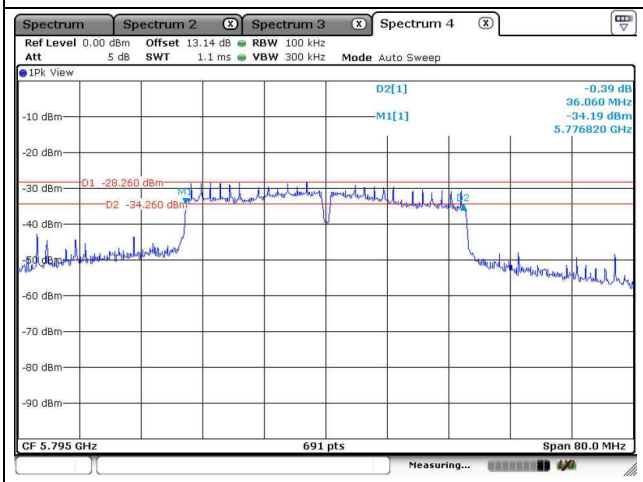
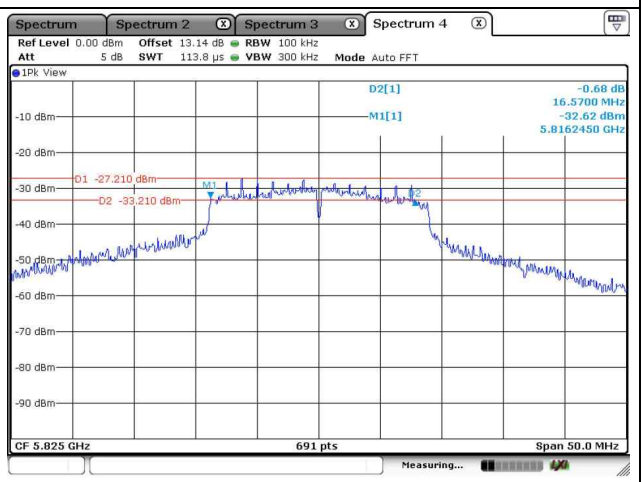
UNII-3_a	UNII-3_HT20
	
	
	

UNII-3_HT40	UNII-3_VHT20
	
Blank	
	

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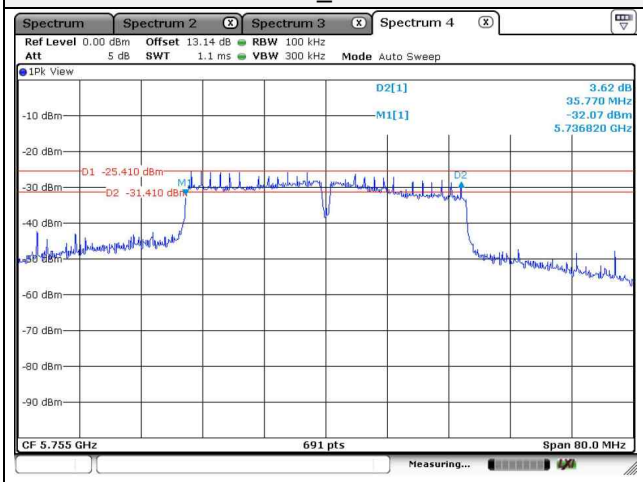
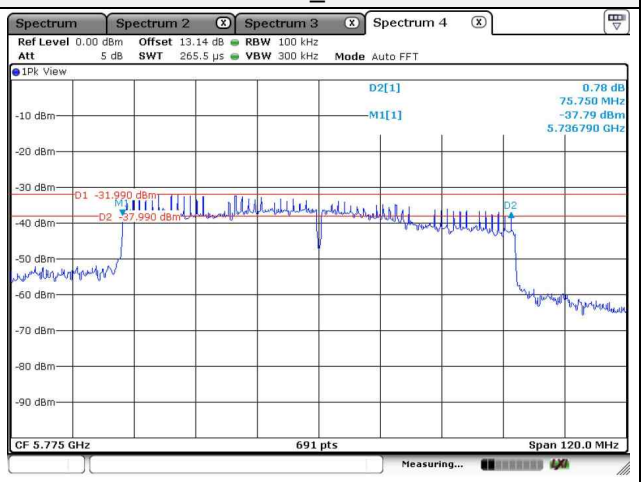
UNII-3_VHT40	UNII-3_VHT80
	
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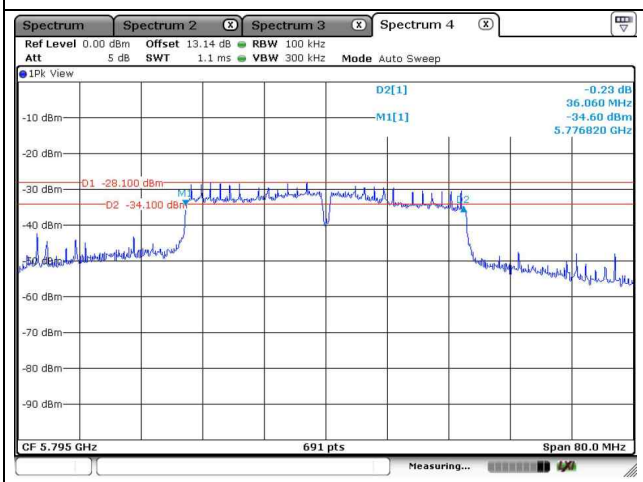
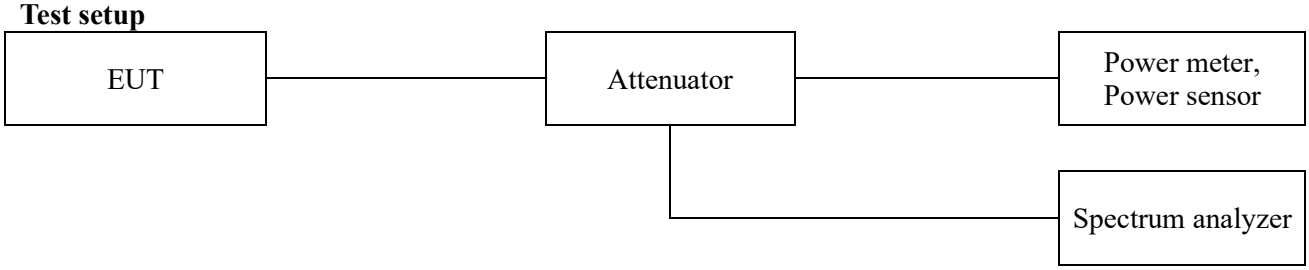
	Blank

3.3. Maximum conducted output power

Test procedure

KDB 789033 D02 v02r01– Section E.3.a) or b)
Used test method is Section E.3.b)

Test setup



Section E.3.a)

Method PM (Measurement using an RF average power meter):

i. Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

- The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
- At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
- The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

ii. If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in section II.B.

iii. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.

iv. Adjust the measurement in dBm by adding 10 log (1/x) where x is the duty cycle (e.g., 10 log (1/0.25) if the duty cycle is 25 %).

Section E.3.b)

Method PM-G (Measurement using a gated RF average power meter):

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

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Limit

Band	EUT Category		Limit
UNII-1		Outdoor access point	1 W (30 dBm)
		Indoor access point	
		Fixed point-to-point access point	
	✓	Mobile and portable client device	250 mW(24 dBm)
UNII-2A	✓		250 mW or 11 dBm + 10logB*
UNII-2C	✓		250 mW or 11 dBm + 10logB*
UNII-3	✓		1 W (30 dBm)

Note.

1. FCC Limit B is the 26 dB emission bandwidth.

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Test results

Band	Frequency (㎒)	Mode	Detector mode	Output power (dBm)	Limit (dBm)
UNII-1	5 180	a	AV	1.30	24.00
	5 220		AV	1.24	
	5 240		AV	1.03	
UNII-2A	5 260		AV	-0.01	24.00
	5 280		AV	-1.39	
	5 320		AV	-1.42	
UNII-2C	5 500		AV	-5.55	24.00
	5 600		AV	-7.24	
	5 700		AV	-10.25	
UNII-3	5 745		AV	-11.46	30.00
	5 785		AV	-13.75	
	5 825		AV	-15.28	
UNII-1	5 180	HT20	AV	0.84	24.00
	5 220		AV	0.59	
	5 240		AV	0.57	
UNII-2A	5 260		AV	-0.95	24.00
	5 280		AV	-1.78	
	5 320		AV	-1.81	
UNII-2C	5 500		AV	-5.86	24.00
	5 600		AV	-7.76	
	5 700		AV	-10.83	
UNII-3	5 745		AV	-12.12	30.00
	5 785		AV	-14.35	
	5 825		AV	-15.58	
UNII-1	5 190	HT40	AV	1.37	24.00
	5 230		AV	1.13	
UNII-2A	5 270		AV	-0.82	24.00
	5 310		AV	-1.13	
UNII-2C	5 510		AV	-5.14	24.00
	5 590		AV	-6.86	
	5 670		AV	-8.97	
UNII-3	5 755		AV	-11.90	30.00
	5 795		AV	-14.05	

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Band	Frequency (㎒)	Mode	Detector mode	Output power (dBm)	Limit(dBm)
UNII-1	5 180	VHT 20	AV	1.92	24.00
	5 220		AV	1.56	
	5 240		AV	1.53	
UNII-2A	5 260		AV	0.15	24.00
	5 280		AV	-0.45	
	5 320		AV	-0.59	
UNII-2C	5 500		AV	-4.77	24.00
	5 600		AV	-6.43	
	5 700		AV	-9.99	
UNII-3	5 745		AV	-11.23	30.00
	5 785		AV	-13.52	
	5 825		AV	-15.28	
UNII-1	5 190	VHT 40	AV	0.86	24.00
	5 230		AV	1.23	
UNII-2A	5 270		AV	-0.82	24.00
	5 310		AV	-1.11	
UNII-2C	5 510		AV	-4.95	24.00
	5 590		AV	-6.85	
	5 670		AV	-9.11	
UNII-3	5 755		AV	-12.07	30.00
	5 795		AV	-14.11	
UNII-1	5 210	VHT 80	AV	0.16	24.00
UNII-2A	5 290		AV	-2.21	24.00
UNII-2C	5 530		AV	-6.42	24.00
	5 610		AV	-8.44	
UNII-3	5 775		AV	-14.20	30.00

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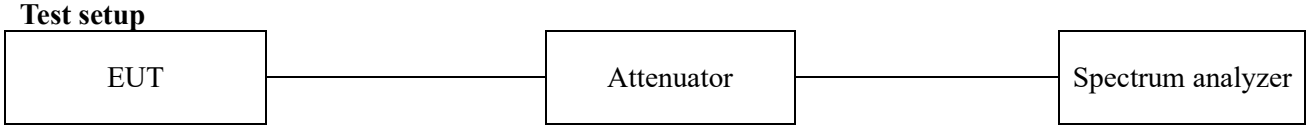
3.4. Power spectral density

Test procedure

KDB 789033 D02 v02r01 – Section F

Test setup



Section F

1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, "Compute power…." (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
2. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
3. Make the following adjustments to the peak value of the spectrum, if applicable:
   a) If Method SA-2 or SA-2 Alternative was used, add 10 log (1/x), where x is the duty cycle, to the peak of the spectrum.
   b) If Method SA-3 Alternative was used and the linear mode was used in step II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
4. The result is the Maximum PSD over 1 MHz reference bandwidth.
5. For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:

   a) Set RBW ≥ 1/T, where T is defined in section II.B.l.a)
   b) Set VBW ≥ 3 RBW.
   c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log (500 kHz/RBW) to the measured result, whereas RBW (< 500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
   d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10 log (1 MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
   e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note.

As a practical matter, it is recommended to use reduced RBW of 100 kHz for the sections 5.c) and 5.d) above, since RBW=100 kHz is available on nearly all spectrum analyzers.

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Limit

Band	EUT Category		Limit
UNII-1		Outdoor access point	17 dBm/㎒
		Indoor access point	
		Fixed point-to-point access point	
	✓	Mobile and portable client device	11 dBm/㎒
UNII-2A	✓		11 dBm/㎒
UNII-2C	✓		11 dBm/㎒
UNII-3	✓		30 dBm/500 ㎑

Note.

1. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceed 6 dBi.

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Test results

Band	Frequency (㎒)	Mode	PSD (dBm/㎒)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm/㎒)
UNII-1	5 180	a	-9.40	-	-	-9.40	11.00
	5 220		-9.57			-9.57	
	5 240		-9.66			-9.66	
	5 180	HT20	-10.30		0.18	-10.12	
	5 220		-10.36			-10.18	
	5 240		-10.56			-10.38	
	5 190	HT40	-13.31		0.58	-12.73	
	5 230		-13.13			-12.55	
	5 180	VHT20	-9.08		0.32	-8.76	
	5 220		-9.40			-9.08	
	5 240		-9.81			-9.49	
	5 190	VHT40	-13.53		0.83	-12.70	
	5 230		-13.07			-12.24	
	5 210	VHT80	-17.72		1.14	-16.58	
UNII-2A	5 260	a	-11.18	-	-	-11.18	11.00
	5 280		-12.02			-12.02	
	5 320		-12.04			-12.04	
	5 260	HT20	-11.96		0.23	-11.73	
	5 280		-12.59			-12.36	
	5 320		-12.81			-12.58	
	5 270	HT40	-15.07		0.58	-14.49	
	5 310		-15.75			-15.17	
	5 260	VHT20	-10.99		0.29	-10.70	
	5 280		-11.87			-11.58	
	5 320		-11.43			-11.14	
	5 270	VHT40	-15.30		0.57	-14.73	
	5 310		-15.71			-15.14	
	5 290	VHT80	-19.35		1.14	-18.21	

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Band	Frequency (㎒)	Mode	PSD (dBm/㎒)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm/㎒)
UNII-2C	5 500	a	-15.68	-	0.09	-15.59	11.00
	5 600		-17.58			-17.49	
	5 700		-20.63			-20.54	
	5 500	HT20	-16.58		0.18	-16.40	
	5 600		-18.27			-18.09	
	5 700		-21.18			-21.00	
	5 510	HT40	-19.10		0.71	-18.39	
	5 590		-21.04			-20.33	
	5 670		-22.99			-22.28	
	5 500	VHT20	-15.63		0.32	-15.31	
	5 600		-17.54			-17.22	
	5 700		-20.27			-19.95	
	5 510	VHT40	-19.26		0.72	-18.54	
	5 590		-21.16			-20.44	
	5 670		-22.94			-22.22	
	5 530	VHT80	-23.39		1.44	-21.95	
	5 610		-25.22			-23.78	

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Band	Frequency (㎒)	Mode	PSD (dBm/500㎑)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm/㎒)
UNII-3	5 745	a	-21.97	-3.01	0.09	-24.89	30.00
	5 785		-24.61			-27.53	
	5 825		-27.14			-30.06	
	5 745	HT20	-22.80		0.23	-25.58	
	5 785		-25.46			-28.24	
	5 825		-27.87			-30.65	
	5 755	HT40	-26.18		0.65	-28.54	
	5 795		-28.82			-31.18	
	5 745	VHT20	-21.76		0.29	-24.48	
	5 785		-24.47			-27.19	
	5 825		-26.89			-29.61	
	5 755	VHT40	-26.21		0.58	-28.64	
	5 795		-28.80			-31.23	
	5 775	VHT80	-33.96		1.29	-35.68	

Note.

1. UNII-1 = 10log(1 ㎒/1 ㎒)
   UNII-2A = 10log(1 ㎒/1 ㎒)
   UNII-2C = 10log(1 ㎒/1 ㎒)
   UNII-3 = 10log(500 ㎑ /1 ㎒)
2. Refer to the page 69 on this report.
3. Sum(dBm) = PSD(dBm) + RBWF + Duty correction factor (dB)

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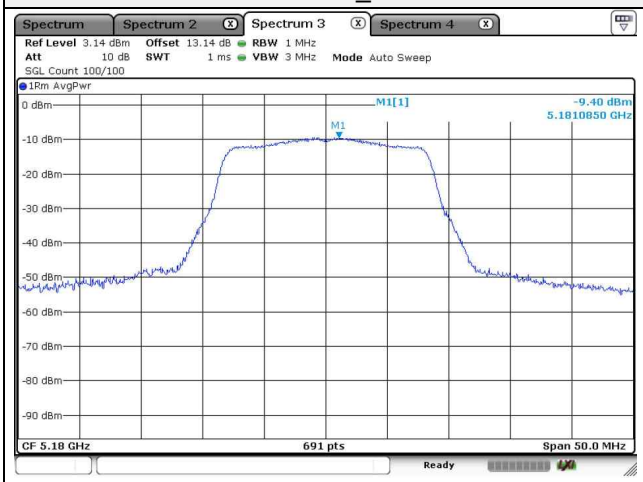
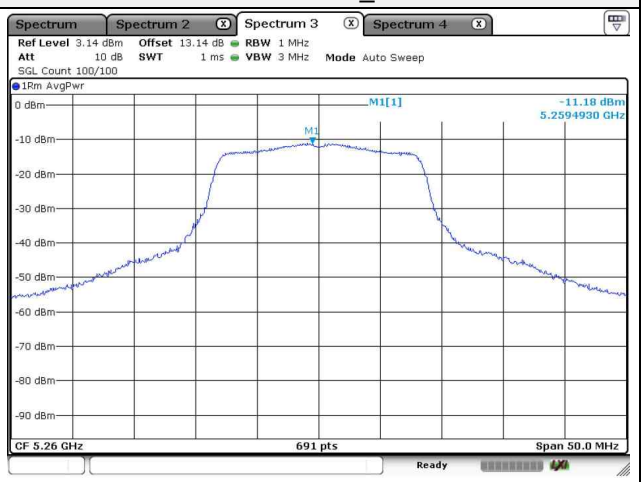
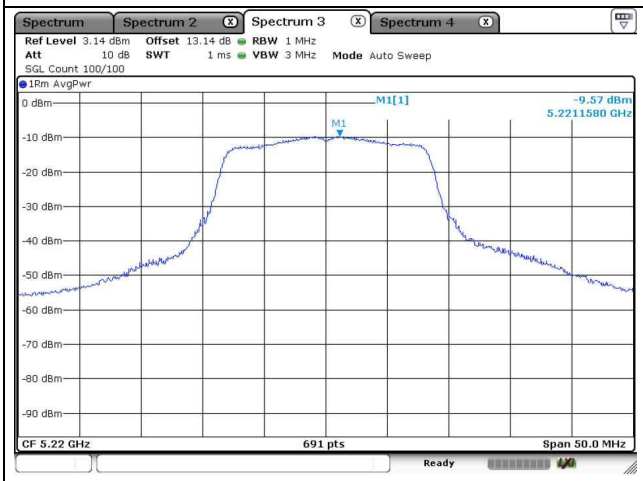
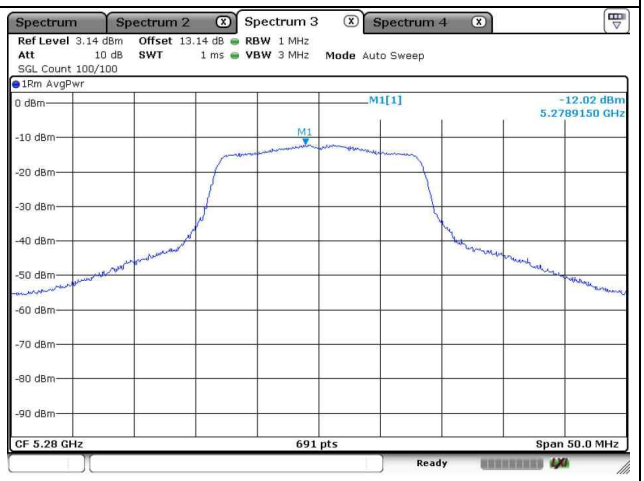
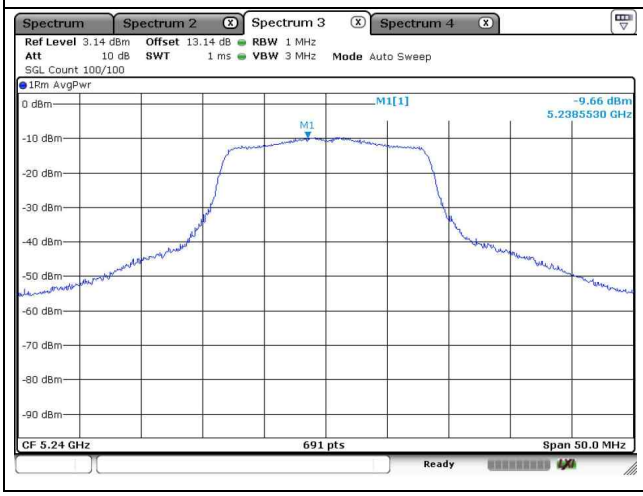
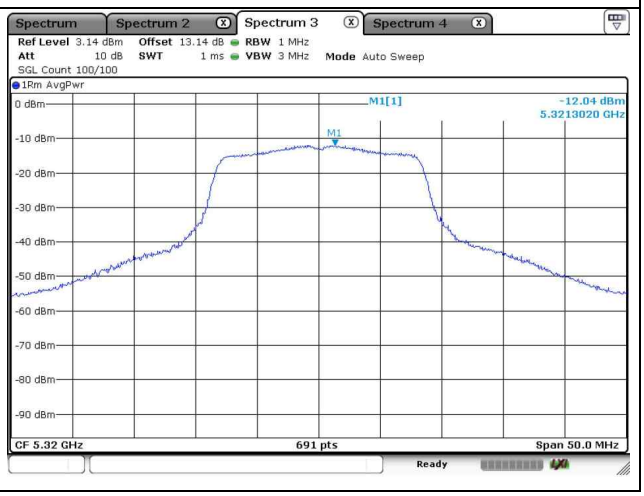
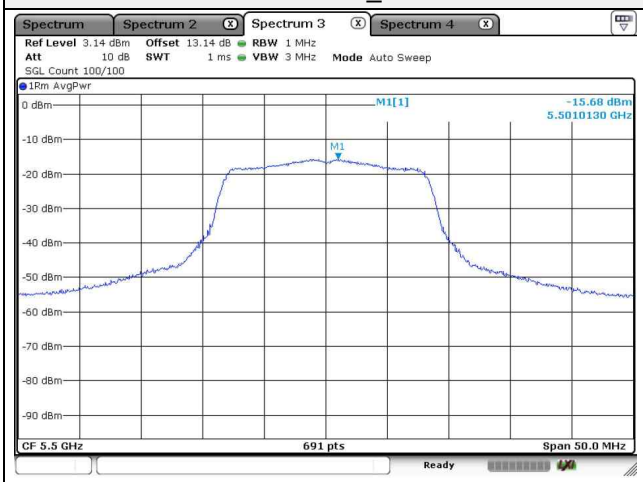
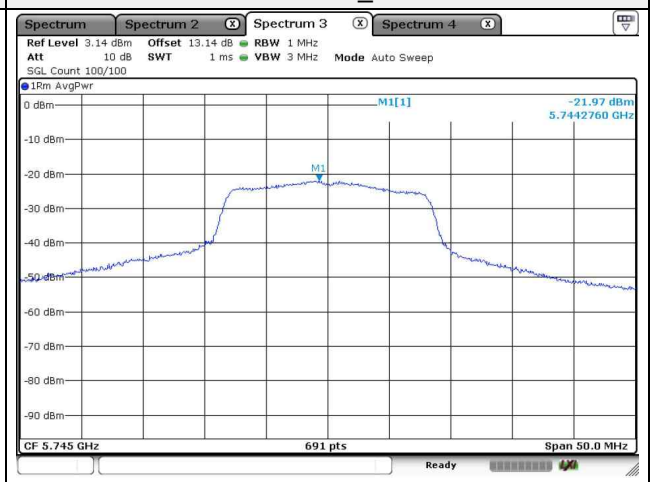
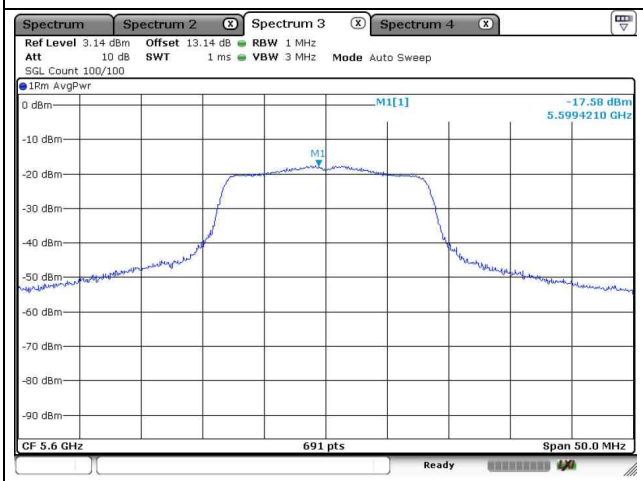
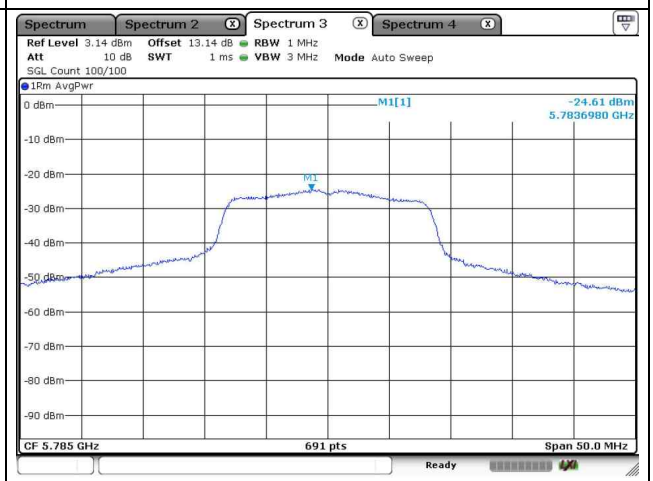
UNII-1_a	UNII-2A_a
	
	
	

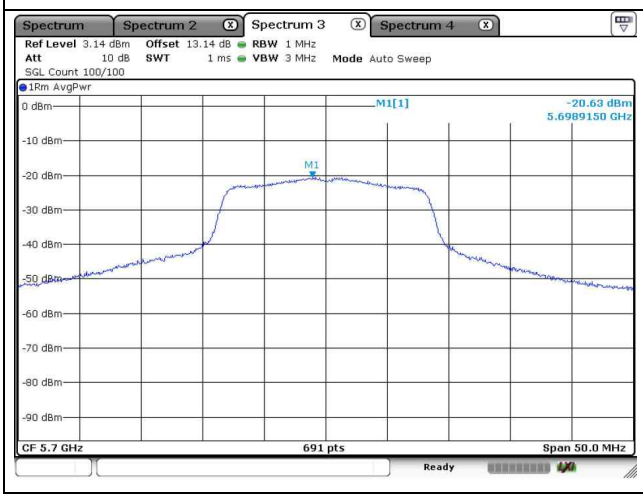
UNII-2C_a	UNII-3_a

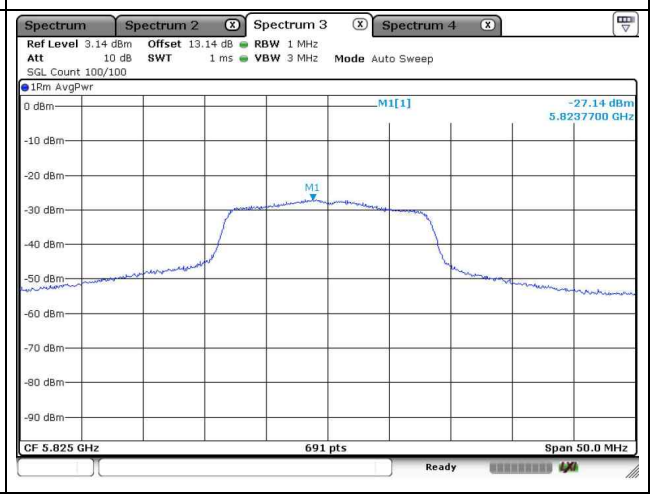












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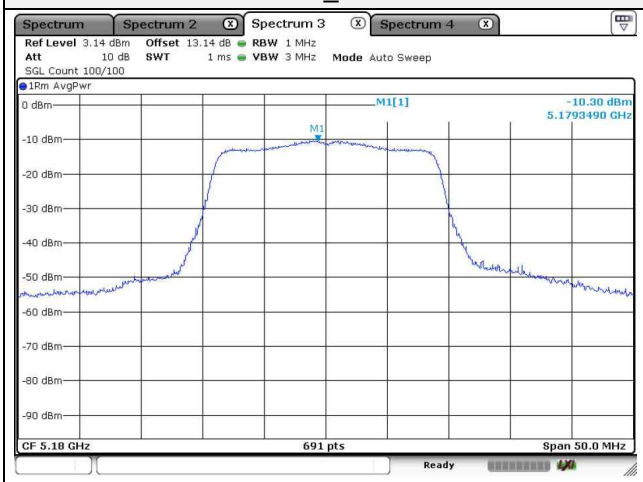
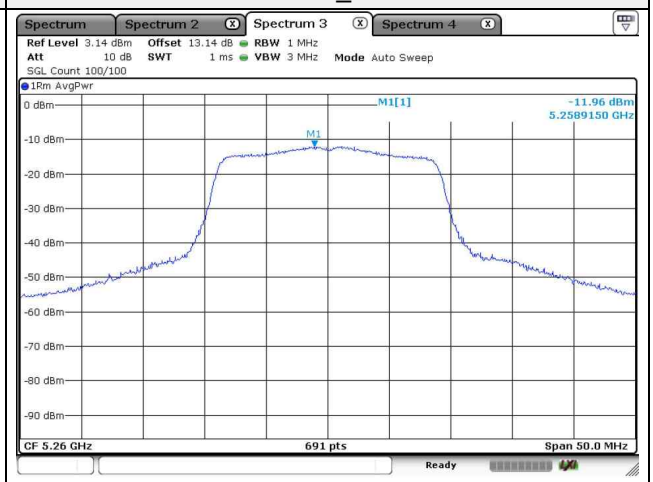
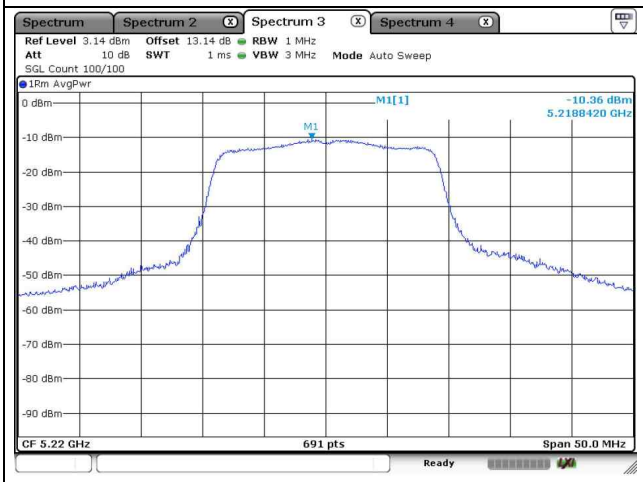
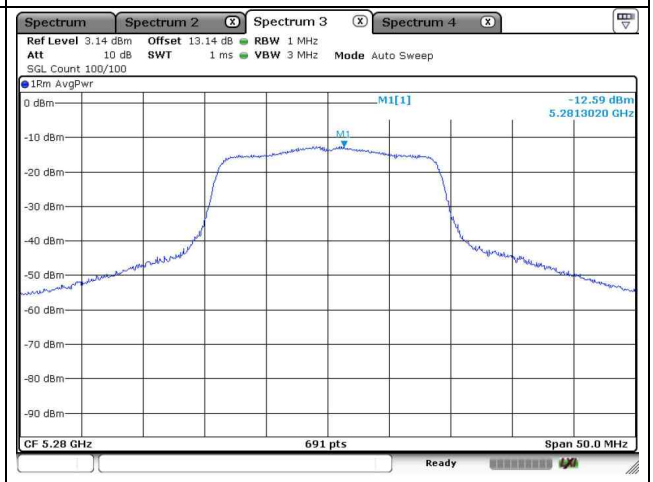
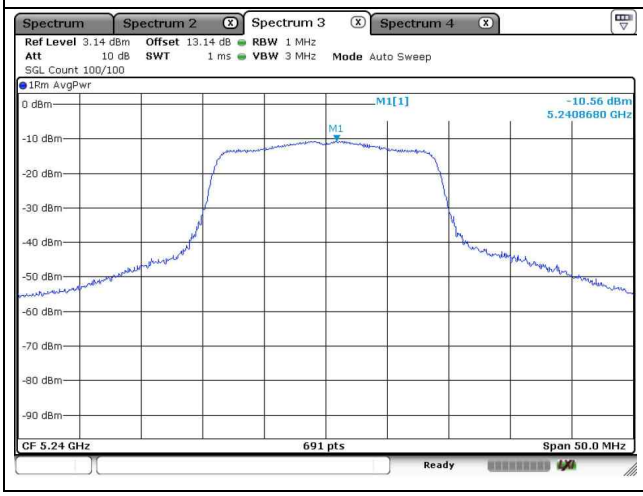
UNII-1_ HT20	UNII-2A_ HT20











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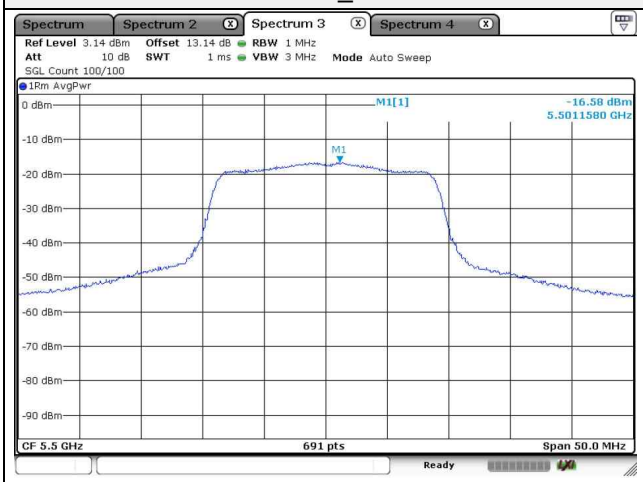
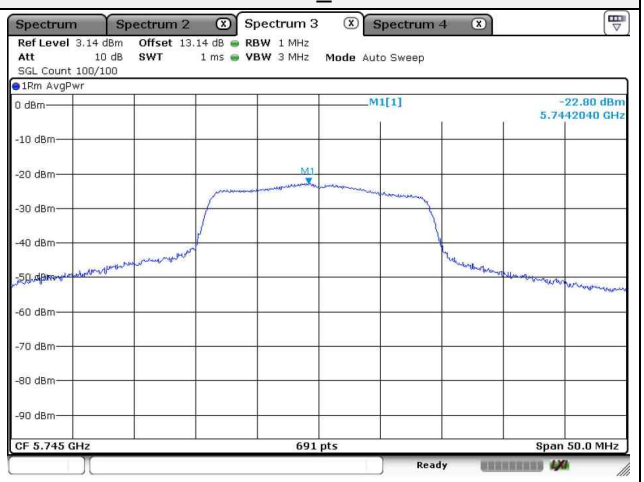
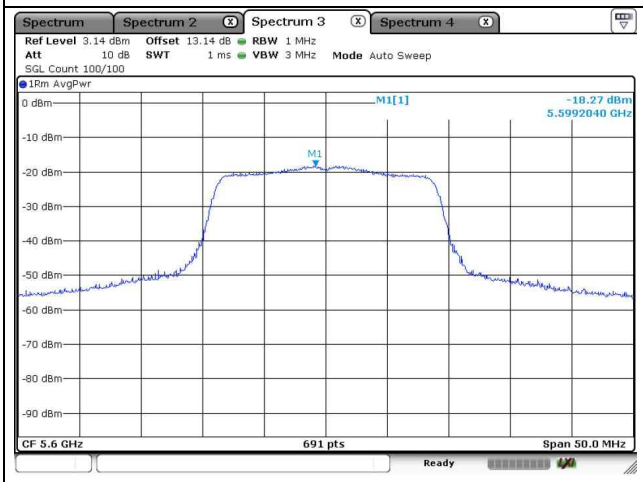
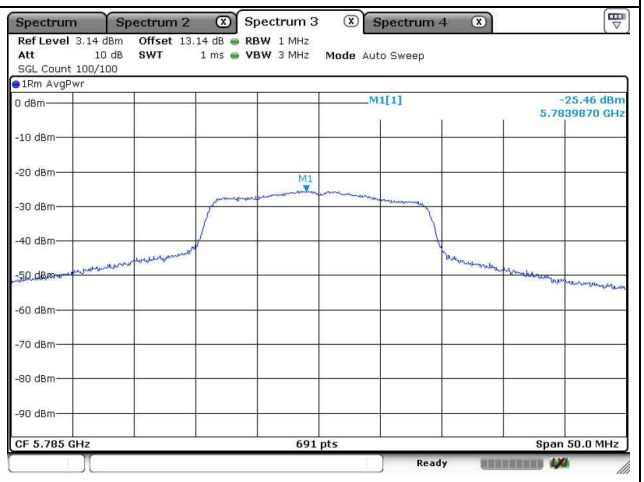
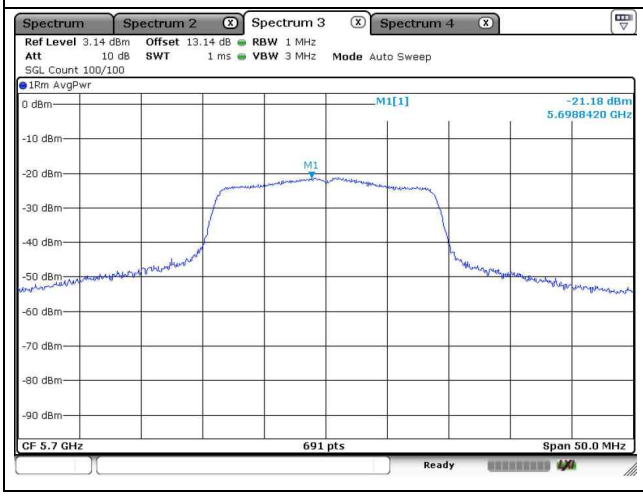
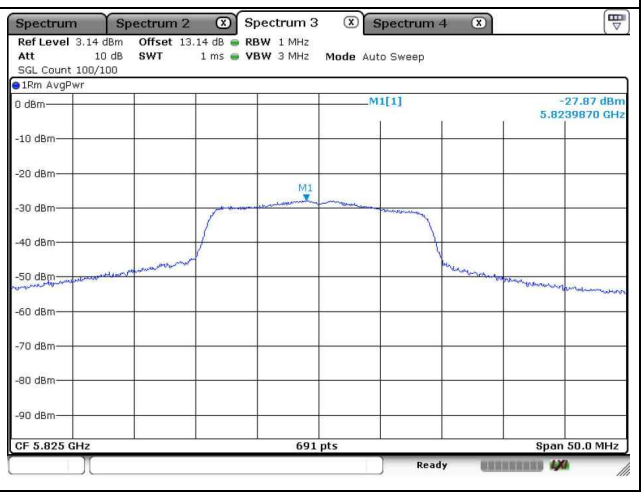
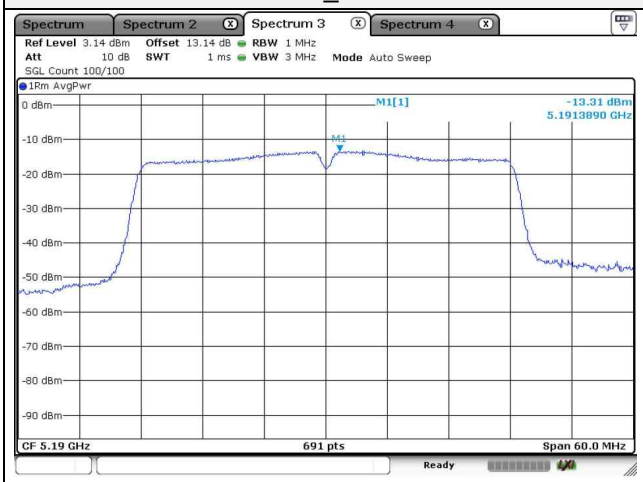
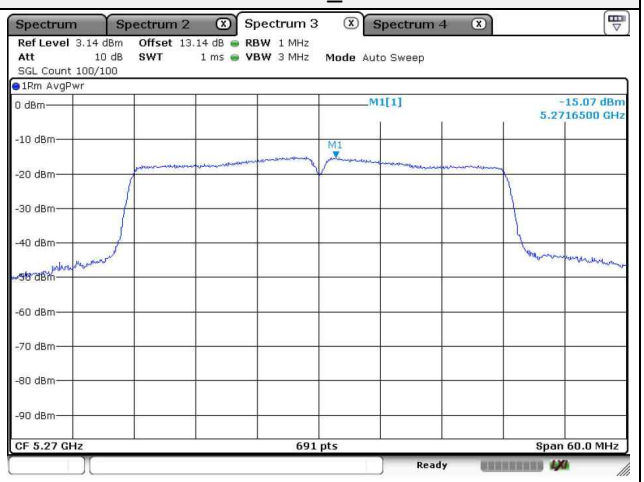
UNII-2C_HT20	UNII-3_ HT20
	
	
	

UNII-1_ HT40	UNII-2A_ HT40
	
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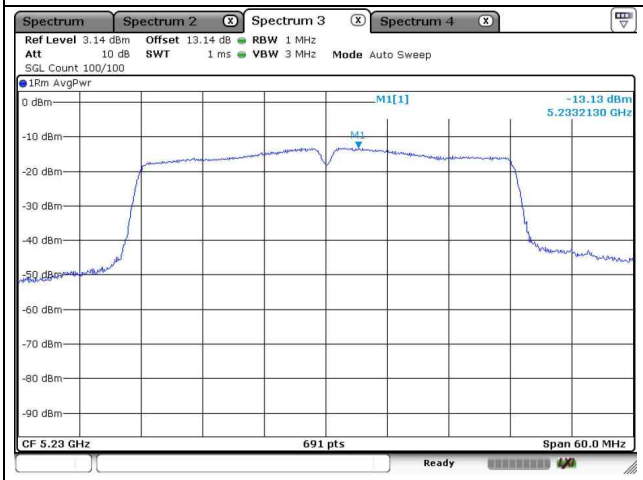	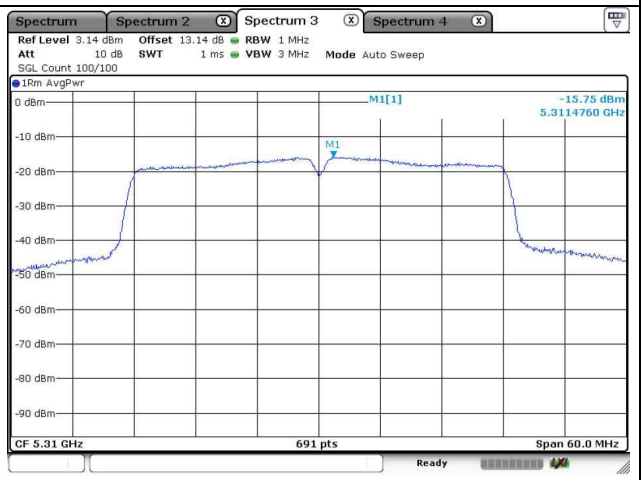

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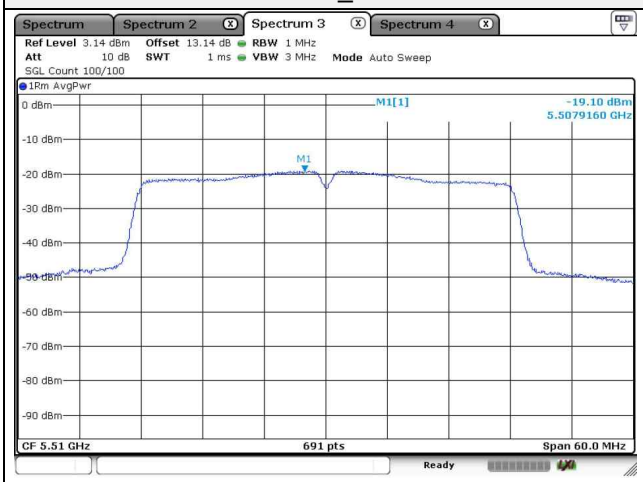
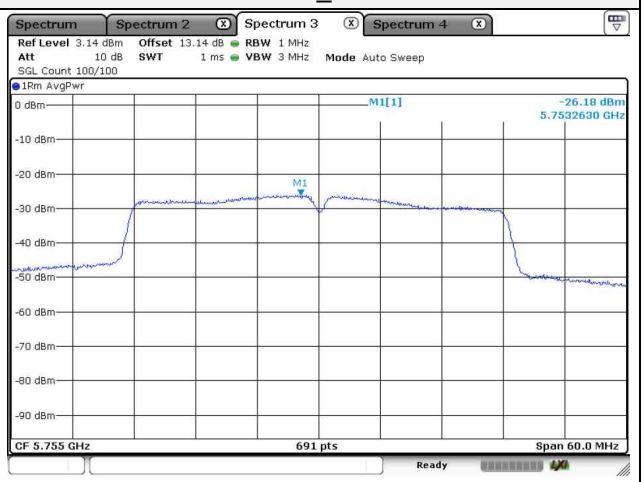
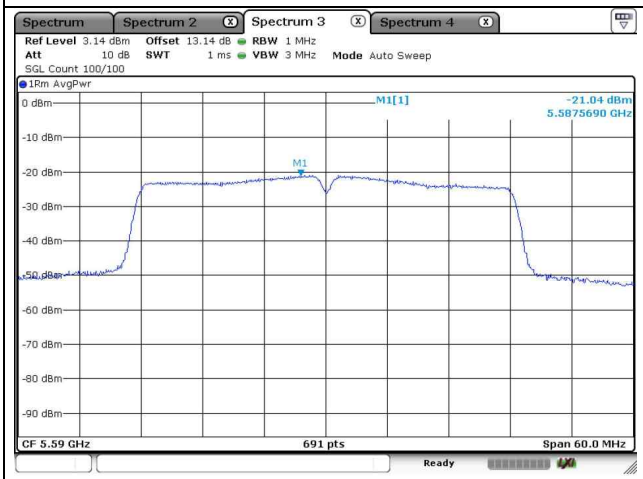
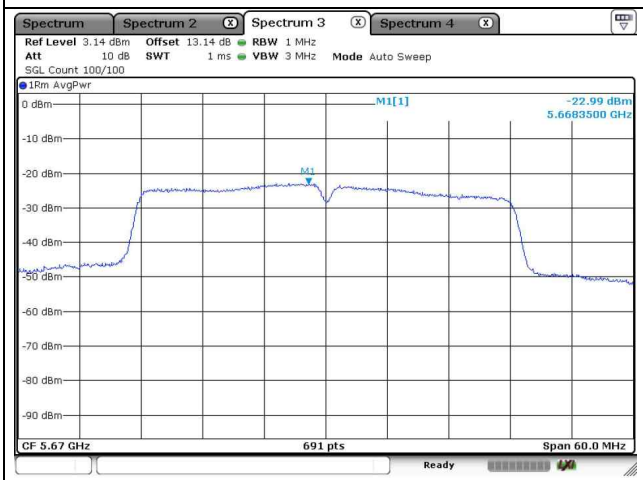
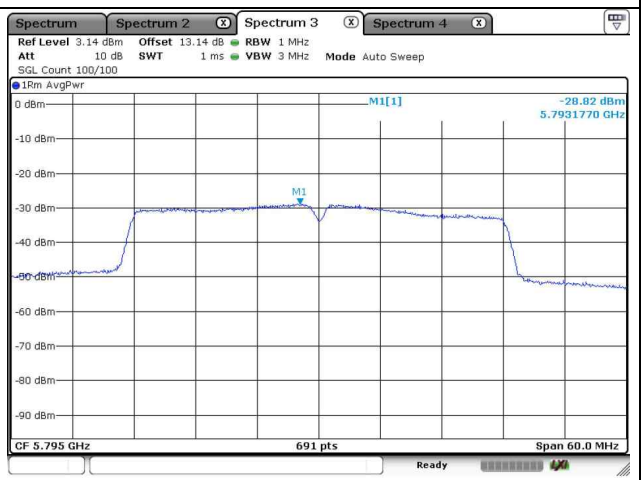
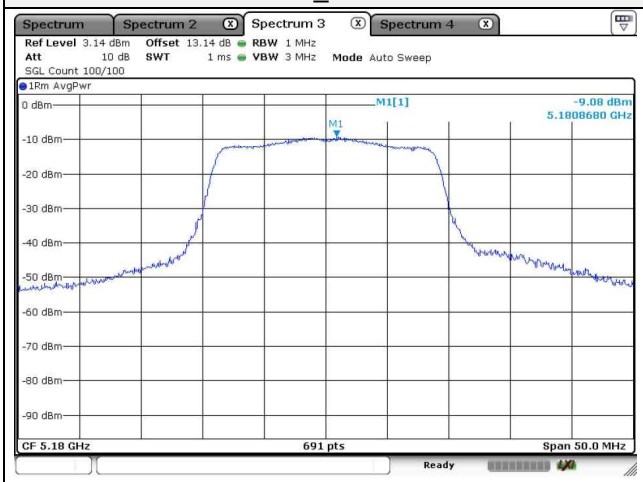
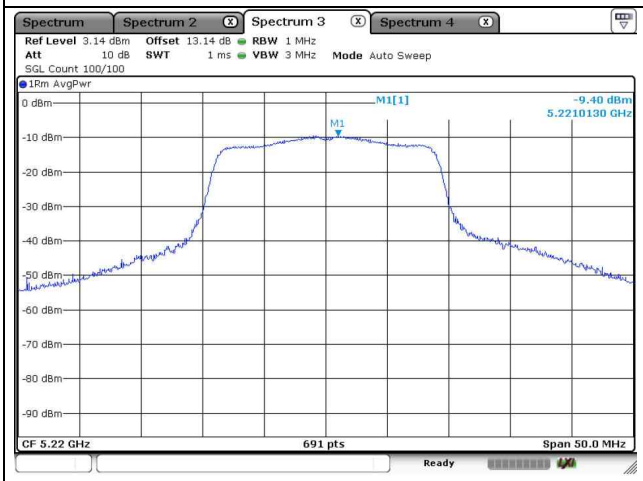
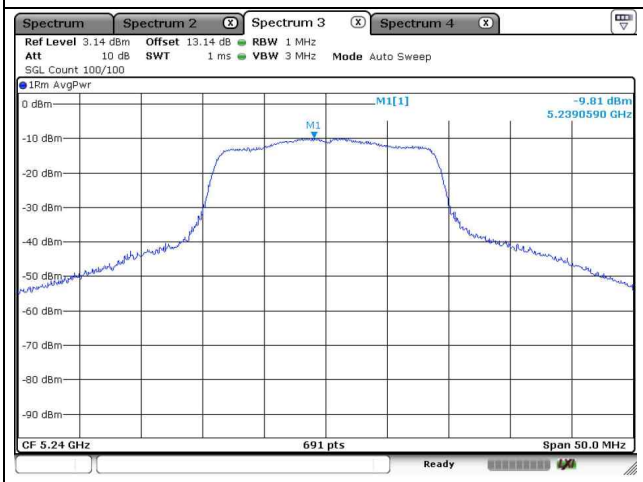
UNII-2C_HT40	UNII-3_ HT40
	
	Blank
	

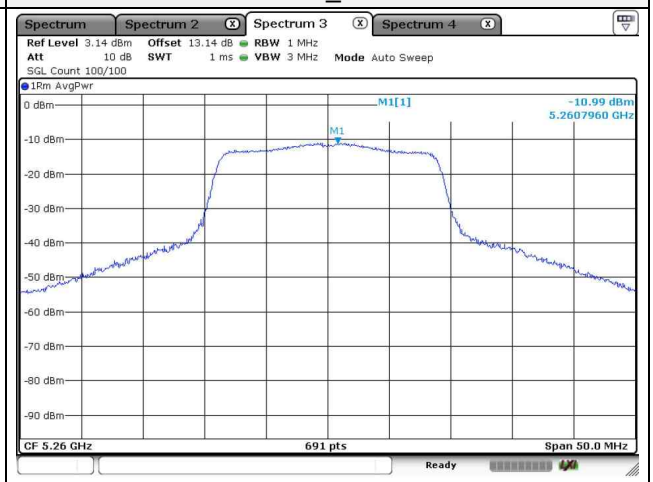
UNII-1_ VHT20

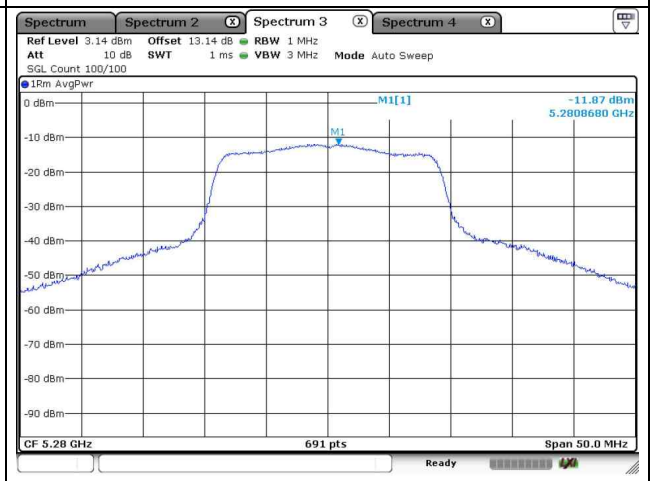


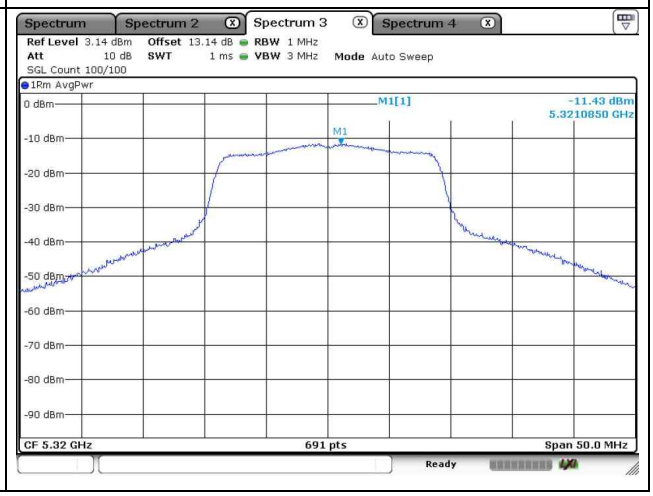




UNII-2A_ VHT20







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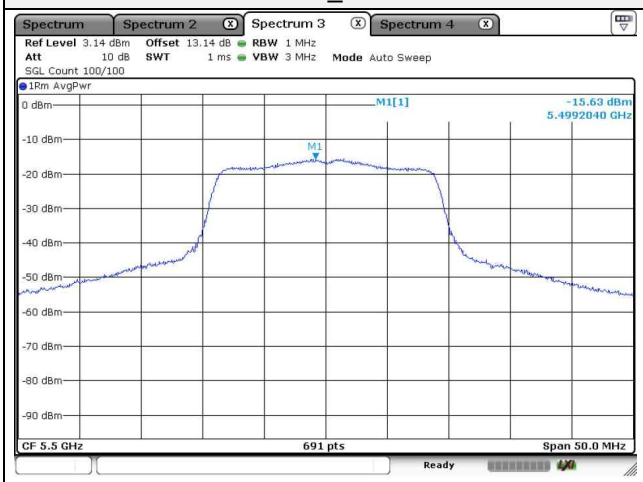
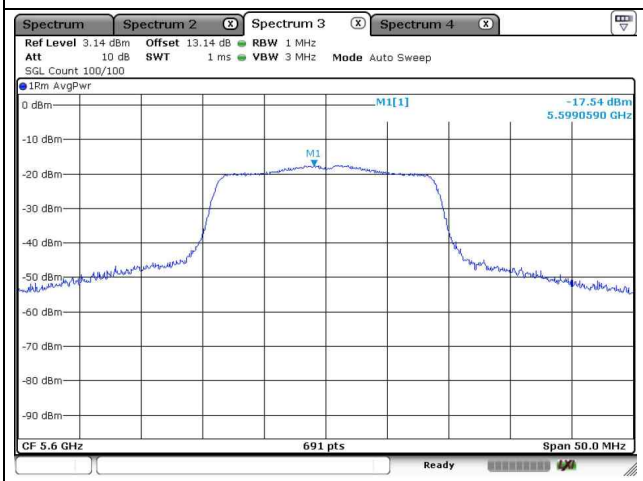
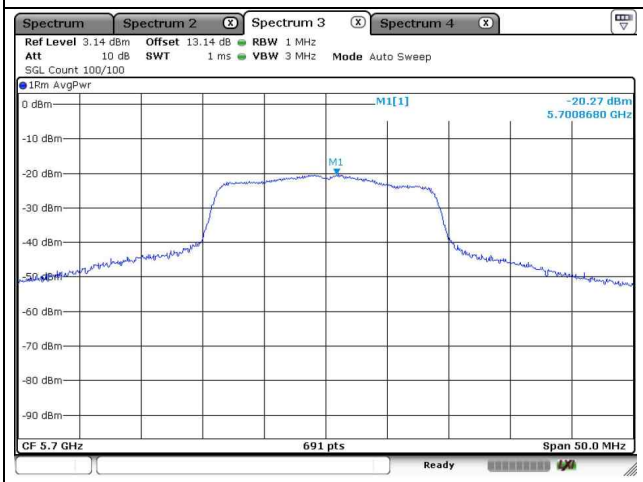
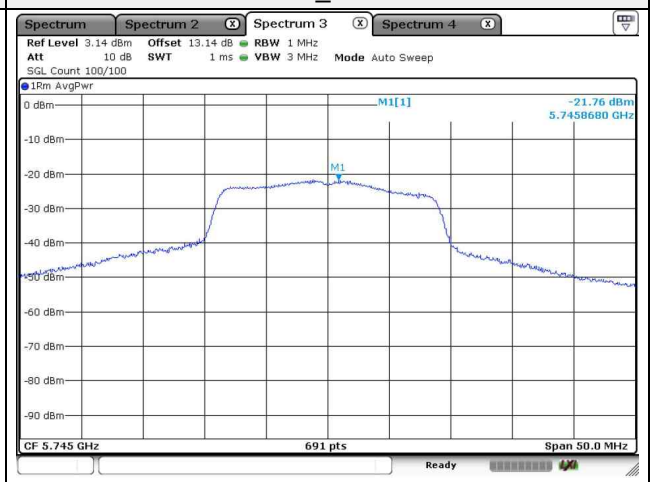
UNII-2C_VHT20

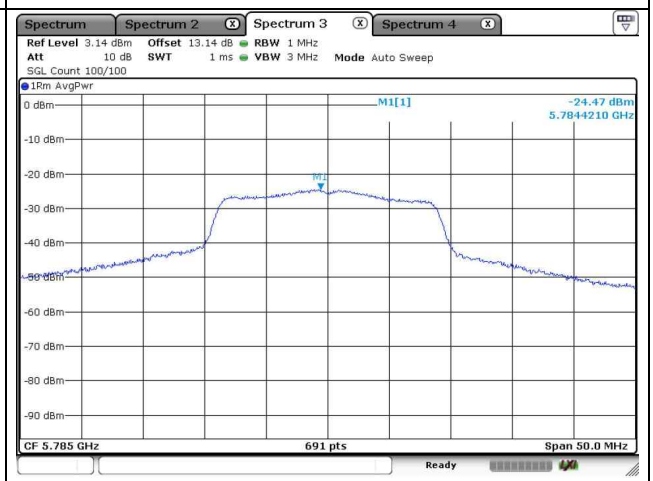


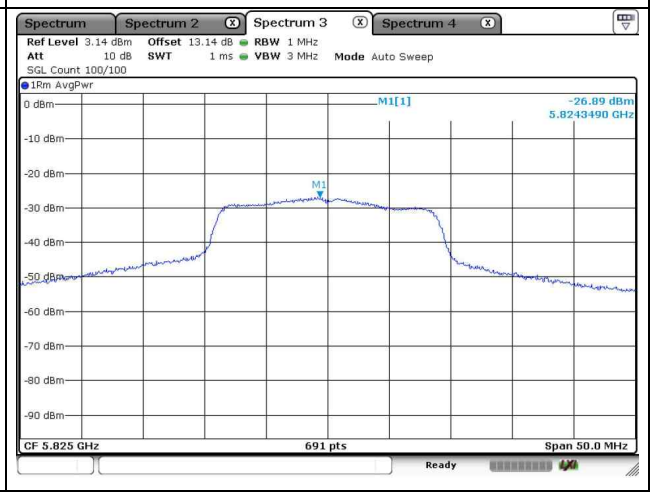




UNII-3_ VHT20







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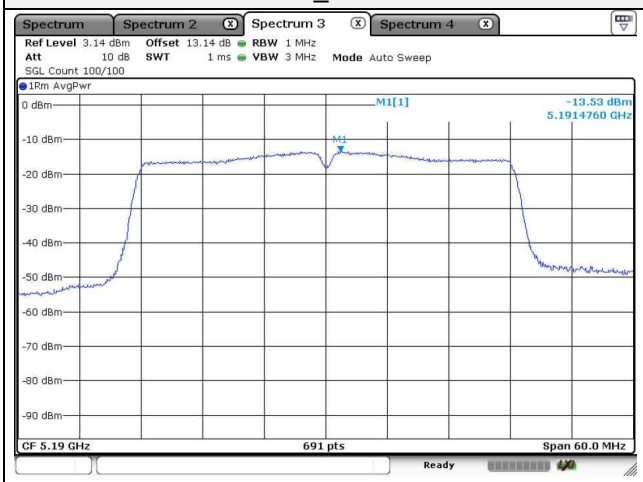
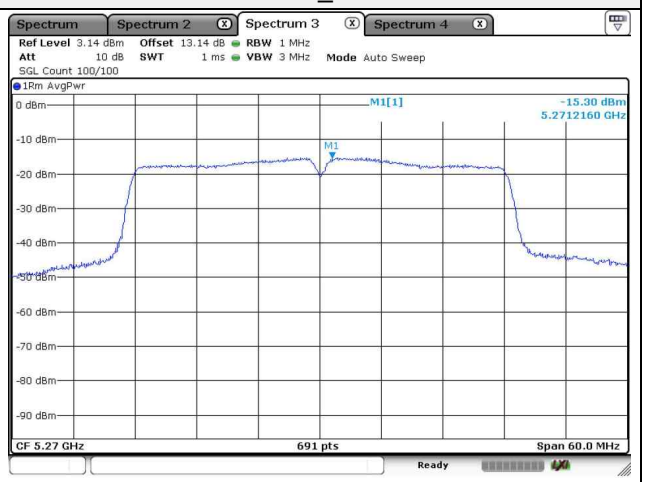
UNII-1_ VHT40	UNII-2A_ VHT40
	
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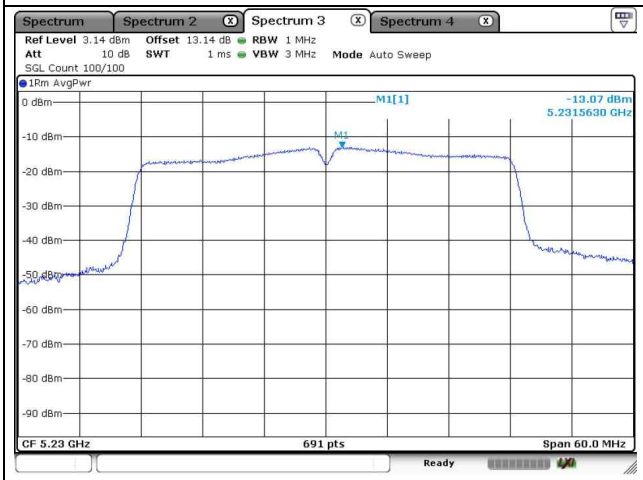	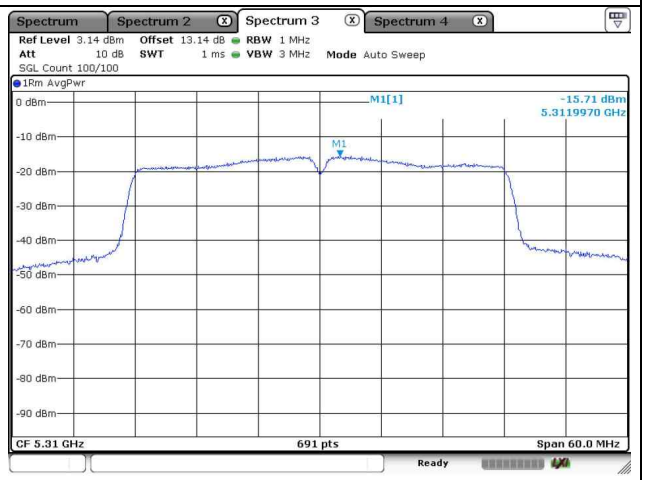

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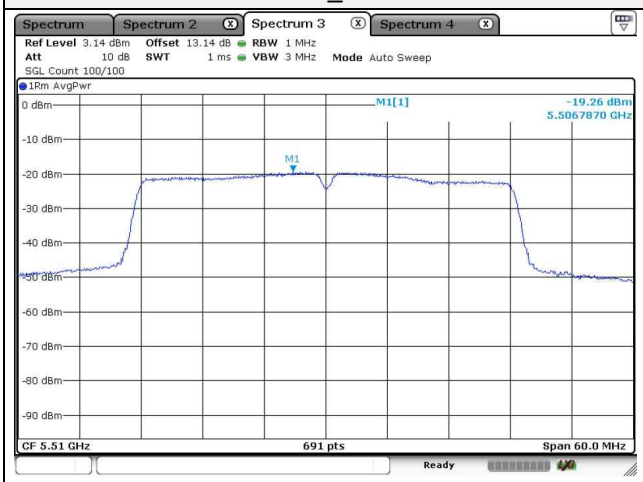
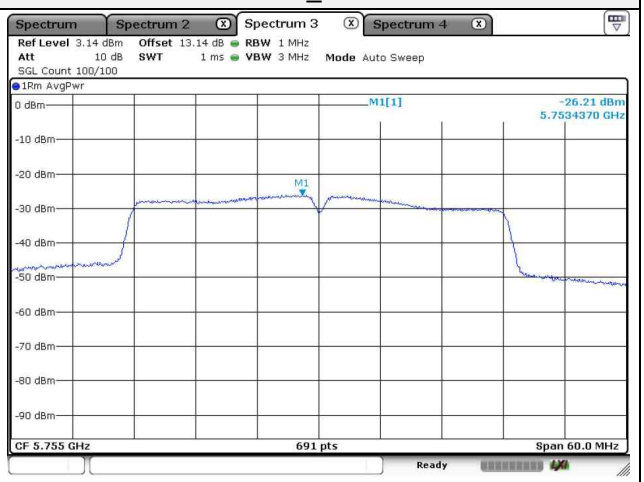
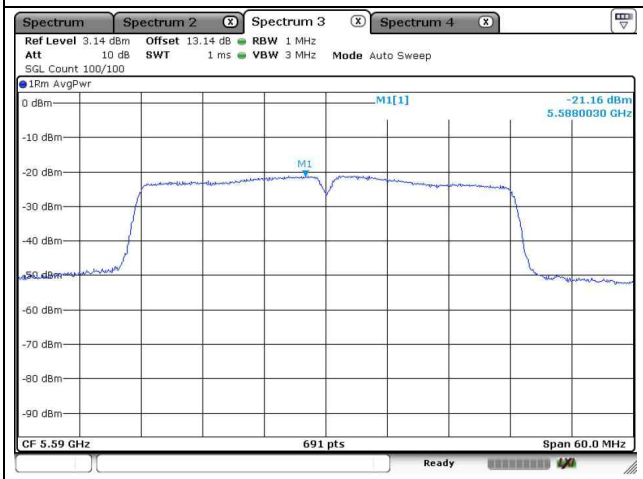
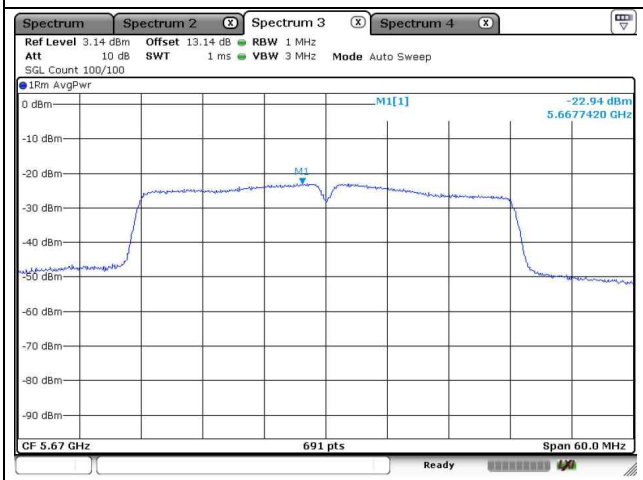
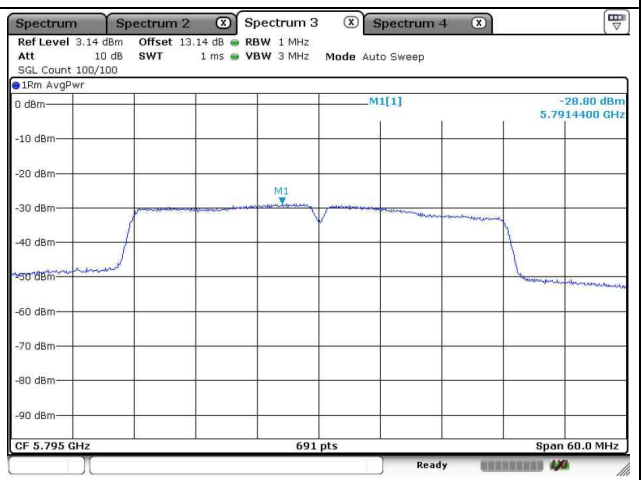
UNII-2C_VHT40	UNII-3_ VHT40
	
	Blank
	

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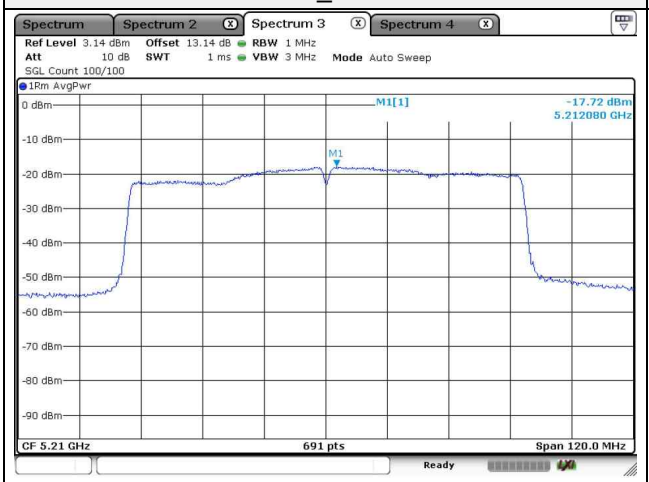
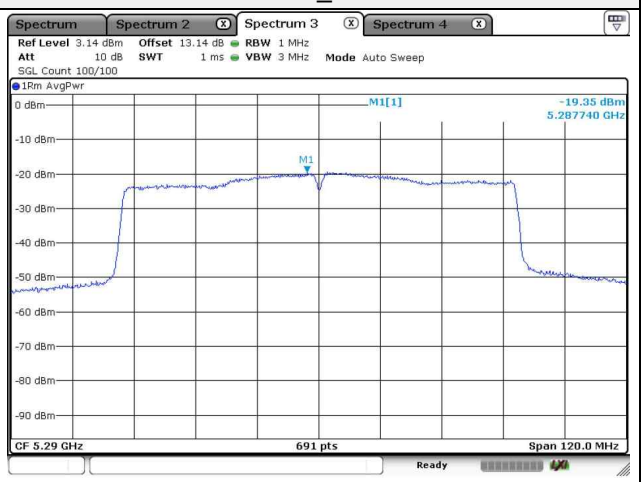
UNII-1_VHT80



UNII-2A_ VHT80



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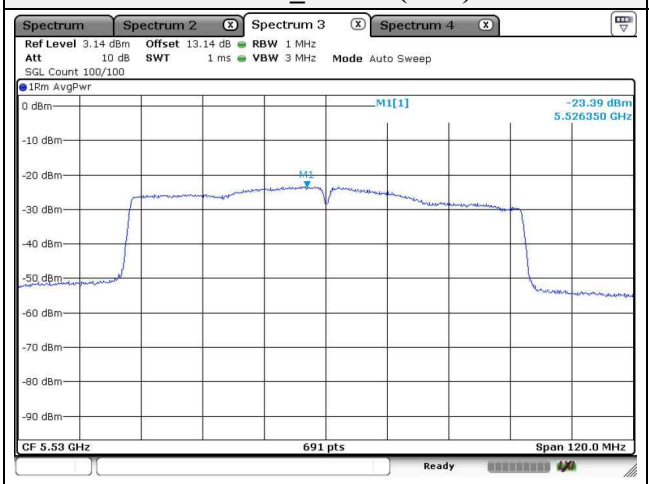

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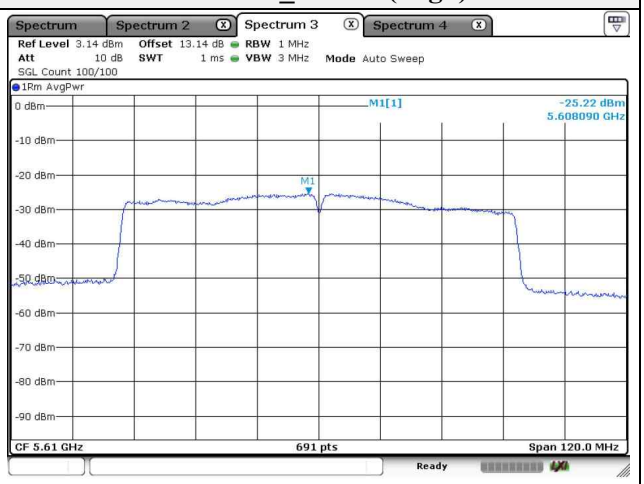
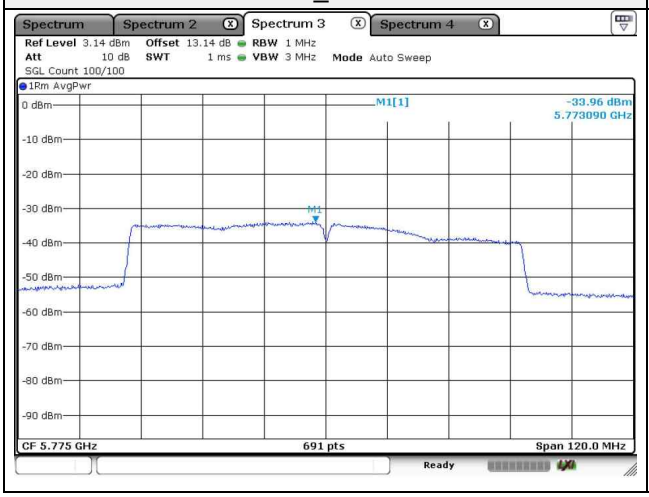


UNII-3_ VHT80



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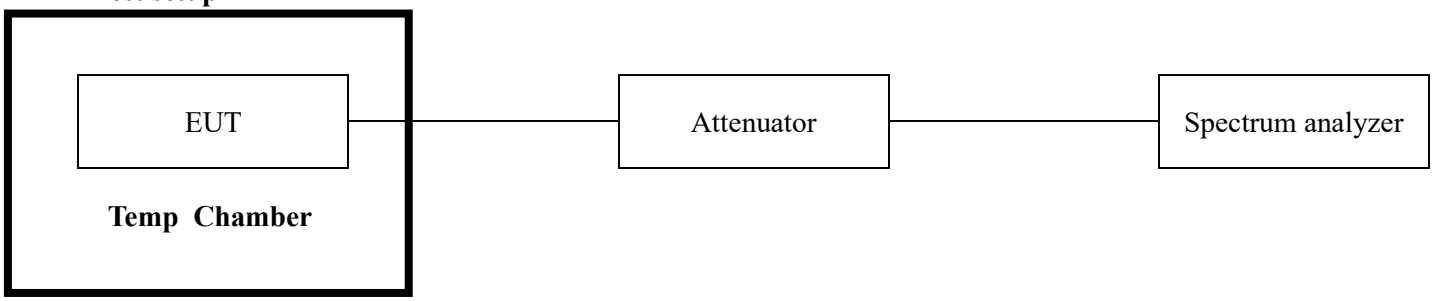
3.5. Frequency Stability

Test procedure

ANSI C63.10-2013, clause 6.8.1

Test setup



1. The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
2. Turn the EUT on and couple its output to a spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency.
5. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.
7. While maintaining a constant temperature inside the environmental chamber, turn the EUT on and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.

Limit

N/A

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Test results

Mode: UNII-1

Operating frequency: 5 180 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	AC 120	-10	Startup	5 180.094 289	94 289	0.018 203
			2 minutes	5 180.093 507	93 507	0.018 052
			5 minutes	5 180.091 729	91 729	0.017 708
			10 minutes	5 180.089 460	89 460	0.017 270
100 %		0	Startup	5 180.046 706	46 706	0.009 017
			2 minutes	5 180.046 633	46 633	0.009 003
			5 minutes	5 180.046 550	46 550	0.008 986
			10 minutes	5 180.045 159	45 159	0.008 718
100 %		10	Startup	5 180.029 413	29 413	0.005 678
			2 minutes	5 180.029 323	29 323	0.005 661
			5 minutes	5 180.029 228	29 228	0.005 642
			10 minutes	5 180.028 653	28 653	0.005 531
100 %		20	Startup	5 180.009 071	9 071	0.001 751
			2 minutes	5 180.008 476	8 476	0.001 636
			5 minutes	5 180.008 189	8 189	0.001 581
			10 minutes	5 180.007 492	7 492	0.001 446
100 %		22	Startup	5 180.006 625	6 625	0.001 279
			2 minutes	5 180.006 557	6 557	0.001 266
			5 minutes	5 180.006 350	6 350	0.001 226
			10 minutes	5 180.006 245	6 245	0.001 206
100 %		30	Startup	5 180.003 873	3 873	0.000 748
			2 minutes	5 180.003 445	3 445	0.000 665
			5 minutes	5 180.003 131	3 131	0.000 604
			10 minutes	5 180.003 003	3 003	0.000 580
100 %		40	Startup	5 179.981 197	-188 03	-0.003 630
			2 minutes	5 179.981 055	-189 45	-0.003 657
			5 minutes	5 179.980 936	-190 64	-0.003 680
			10 minutes	5 179.980 106	-198 94	-0.003 841
100 %		50	Startup	5 179.977 750	-222 50	-0.004 295
			2 minutes	5 179.977 607	-223 93	-0.004 323
			5 minutes	5 179.977 259	-227 41	-0.004 390
			10 minutes	5 179.976 965	-230 35	-0.004 447
85 %	AC 102	22	Startup	5 180.006 214	6 214	0.001 200
			2 minutes	5 180.006 196	6 196	0.001 196
			5 minutes	5 180.006 012	6 012	0.001 161
			10 minutes	5 180.005 873	5 873	0.001 134
115 %	AC 138	22	Startup	5 180.006 825	6 825	0.001 318
			2 minutes	5 180.006 817	6 817	0.001 316
			5 minutes	5 180.006 705	6 705	0.001 294
			10 minutes	5 180.006 463	6 463	0.001 248

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Mode: UNII-2A

Operating frequency: 5 260 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	AC 120	-10	Startup	5 260.093 149	93 149	0.017 982
			2 minutes	5 260.093 085	93 085	0.017 970
			5 minutes	5 260.092 997	92 997	0.017 953
			10 minutes	5 260.091 654	91 654	0.017 694
100 %		0	Startup	5 260.046 292	46 292	0.008 937
			2 minutes	5 260.045 586	45 586	0.008 800
			5 minutes	5 260.045 188	45 188	0.008 724
			10 minutes	5 260.045 073	45 073	0.008 701
100 %		10	Startup	5 260.030 189	30 189	0.005 828
			2 minutes	5 260.029 201	29 201	0.005 637
			5 minutes	5 260.028 824	28 824	0.005 564
			10 minutes	5 260.028 702	28 702	0.005 541
100 %		20	Startup	5 260.008 762	8 762	0.001 692
			2 minutes	5 260.008 748	8 748	0.001 689
			5 minutes	5 260.007 950	7 950	0.001 535
			10 minutes	5 260.007 506	7 506	0.001 507
100 %		22	Startup	5 260.008 636	8 636	0.001 667
			2 minutes	5 260.008 506	8 506	0.001 642
			5 minutes	5 260.008 322	8 322	0.001 607
			10 minutes	5 260.008 183	8 183	0.001 580
100 %		30	Startup	5 260.004 557	4 557	0.000 880
			2 minutes	5 260.004 264	4 264	0.000 823
			5 minutes	5 260.003 826	3 826	0.000 739
			10 minutes	5 260.003 534	3 534	0.000 079
100 %		40	Startup	5 259.981 286	-187 14	-0.003 613
			2 minutes	5 259.980 910	-190 90	-0.003 685
			5 minutes	5 259.980 841	-191 59	-0.003 699
			10 minutes	5 259.980 384	-196 16	-0.003 787
100 %		50	Startup	5 259.977 373	-226 27	-0.004 368
			2 minutes	5 259.977 253	-227 47	-0.004 391
			5 minutes	5 259.976 592	-234 08	-0.004 519
			10 minutes	5 259.975 322	-246 78	-0.004 764
85 %	AC 102	22	Startup	5 260.008 737	8 737	0.001 687
			2 minutes	5 260.008 570	8 570	0.001 654
			5 minutes	5 260.008 274	8 274	0.001 597
			10 minutes	5 260.007 906	7 906	0.001 526
115 %	AC 138	22	Startup	5 260.008 293	8 293	0.001 601
			2 minutes	5 260.008 043	8 043	0.001 553
			5 minutes	5 260.007 877	7 877	0.001 521
			10 minutes	5 260.007 442	7 442	0.001 437

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Mode: UNII-2C

Operating frequency: 5500 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	AC 120	-10	Startup	5 500.094 991	94 991	0.018 338
			2 minutes	5 500.094 021	94 021	0.018 151
			5 minutes	5 500.093 203	93 203	0.017 993
			10 minutes	5 500.091 749	91 749	0.017 712
100 %		0	Startup	5 500.056 768	56 768	0.010 959
			2 minutes	5 500.056 352	56 352	0.010 879
			5 minutes	5 500.056 295	56 295	0.010 868
			10 minutes	5 500.055 020	55 020	0.010 662
100 %		10	Startup	5 500.030 558	30 558	0.005 899
			2 minutes	5 500.030 188	30 188	0.005 828
			5 minutes	5 500.029 717	29 717	0.005 737
			10 minutes	5 500.028 928	28 928	0.005 585
100 %		20	Startup	5 500.009 737	9 737	0.001 880
			2 minutes	5 500.009 593	9 593	0.001 852
			5 minutes	5 500.009 317	9 317	0.001 799
			10 minutes	5 500.009 125	9 125	0.001 762
100 %		22	Startup	5 500.009 068	9 068	0.001 751
			2 minutes	5 500.008 436	8 436	0.001 629
			5 minutes	5 500.007 638	7 638	0.001 475
			10 minutes	5 500.007 391	7 391	0.001 427
100 %		30	Startup	5 500.005 976	5 976	0.001 154
			2 minutes	5 500.005 813	5 813	0.001 122
			5 minutes	5 500.005 611	5 611	0.001 083
			10 minutes	5 500.005 320	5 320	0.001 027
100 %		40	Startup	5 499.980 867	-191 33	-0.003 694
			2 minutes	5 499.980 466	-195 34	-0.003 771
			5 minutes	5 499.980 262	-197 38	-0.003 810
			10 minutes	5 499.979 965	-200 35	-0.003 868
100 %		50	Startup	5 499.975 228	-247 72	-0.004 782
			2 minutes	5 499.975 045	-249 55	-0.004 818
			5 minutes	5 499.974 716	-252 84	-0.004 881
			10 minutes	5 499.973 693	-263 07	-0.005 079
85 %	AC 102	22	Startup	5 500.009 405	9 405	0.001 816
			2 minutes	5 500.009 293	9 293	0.001 794
			5 minutes	5 500.009 053	9 053	0.001 748
			10 minutes	5 500.008 798	8 798	0.001 698
115 %	AC 138	22	Startup	5 500.009 287	9 287	0.001 793
			2 minutes	5 500.009 020	9 020	0.001 741
			5 minutes	5 500.008 952	8 952	0.001 728
			10 minutes	5 500.008 722	8 722	0.001 684

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Mode: UNII-3

Operating frequency: 5 745 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	AC 120	-10	Startup	5 745.102 402	102 402	0.019 769
			2 minutes	5 745.101 727	101 727	0.019 638
			5 minutes	5 745.100 063	100 063	0.019 317
			10 minutes	5 745.092 027	92 027	0.017 766
100 %		0	Startup	5 745.046 845	46 845	0.009 043
			2 minutes	5 745.046 668	46 668	0.009 009
			5 minutes	5 745.045 610	45 610	0.008 805
			10 minutes	5 745.045 325	45 325	0.008 750
100 %		10	Startup	5 745.020 609	20 609	0.003 979
			2 minutes	5 745.020 548	20 548	0.003 967
			5 minutes	5 745.019 115	19 115	0.003 690
			10 minutes	5 745.018 938	18 938	0.003 656
100 %		20	Startup	5 745.011 371	11 371	0.002 195
			2 minutes	5 745.010 909	10 909	0.002 106
			5 minutes	5 745.009 661	9 661	0.001 865
			10 minutes	5 745.007 544	7 544	0.001 456
100 %		22	Startup	5 745.010 063	10 063	0.001 943
			2 minutes	5 745.009 130	9 130	0.001 763
			5 minutes	5 745.008 216	8 216	0.001 586
			10 minutes	5 745.007 368	7 368	0.001 422
100 %		30	Startup	5 745.006 083	6 083	0.001 174
			2 minutes	5 745.005 895	5 895	0.001 138
			5 minutes	5 745.004 841	4 841	0.000 935
			10 minutes	5 745.004 578	4 578	0.000 884
100 %		40	Startup	5 744.981 779	-182 21	-0.003 518
			2 minutes	5 744.981 634	-183 66	-0.003 546
			5 minutes	5 744.981 026	-189 74	-0.003 663
			10 minutes	5 744.980 849	-191 51	-0.003 697
100 %		50	Startup	5 744.975 074	-249 26	-0.004 812
			2 minutes	5 744.974 972	-250 28	-0.004 832
			5 minutes	5 744.974 852	-251 48	-0.004 855
			10 minutes	5 744.974 721	-252 79	-0.004 880
85 %	AC 102	22	Startup	5 745.009 795	9 795	0.001 891
			2 minutes	5 745.009 641	9 641	0.001 861
			5 minutes	5 745.009 412	9 412	0.001 817
			10 minutes	5 745.009 127	9 127	0.001 762
115 %	AC 138	22	Startup	5 745.010 214	10 214	0.001 972
			2 minutes	5 745.010 154	10 154	0.001 960
			5 minutes	5 745.009 442	9 442	0.001 823
			10 minutes	5 745.009 092	9 092	0.001 755

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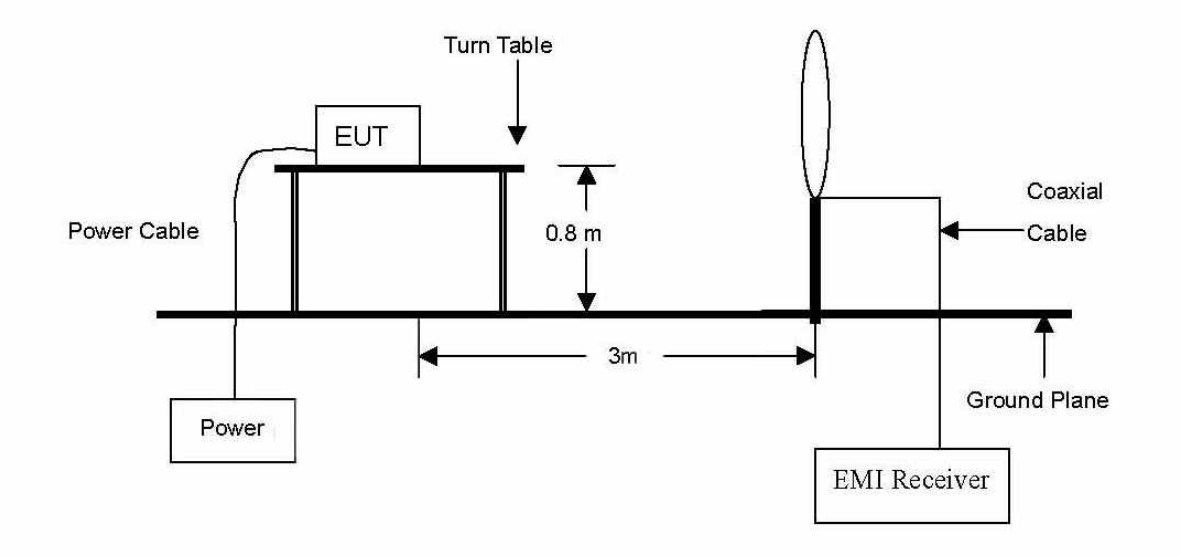
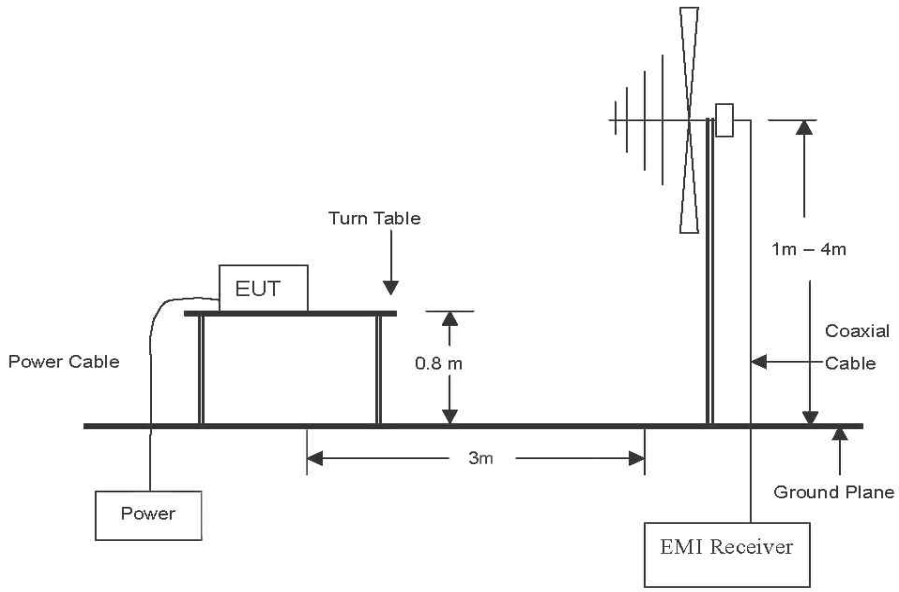
3.6. Radiated restricted band and emissions

Test setup

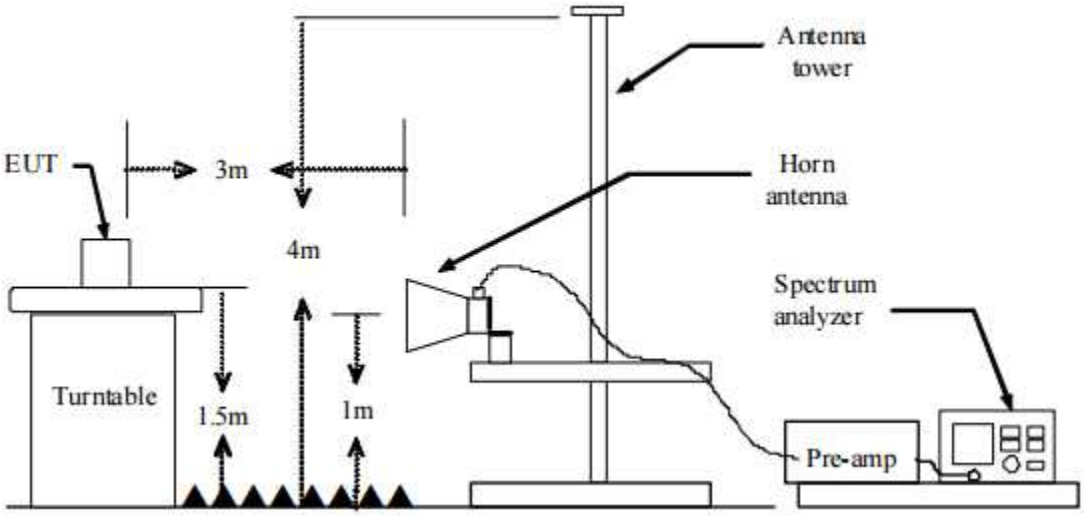
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to the tenth harmonic of the highest fundamental frequency or to 40 ㎓ emissions, whichever is lower.



Test procedure below 30 ㎒

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
3. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum hold mode.

Test procedure above 30 ㎒

1. Spectrum analyzer settings for f < 1 ㎓:
   ① Span = wide enough to fully capture the emission being measured
   ② RBW = 120 ㎑
   ③ VBW ≥ RBW
   ④ Detector = quasi peak
   ⑤ Sweep time = auto
   ⑥ Trace = max hold
2. Spectrum analyzer settings for f ≥1 ㎓: Peak
   ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
   ② RBW = 1 ㎒
   ③ VBW = 3 ㎒ (≥ 3 x RBW)
   ④ Detector = peak
   ⑤ Sweep time = auto
   ⑥ Trace = max hold
   ⑦ Trace was allowed to stabilize

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3. Spectrum analyzer settings for $f \geq 1$ GHz: Average
   ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
   ② RBW = 1 MHz
   ③ VBW ≥ 3 × RBW
   ④ Detector = RMS, if span/(# of points in sweep) ≤ (RBW/2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.
   ⑤ Averaging type = power(i.e., RMS)
      1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
      2) Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.
   ⑥ Sweep = auto
   ⑦ Trace = max hold
   ⑧ Perform a trace average of at least 100 traces.
   ⑨ A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:

      1) If power averaging (RMS) mode was used in step ⑤, then the applicable correction factor is 10 log(1/x), where x is the duty cycle.
      2) If linear voltage averaging mode was used in step ⑤, then the applicable correction factor is 20 log(1/x), where x is the duty cycle.
      3) If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

Note.

1. f<30 MHz, extrapolation factor of 40 dB/decade of distance. $F_d = 40\log(D_m/Ds)$
   $f \geq 30$ MHz, extrapolation factor of 20 dB/decade of distance. $F_d = 20\log(D_m/Ds)$
   Where:
   F_d = Distance factor in dB
   D_m = Measurement distance in meters
   D_s = Specification distance in meters
2. CF(Correction factors(dB)) = Antenna factor(dB/m) + Cable loss(dB) + or Amp. gain(dB) + or F_d(dB)
4. Field strength(dBμV/m) = Level(dBμV) + CF (dB) + or DCF(dB)
5. Margin(dB) = Limit(dBμV/m) - Field strength(dBμV/m)
6. Emissions below 18 GHz were measured at a 3 meter test distance while emissions above 18 GHz were measured at a 1 meter test distance with the application of a distance correction factor.
7. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z, it was determined that **X orientation** was worst-case orientation; therefore, all final radiated testing was performed with the EUT in **X orientation.**
8. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
9. All channels, modes (e.g. 802.11a, 802.11n (20 MHz/40 MHz BW), 802.11ac (20 MHz/40 MHz /80 MHz)), and modulations/data rates were investigated among all UNII bands. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

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10. According to exploratory test no any obvious emission were detected from 9 ㎑ to 30 ㎒. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

Limit

According to 15.209(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values：

Frequency (㎒)	Distance (Meters)	Radiated (㎶/m)
0.009 ~ 0.490	300	2400/F(㎑)
0.490 ~ 1.705	30	24000/F(㎑)
1.705 ~ 30.0	30	30
30 ~ 88	3	100**
88 ~ 216	3	150**
216 ~ 960	3	200**
Above 960	3	500

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

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According to 15.407(b), (b) Undesirable emission limits: Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15–5.25 ㎓ band: all emissions outside of the 5.15–5.35 ㎓ band shall not exceed an e.i.r.p of –27 ㏈m/㎒.
(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(4) For transmitters operating in the 5.725-5.85 GHz band:
i) 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.
ii) Devices certified before March 2, 2017 with antenna gain greater than 10 dBi may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.
(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 ㎒.
A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 ㎒.
(6) Unwanted emissions below 1 ㎓ must comply with the general field strength limits set forth in § 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in § 15.207.
(7) The provisions of §15.205 apply to intentional radiators operating under this section.
(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

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Duty cycle

Regarding to KDB 789033 D02 v02r01, B)2)b), the maximum duty cycles of all modes were investigated and set the spectrum analyzer as below.

Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T, where T is defined in II.B.1.a), and the number of sweep points across duration T exceeds 100.

For the band 5.15-5.25 ㎓

Test mode	T_{on} time (㎳)	Period (㎳)	Duty cycle (Linear)	Duty cycle (%)	Duty cycle correction factor (dB)
802.11a	2.058 0	2.087 0	0.986 1	98.61	-
802.11n_HT20	1.333 3	1.391 3	0.958 3	95.83	0.18
802.11n_HT40	0.913 0	1.043 5	0.874 9	87.49	0.58
802.11ac_VHT20	1.884 1	2.029 0	0.928 6	92.86	0.32
802.11ac_VHT40	0.898 6	1.087 0	0.826 7	82.67	0.83
802.11ac_VHT80	0.434 8	0.565 2	0.769 3	76.93	1.14

For the band 5.250-5.350 ㎓

Test mode	T_{on} time (㎳)	Period (㎳)	Duty cycle (Linear)	Duty cycle (%)	Duty cycle correction factor (dB)
802.11a	2.058 0	2.087 0	0.986 1	98.61	-
802.11n_HT20	1.318 8	1.391 3	0.947 9	94.79	0.23
802.11n_HT40	0.913 0	1.043 5	0.874 9	87.49	0.58
802.11ac_VHT20	1.898 6	2.029 0	0.935 7	93.57	0.29
802.11ac_VHT40	0.927 5	1.058 0	0.876 7	87.67	0.57
802.11ac_VHT80	0.434 8	0.565 2	0.769 3	76.93	1.14

For the band 5.470-5.725 ㎓

Test mode	T_{on} time (㎳)	Period (㎳)	Duty cycle (Linear)	Duty cycle (%)	Duty cycle correction factor (dB)
802.11a	2.043 5	2.087 0	0.979 1	97.91	0.09
802.11n_HT20	1.333 3	1.391 3	0.958 3	95.83	0.18
802.11n_HT40	0.898 6	1.058 0	0.849 3	84.93	0.71
802.11ac_VHT20	1.898 6	2.043 5	0.929 1	92.91	0.32
802.11ac_VHT40	0.884 1	1.043 5	0.847 2	84.72	0.72
802.11ac_VHT80	0.405 8	0.565 2	0.718 0	71.80	1.44

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For the band 5.725-5.85 ㎓

Test mode	T_{on} time (㎳)	Period (㎳)	Duty cycle (Linear)	Duty cycle (%)	Duty cycle correction factor (㏈)
802.11a	2.058 0	2.101 4	0.979 3	97.93	0.09
802.11n_HT20	1.318 8	1.391 3	0.947 9	94.79	0.23
802.11n_HT40	0.898 6	1.043 5	0.861 1	86.11	0.65
802.11ac_VHT20	1.898 6	2.029 0	0.935 7	93.57	0.29
802.11ac_VHT40	0.913 0	1.043 5	0.874 9	87.49	0.58
802.11ac_VHT80	0.420 3	0.565 2	0.743 6	74.36	1.29

Note:
Duty cycle (Linear) = T_{on} time/Period
DCF(Duty cycle correction factor (㏈)) = 10log(1/duty cycle)

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