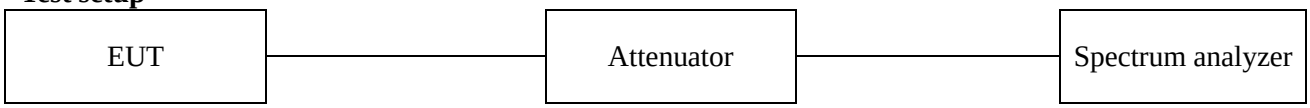
3.4. Power spectral density

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 ㎒ reference bandwidth.
5. For devices operating in the bands 5.15-5.25 ㎓, 5.25-5.35 ㎓, and 5.47-5.725 ㎓, the above procedures make use of 1 ㎒ RBW to satisfy directly the 1 ㎒ reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 ㎓, the rules specify a measurement bandwidth of 500 ㎑. Many spectrum analyzers do not have 500 ㎑ RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 ㎒, or 500 ㎑, "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 ㎒, or 500 ㎑). If measurements are performed using a reduced resolution bandwidth (< 1 ㎒, or < 500 ㎑) and integrated over 1 ㎒, or 500 ㎑ 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 ㎑, add 10 log (500 ㎑/RBW) to the measured result, whereas RBW (< 500 ㎑) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
   d) If measurement bandwidth of Maximum PSD is specified in 1 ㎒, add 10 log (1 ㎒/RBW) to the measured result, whereas RBW (< 1 ㎒) 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 ㎑ for the sections 5.c) and 5.d) above, since RBW=100 ㎑ is available on nearly all spectrum analyzers.

Limit
FCC

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.

Test results

Mode	Frequency (㎒)	Band	PSD (dBm/㎒)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm/㎒)
							FCC
802.11 a	5 180	UNII-1	3.28	-	1.72	5.00	11.00
	5 220		3.55			5.27	
	5 240		3.35			5.07	
	5 260	UNII-2A	3.60		1.72	5.32	
	5 300		3.59			5.31	
	5 320		3.08			4.80	
	5 500	UNII-2C	-0.60		1.72	1.12	
	5 620		-0.57			1.15	
	5 720		0.45			2.17	
	5 745	UNII-3	-4.49		1.72	-2.77	
	5 785		-5.20			-3.48	
	5 825		-5.74			-4.02	

Mode	Frequency (㎒)	Band	PSD (dBm/㎒)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm/㎒)
							FCC
802.11 an_HT20	5 180	UNII-1	3.52	-	1.82	5.34	11.00
	5 220		3.55			5.37	
	5 240		3.99			5.81	
	5 260	UNII-2A	3.35		1.82	5.17	
	5 300		3.31			5.13	
	5 320		3.05			4.87	
	5 500	UNII-2C	0.23		1.82	2.05	
	5 620		-0.69			1.13	
	5 720		0.01			1.83	
	5 745	UNII-3	-4.86		1.82	-3.04	
	5 785		-5.22			-3.40	
	5 825		-5.78			-3.96	

Mode	Frequency (㎒)	Band	PSD (dBm/㎒)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm/㎒)
							FCC
802.11 ac_HT20	5 180	UNII-1	3.73	-	1.82	5.55	11.00
	5 220		3.37			5.19	
	5 240		3.51			5.33	
	5 260	UNII-2A	3.57		1.82	5.39	
	5 300		3.19			5.01	
	5 320		3.37			5.19	
	5 500	UNII-2C	0.51		1.81	2.32	
	5 620		-0.59			1.22	
	5 720		0.11			1.92	
	5 745	UNII-3	-4.97		1.83	-3.14	
	5 785		-5.89			-4.06	
	5 825		-6.06			-4.23	

Mode	Frequency (㎒)	Band	PSD (dBm/㎒)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm/㎒)
							FCC
802.11 an_HT40	5 190	UNII-1	-0.54	-	3.16	2.62	11.00
	5 210		-0.57			2.59	
	5 270	UNII-2A	-1.04		3.13	2.09	
	5 310		-0.61			2.52	
	5 510	UNII-2C	-3.36		3.16	-0.20	
	5 630		-4.54			-1.38	
	5 710		-4.26			-1.10	
	5 755	UNII-3	-8.93		3.16	-5.77	
	5 795		-9.41			-6.25	

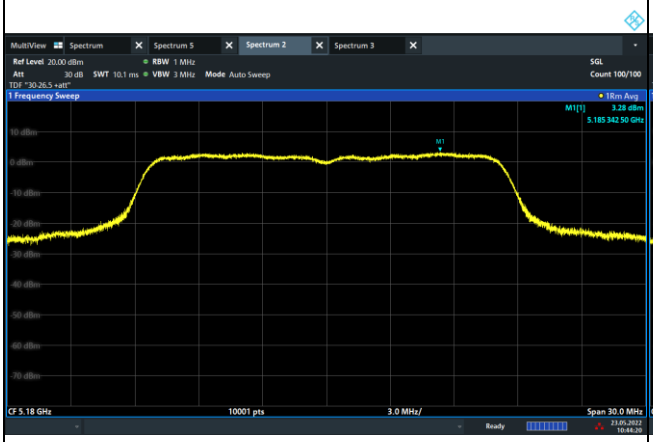
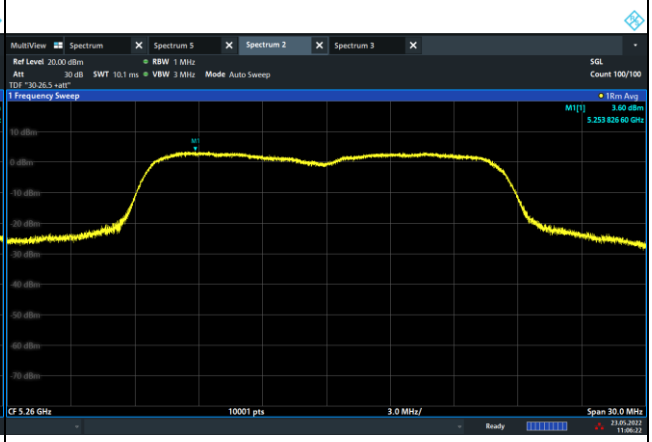
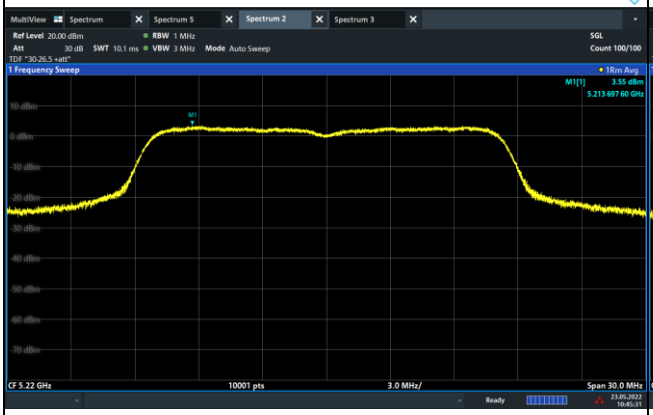
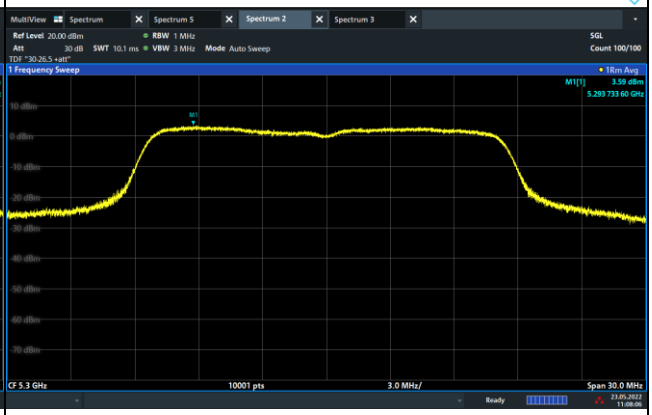
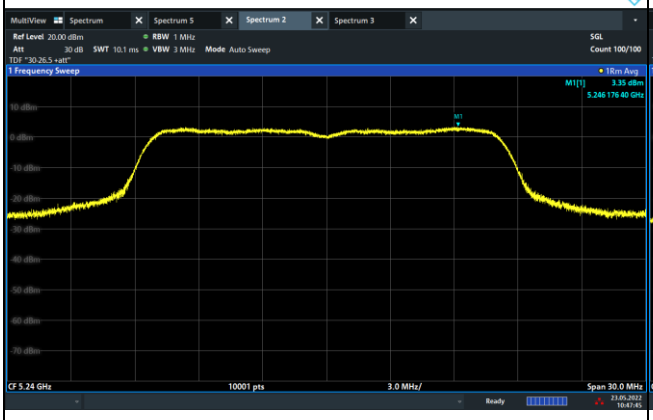
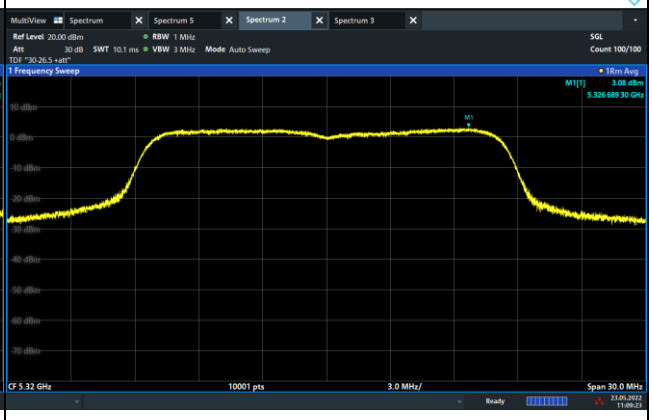
Mode	Frequency (㎒)	Band	PSD (dBm/㎒)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm/㎒)
							FCC
802.11 ac_HT40	5 190	UNII-1	-0.24	-	3.12	2.88	11.00
	5 210		-0.37			2.75	
	5 270	UNII-2A	-0.73		3.14	2.41	
	5 310		-0.86			2.28	
	5 510	UNII-2C	-3.69		3.13	-0.56	
	5 630		-4.76			-1.63	
	5 710		-4.30			-1.17	
	5 755	UNII-3	-8.81		3.14	-5.67	
	5 795		-9.46			-6.32	

Mode	Frequency (㎒)	Band	PSD (dBm/㎒)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm/㎒)
							FCC
802.11 ac_HT80	5 210	UNII-1	-3.02	-	5.02	2.00	11.00
	5 290	UNII-2A	-3.91		5.04	1.13	
	5 530	UNII-2C	-6.37		5.02	-1.35	
	5 610		-7.18			-2.16	
	5 690		-7.82			-2.80	
	5 775	UNII-3	-12.67		5.04	-7.63	

Note.

1. UNII-1 = 10log(1 ㎒/1 ㎒)
   UNII-2A = 10log(1 ㎒/1 ㎒)
   UNII-2C = 10log(1 ㎒/1 ㎒)
   UNII-3 = 10log(500 ㎑ /500 ㎑)
2. Refer to the page 90 on this report.
3. Sum(dBm) = PSD(dBm) + RBWF + Duty correction factor (dB)

Mode : 802.11a

UNII-1	UNII-2A
	
	
	

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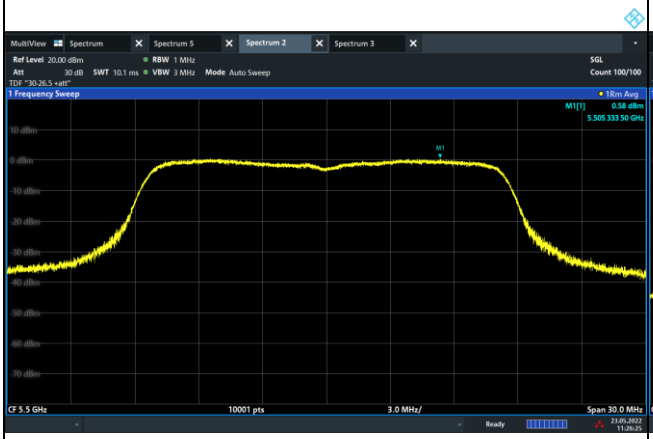	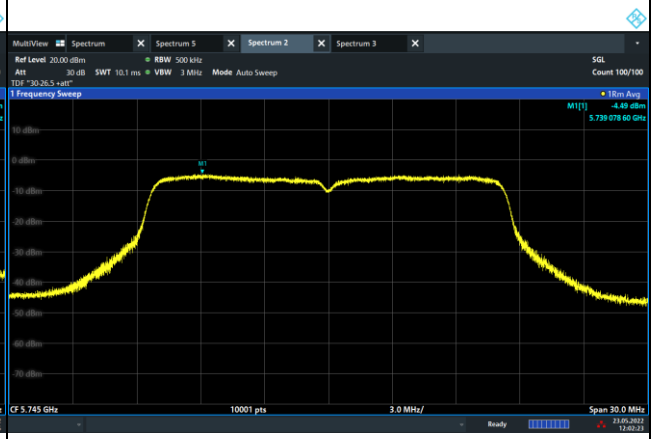
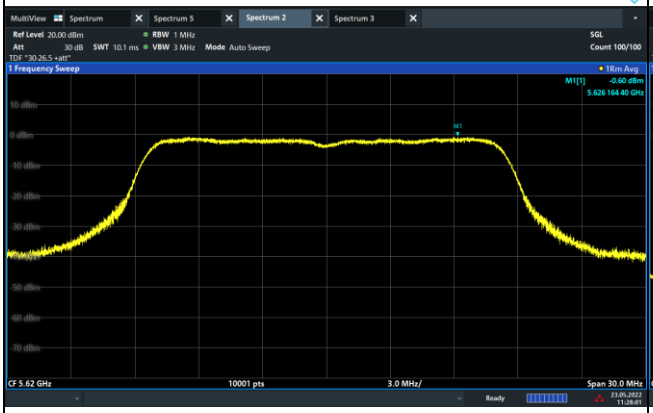	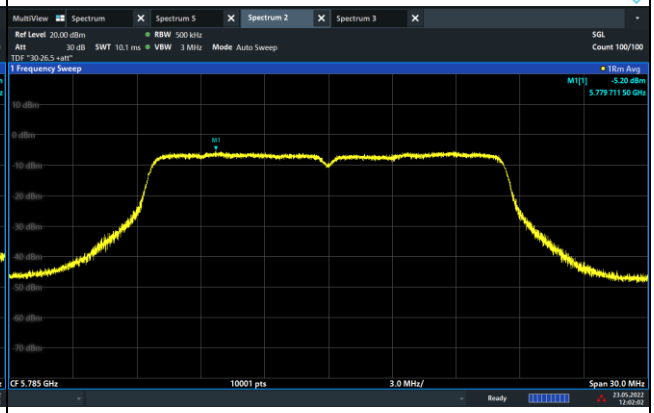
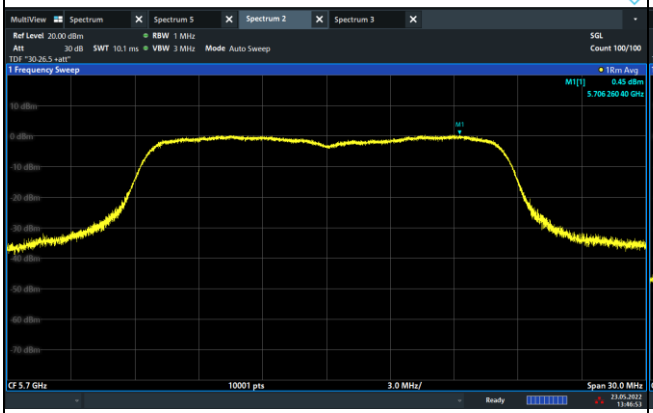	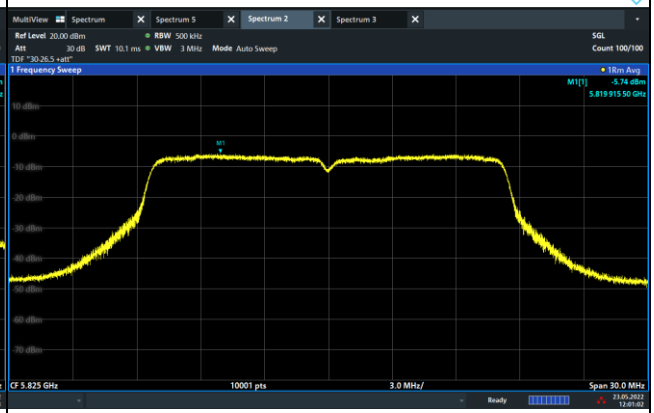

Mode : 802.11an_HT20

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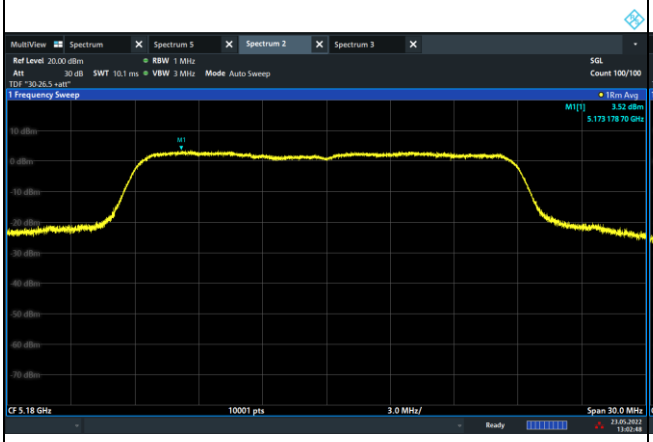	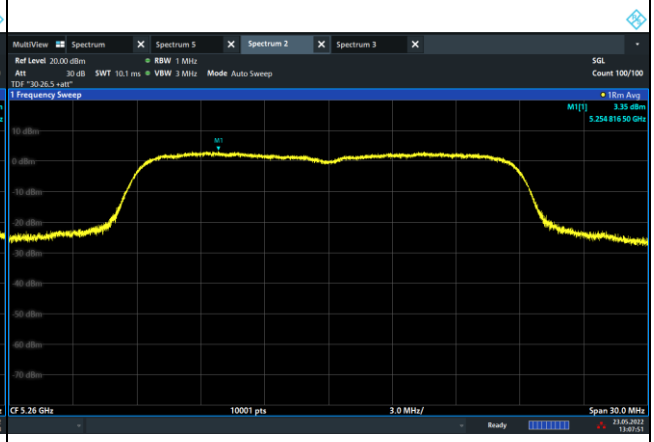
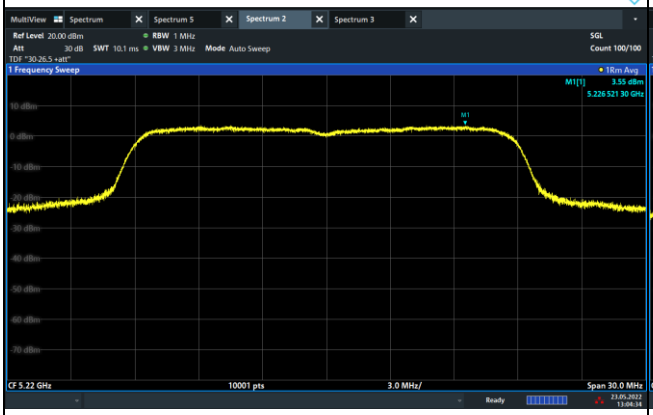	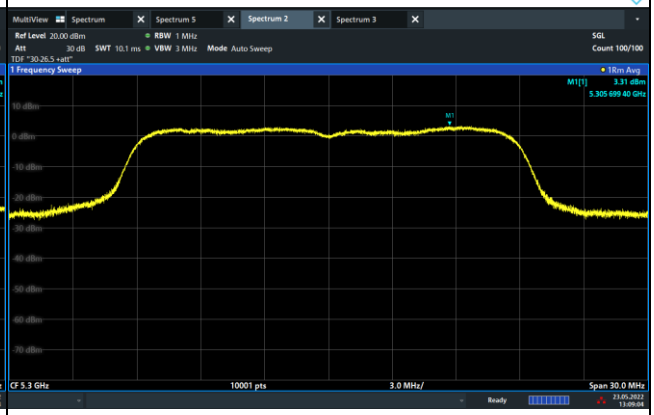
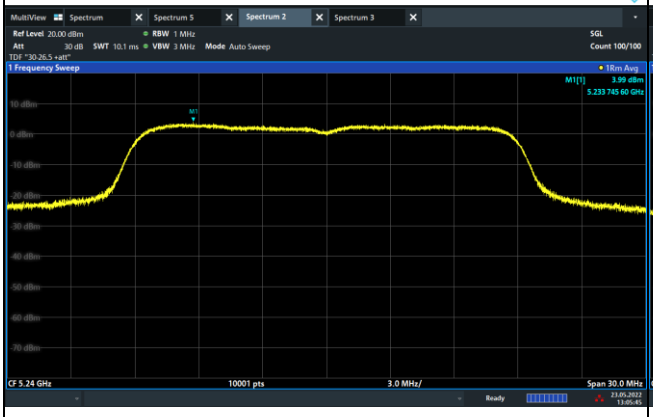	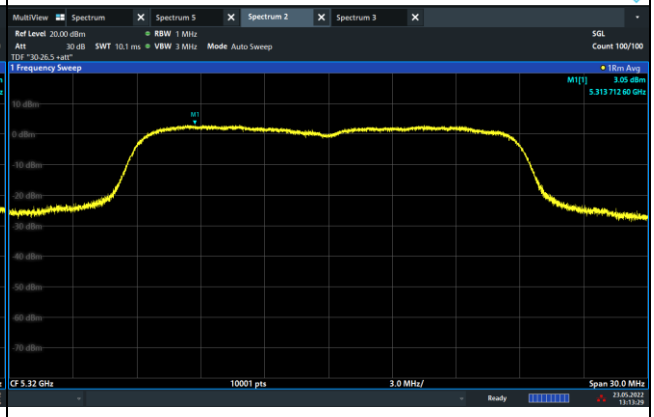

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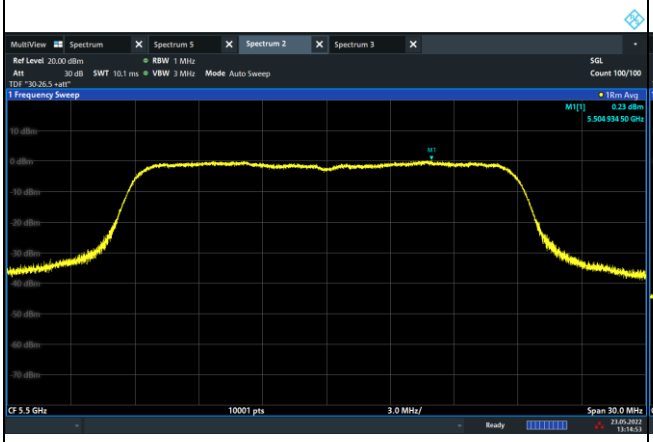	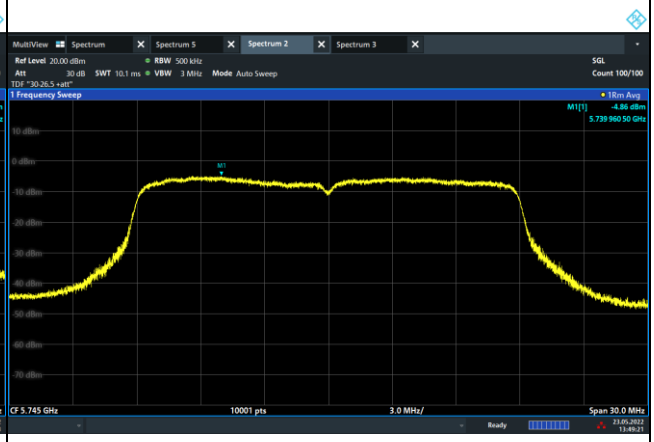
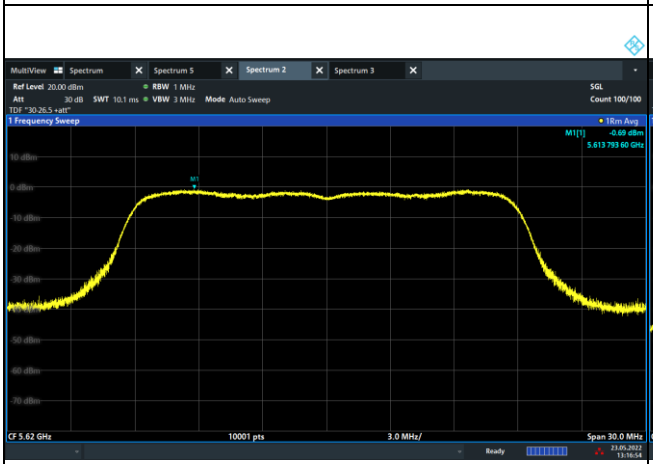	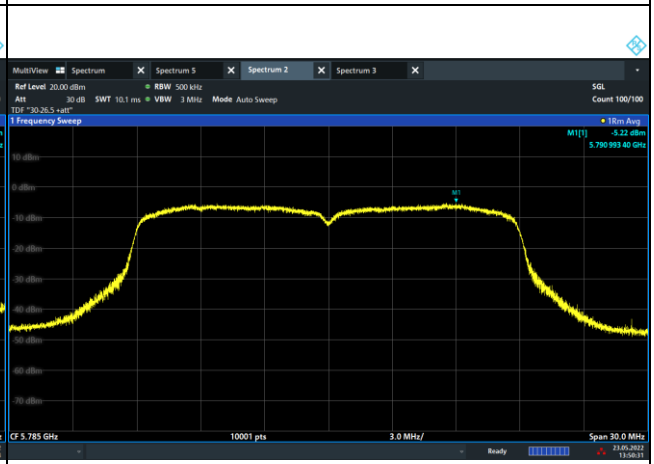
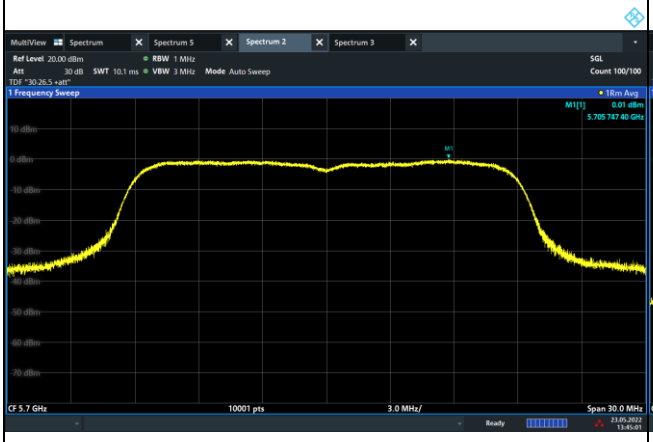	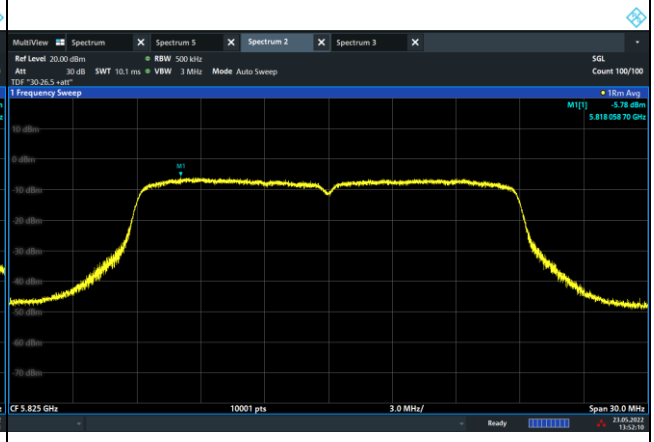

Mode : 802.11ac_HT20

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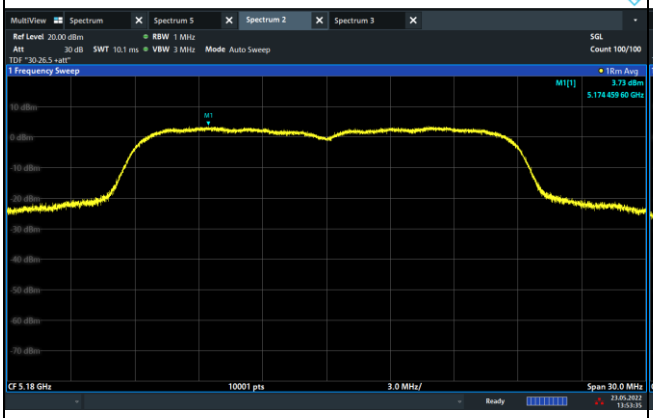	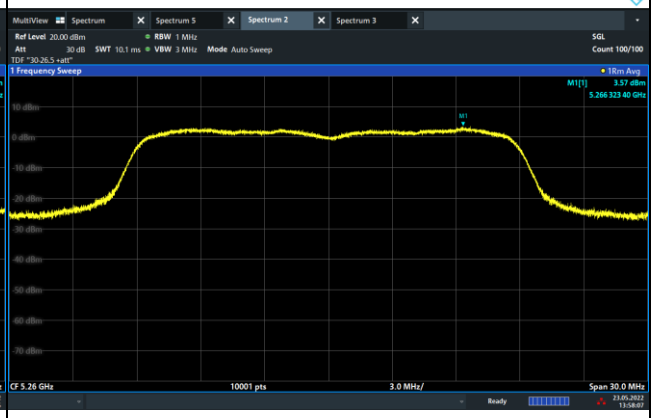
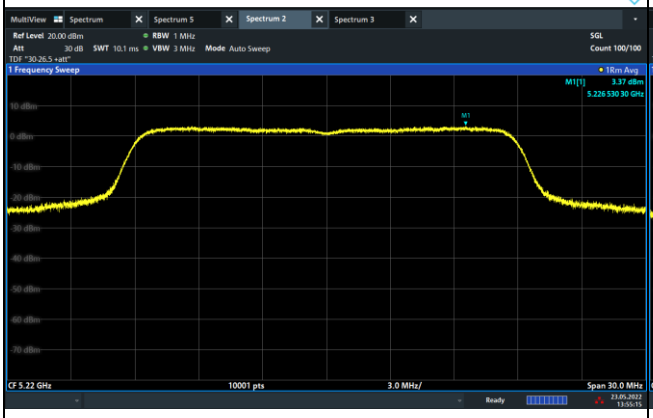	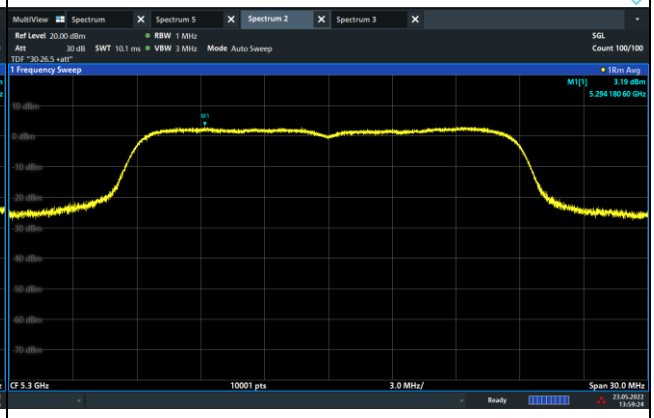
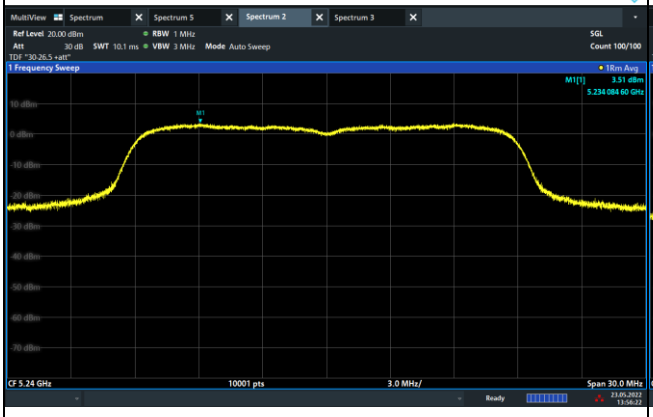	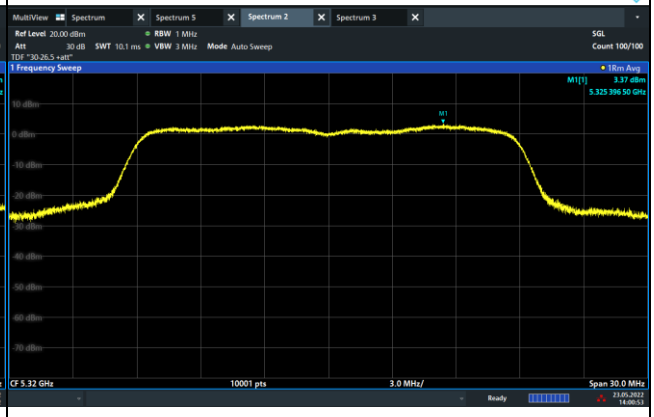

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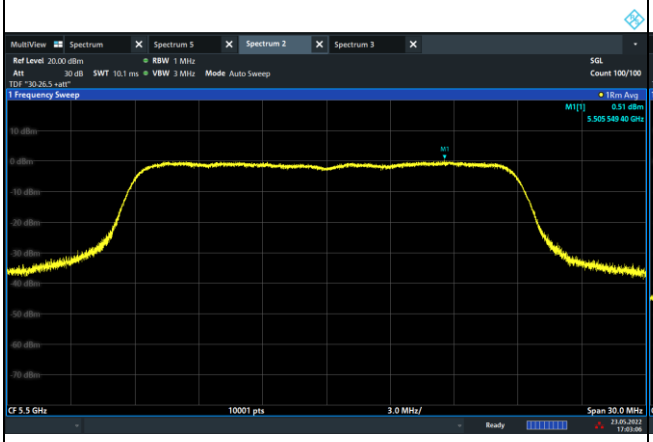	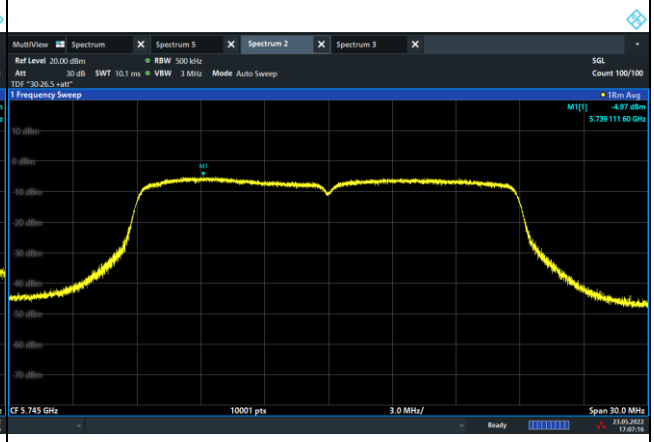
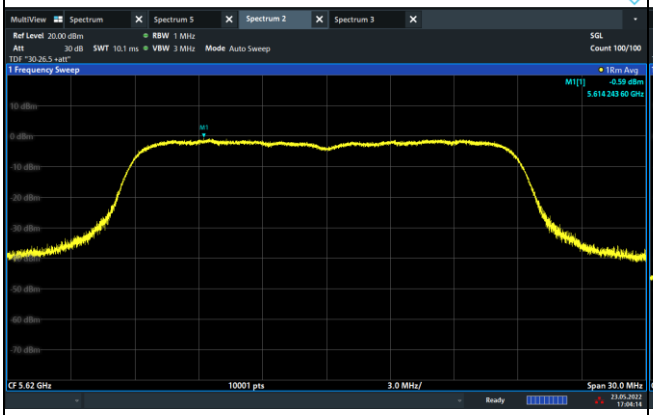	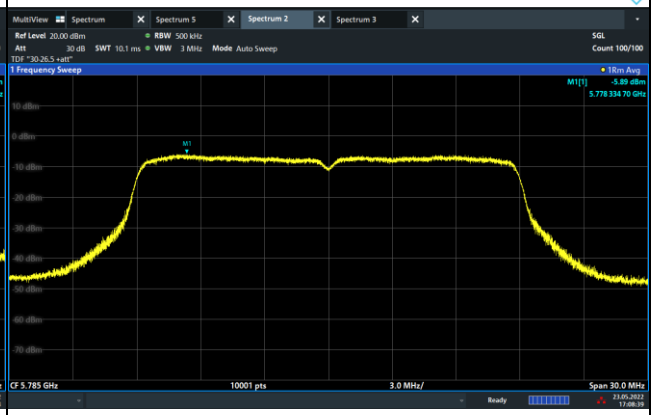
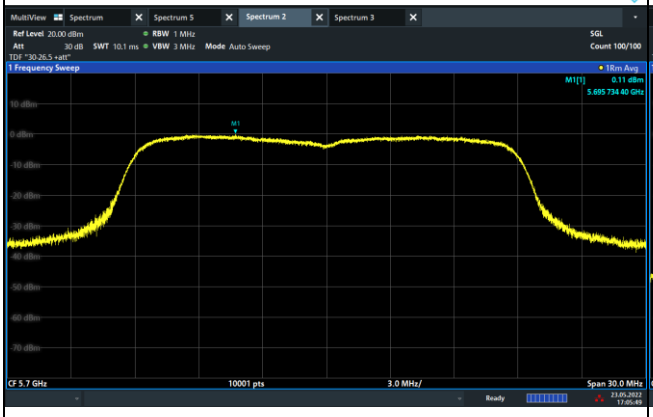	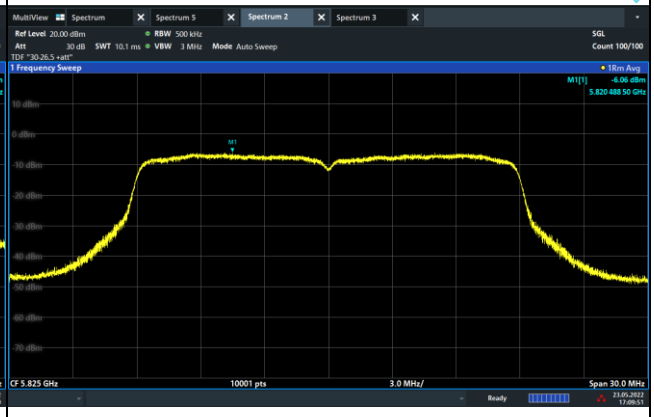

Mode : 802.11an_HT40

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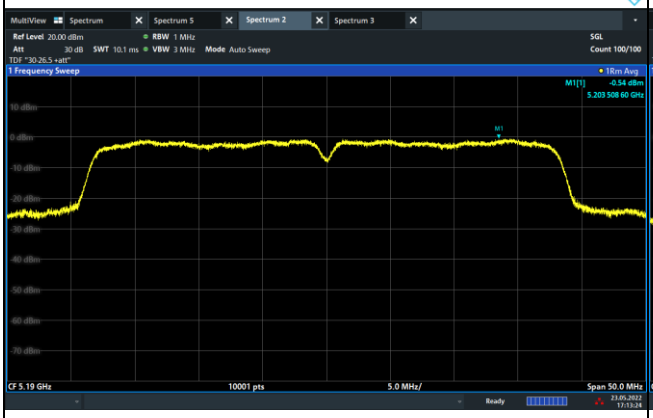	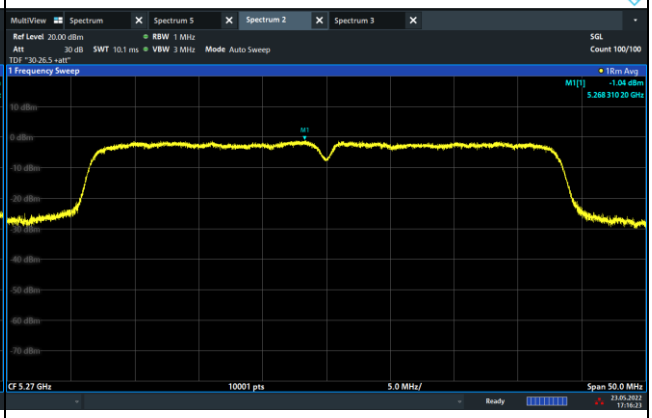
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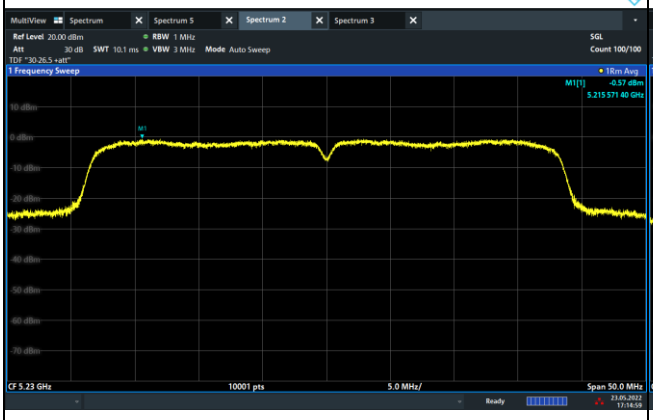
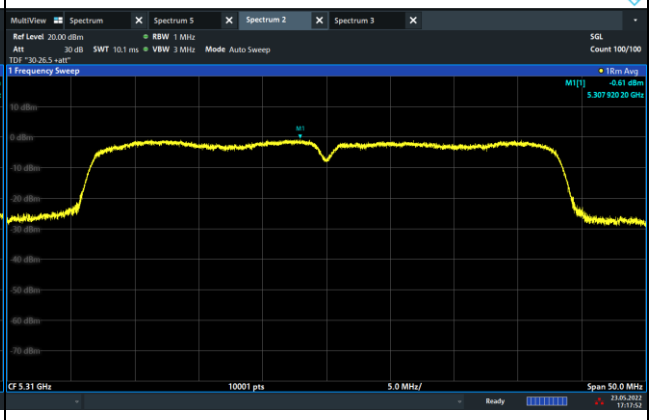
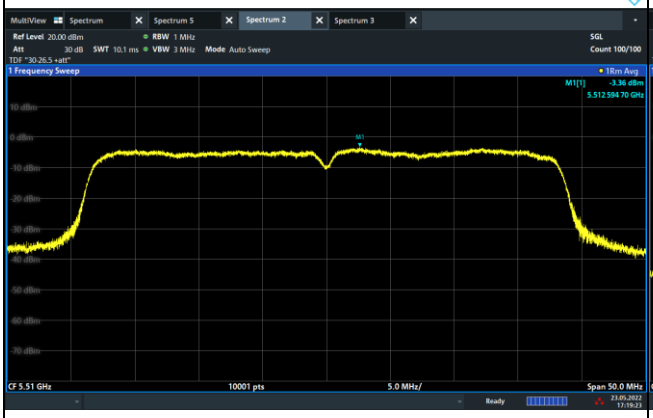
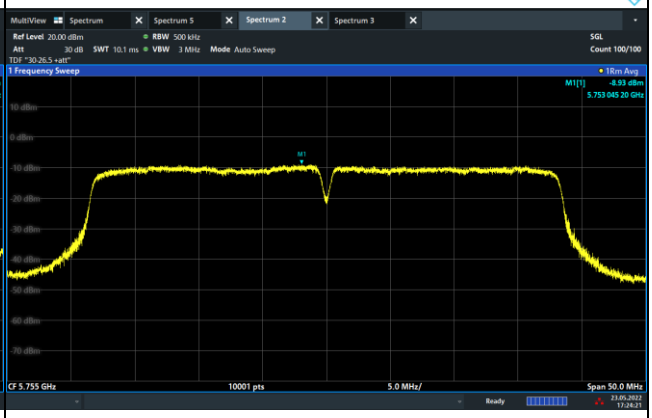
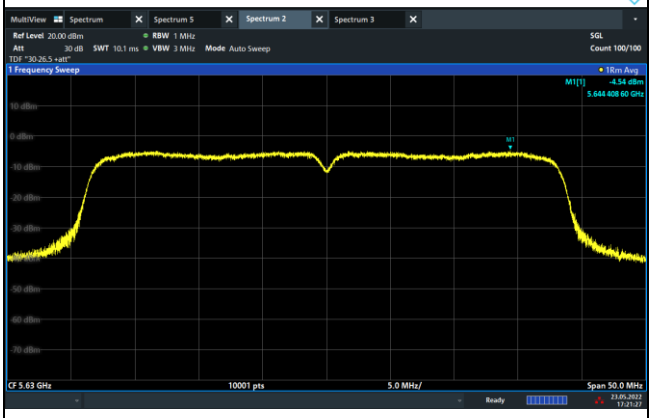
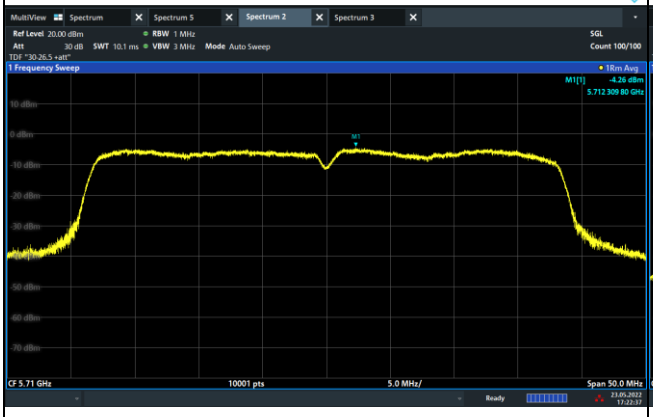
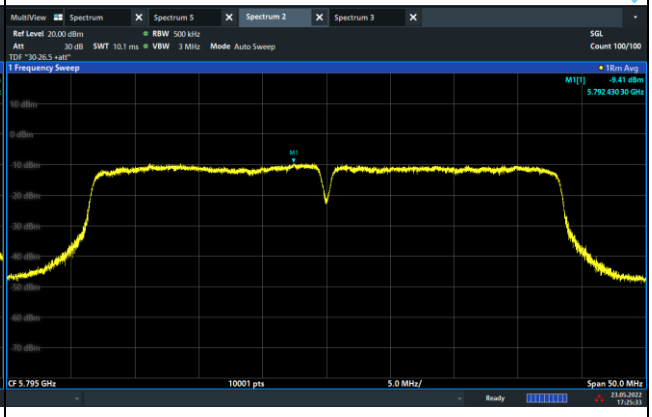
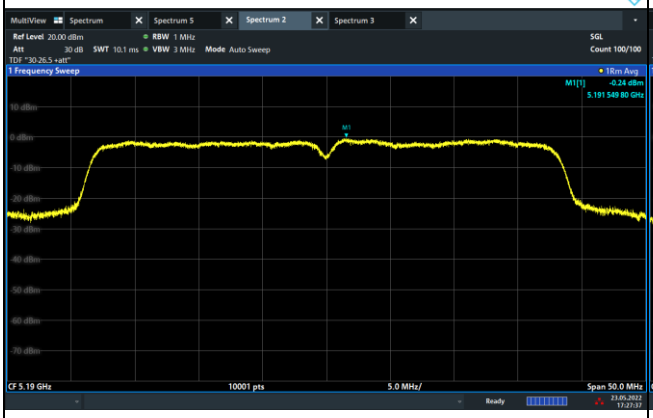
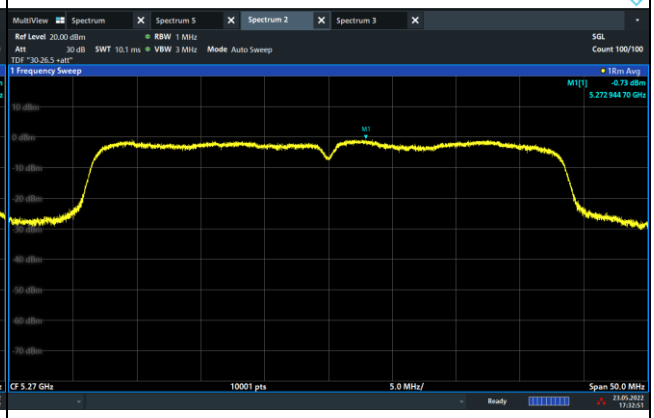
	

UNII-2C	UNII-3
	
	Blank
	

Mode : 802.11ac_HT40

UNII-1	UNII-2A
	
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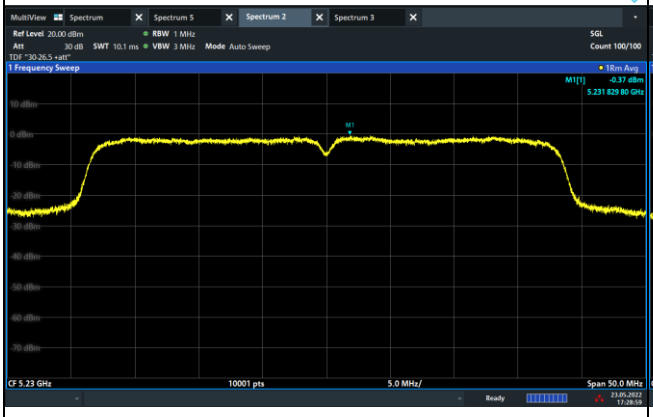
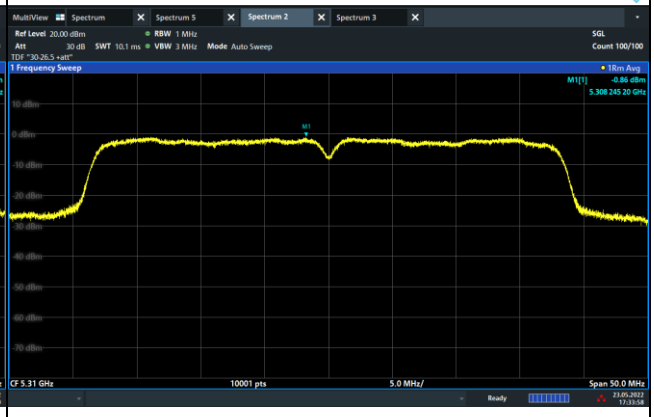
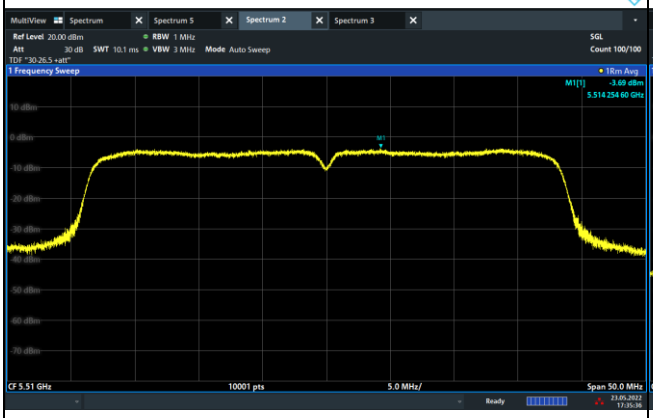
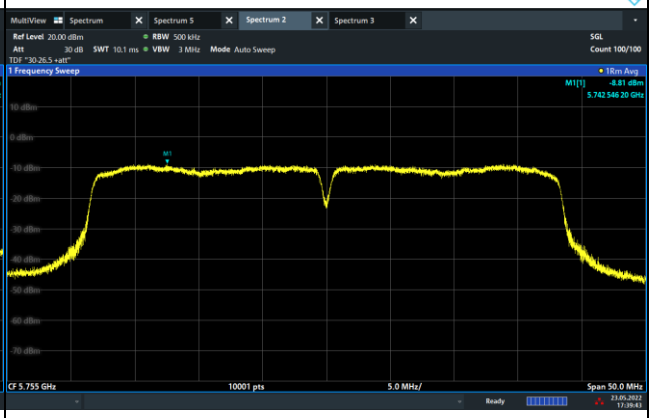
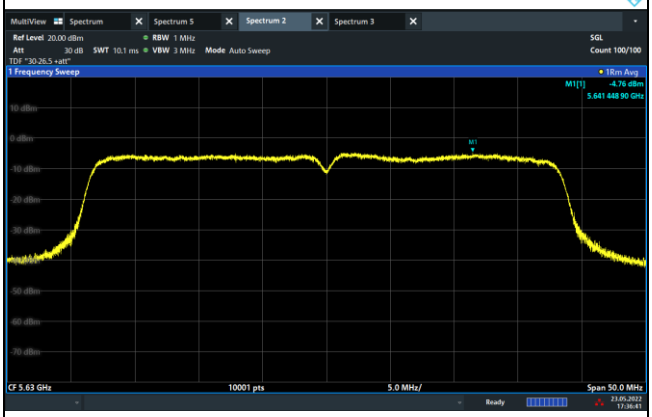
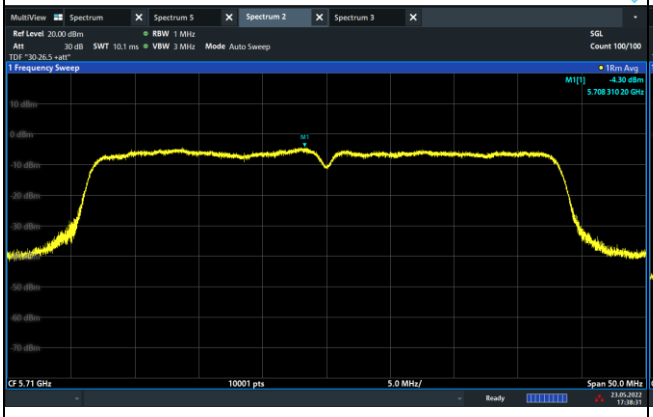
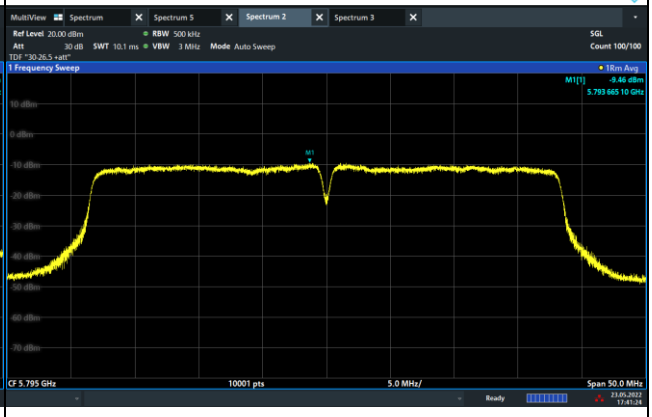
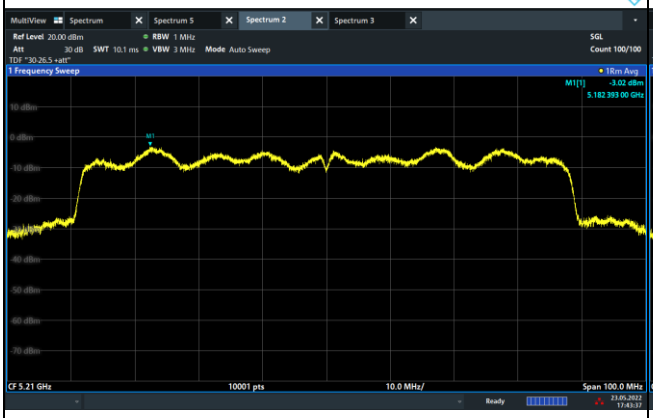
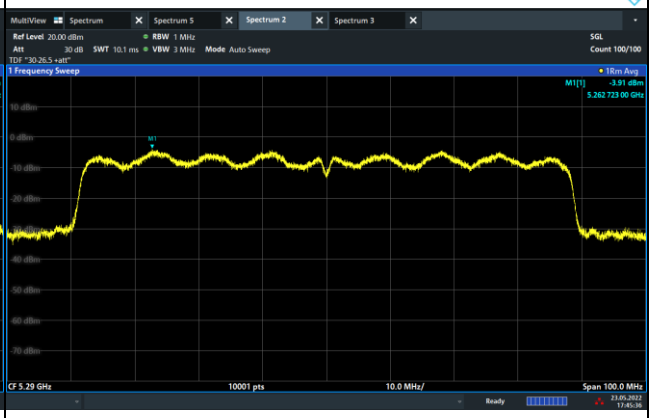
	

UNII-2C	UNII-3
	
	Blank
	

Mode : 802.11ac_HT80

UNII-1	UNII-2A
	
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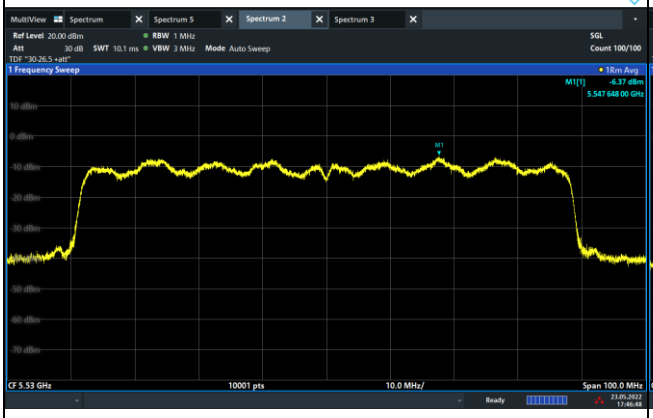
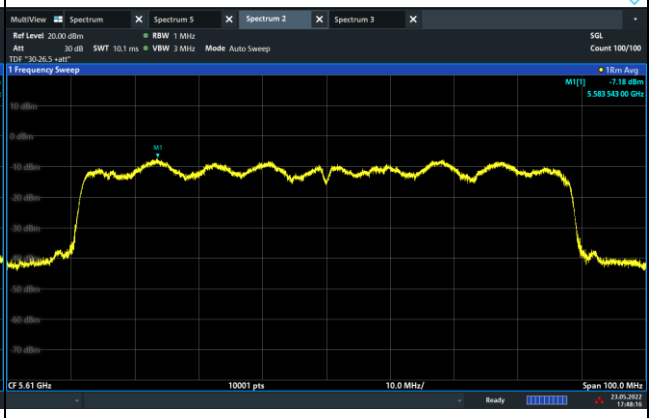
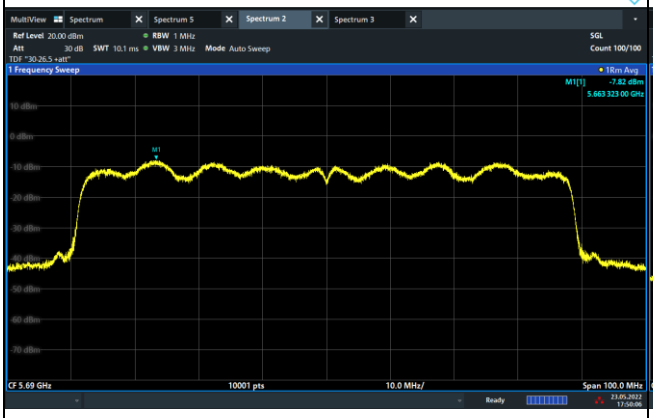
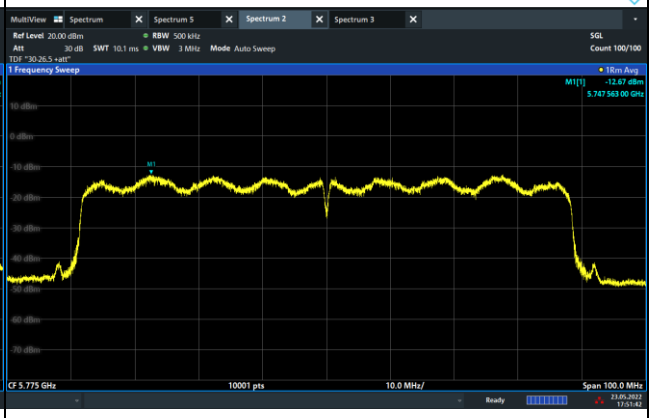
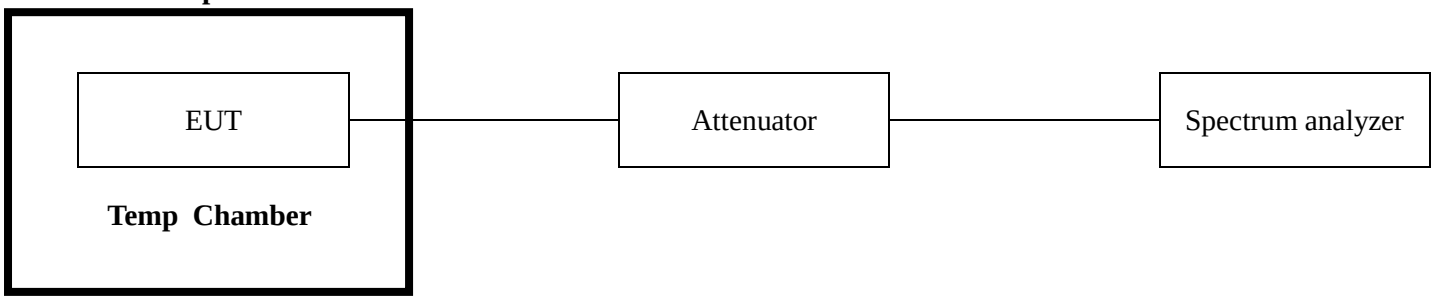
	
UNII-2C(High)	**UNII-3**
	

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

Test results

Mode: UNII-1

Operating frequency: 5 180 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	DC 24	-20	Startup	5 180.028 385	28 385	0.000 548
			2 minutes	5 180.027 981	27 981	0.000 540
			5 minutes	5 180.027 141	27 141	0.000 524
			10 minutes	5 180.026 930	26 930	0.000 520
100 %		-10	Startup	5 180.024 261	24 261	0.000 468
			2 minutes	5 180.024 179	24 179	0.000 467
			5 minutes	5 180.023 701	23 701	0.000 458
			10 minutes	5 180.023 432	23 432	0.000 452
100 %		0	Startup	5 180.016 678	16 678	0.000 322
			2 minutes	5 180.016 605	16 605	0.000 321
			5 minutes	5 180.016 522	16 522	0.000 319
			10 minutes	5 180.015 131	15 131	0.000 292
100 %		10	Startup	5 180.009 385	9 385	0.000 181
			2 minutes	5 180.009 295	9 295	0.000 179
			5 minutes	5 180.00 9200	9 200	0.000 178
			10 minutes	5 180.008 625	8 625	0.000 167
100 %		20	Startup	5 180.008 043	8 043	0.000 155
			2 minutes	5 180.007 448	7 448	0.000 144
			5 minutes	5 180.007 161	7 161	0.000 138
			10 minutes	5 180.006 464	6 464	0.000 125
100 %		23	Startup	5 180.006 705	6 705	0.000 129
			2 minutes	5 180.006 499	6 499	0.000 125
			5 minutes	5 180.005 542	5 542	0.000 107
			10 minutes	5 180.005 217	5 217	0.000 101
100 %		30	Startup	5 180.005 845	5 845	0.000 113
			2 minutes	5 180.006 417	6 417	0.000 124
			5 minutes	5 180.006 103	6 103	0.000 118
			10 minutes	5 180.005 155	5 155	0.000 100
100 %		40	Startup	5 179.991 169	-8 831	-0.000 170
			2 minutes	5 179.991 027	-8 973	-0.000 173
			5 minutes	5 179.990 908	-9 092	-0.000 176
			10 minutes	5 179.990 078	-9 922	-0.000 192
100 %		50	Startup	5 179.987 722	-12 278	-0.000 237
			2 minutes	5 179.987 579	-12 421	-0.000 240
			5 minutes	5 179.987 231	-12 769	-0.000 247
			10 minutes	5 179.986 937	-13 063	-0.000 252
85 %	DC 20.4	23	Startup	5 180.008 186	8 186	0.000 158
			2 minutes	5 180.007 868	7 868	0.000 152
			5 minutes	5 180.007 584	7 584	0.000 146
			10 minutes	5 180.007 545	7 545	0.000 146
115 %	DC 27.6	23	Startup	5 180.008 797	8 797	0.000 170
			2 minutes	5 180.008 289	8 289	0.000 160
			5 minutes	5 180.008 277	8 277	0.000 160
			10 minutes	5 180.007 435	7 435	0.000 144

Mode: UNII-2A

Operating frequency: 5 260 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	DC 24	-20	Startup	5 260.028 295	28 295	0.000 538
			2 minutes	5 260.028 173	28 173	0.000 536
			5 minutes	5 260.027 784	27 784	0.000 528
			10 minutes	5 260.026 830	26 830	0.000 510
100 %		-10	Startup	5 260.025 120	25 120	0.000 478
			2 minutes	5 260.024 956	24 956	0.000 474
			5 minutes	5 260.024 468	24 468	0.000 465
			10 minutes	5 260.023 625	23 625	0.000 449
100 %		0	Startup	5 260.016 263	16 263	0.000 309
			2 minutes	5 260.015 557	15 557	0.000 296
			5 minutes	5 260.015 159	15 159	0.000 288
			10 minutes	5 260.015 044	15 044	0.000 286
100 %		10	Startup	5 260.010 160	10 160	0.000 193
			2 minutes	5 260.009 172	9 172	0.000 174
			5 minutes	5 260.008 795	8 795	0.000 167
			10 minutes	5 260.008 673	8 673	0.000 165
100 %		20	Startup	5 260.007 733	7 733	0.000 147
			2 minutes	5 260.007 719	7 719	0.000 147
			5 minutes	5 260.006 921	6 921	0.000 132
			10 minutes	5 260.006 277	6 277	0.000 119
100 %		23	Startup	5 260.007 107	7 107	0.000 135
			2 minutes	5 260.006 977	6 977	0.000 133
			5 minutes	5 260.006 093	6 093	0.000 116
			10 minutes	5 260.005 454	5 454	0.000 104
100 %		30	Startup	5 260.004 528	4 528	0.000 086
			2 minutes	5 260.005 335	5 335	0.000 101
			5 minutes	5 260.005 097	5 097	0.000 097
			10 minutes	5 260.004 105	4 105	0.000 078
100 %		40	Startup	5 259.991 257	-8 743	-0.000 166
			2 minutes	5 259.990 881	-9 119	-0.000 173
			5 minutes	5 259.990 812	-9 188	-0.000 175
			10 minutes	5 259.990 355	-9 645	-0.000 183
100 %		50	Startup	5 259.988 344	-11 656	-0.000 222
			2 minutes	5 259.988 224	-11 776	-0.000 224
			5 minutes	5 259.987 563	-12 437	-0.000 236
			10 minutes	5 259.987 293	-12 707	-0.000 242
85 %	DC 20.4	23	Startup	5 260.008 708	8 708	0.000 166
			2 minutes	5 260.008 241	8 241	0.000 157
			5 minutes	5 260.008 145	8 145	0.000 155
			10 minutes	5 260.007 877	7 877	0.000 150
115 %	DC 27.6	23	Startup	5 260.009 264	9 264	0.000 176
			2 minutes	5 260.008 514	8 514	0.000 162
			5 minutes	5 260.008 448	8 448	0.000 161
			10 minutes	5 260.008 413	8 413	0.000 160

Mode: UNII-2C

Operating frequency: 5500 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	DC 24	-20	Startup	5 500.028 807	28 807	0.000 524
			2 minutes	5 500.028 707	28 707	0.000 522
			5 minutes	5 500.027 321	27 321	0.000 497
			10 minutes	5 500.027 036	27 036	0.000 492
100 %		-10	Startup	5 500.024 961	24 961	0.000 454
			2 minutes	5 500.023 891	23 891	0.000 434
			5 minutes	5 500.023 773	23 773	0.000 432
			10 minutes	5 500.023 719	23 719	0.000 431
100 %		0	Startup	5 500.016 738	16 738	0.000 304
			2 minutes	5 500.016 322	16 322	0.000 297
			5 minutes	5 500.016 265	16 265	0.000 296
			10 minutes	5 500.014 990	14 990	0.000 273
100 %		10	Startup	5 500.010 528	10 528	0.000 191
			2 minutes	5 500.010 158	10 158	0.000 185
			5 minutes	5 500.009 687	9 687	0.000 176
			10 minutes	5 500.008 898	8 898	0.000 162
100 %		20	Startup	5 500.007 707	7 707	0.000 140
			2 minutes	5 500.007 163	7 163	0.000 130
			5 minutes	5 500.006 787	6 787	0.000 123
			10 minutes	5 500.006 395	6 395	0.000 116
100 %		23	Startup	5 500.007 038	7 038	0.000 128
			2 minutes	5 500.006 406	6 406	0.000 116
			5 minutes	5 500.006 008	6 008	0.000 109
			10 minutes	5 500.005 361	5 361	0.000 097
100 %		30	Startup	5 500.005 946	5 946	0.000 108
			2 minutes	5 500.006 083	6 083	0.000 111
			5 minutes	5 500.006 081	6 081	0.000 111
			10 minutes	5 500.004 990	4 990	0.000 091
100 %		40	Startup	5 499.990 837	-916 3	-0.000 167
			2 minutes	5 499.990 436	-956 4	-0.000 174
			5 minutes	5 499.990 232	-976 8	-0.000 178
			10 minutes	5 499.989 935	-100 65	-0.000 183
100 %		50	Startup	5 499.988 198	-118 02	-0.000 215
			2 minutes	5 499.988 015	-119 85	-0.000 218
			5 minutes	5 499.987 686	-123 14	-0.000 224
			10 minutes	5 499.987 663	-123 37	-0.000 224
85 %	DC 20.4	23	Startup	5 500.008 375	8 375	0.000 152
			2 minutes	5 500.007 763	7 763	0.000 141
			5 minutes	5 500.007 623	7 623	0.000 139
			10 minutes	5 500.007 468	7 468	0.000 136
115 %	DC 27.6	23	Startup	5 500.008 257	8 257	0.000 150
			2 minutes	5 500.007 890	7 890	0.000 143
			5 minutes	5 500.007 822	7 822	0.000 142
			10 minutes	5 500.007 592	7 592	0.000 138

Mode: UNII-3

Operating frequency: 5 745 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	DC 24	-20	Startup	5 745.028 509	28 509	0.000 496
			2 minutes	5 745.028 291	28 291	0.000 492
			5 minutes	5 745.027 075	27 075	0.000 471
			10 minutes	5 745.026 919	26 919	0.000 469
100 %		-10	Startup	5 745.025 371	25 371	0.000 442
			2 minutes	5 745.024 696	24 696	0.000 430
			5 minutes	5 745.024 032	24 032	0.000 418
			10 minutes	5 745.023 996	23 996	0.000 418
100 %		0	Startup	5 745.016 814	16 814	0.000 293
			2 minutes	5 745.016 637	16 637	0.000 290
			5 minutes	5 745.015 579	15 579	0.000 271
			10 minutes	5 745.015 294	15 294	0.000 266
100 %		10	Startup	5 745.010 578	10 578	0.000 184
			2 minutes	5 745.010 517	10 517	0.000 183
			5 minutes	5 745.009 084	9 084	0.000 158
			10 minutes	5 745.008 907	8 907	0.000 155
100 %		20	Startup	5 745.008 340	8 340	0.000 145
			2 minutes	5 745.006 878	6 878	0.000 120
			5 minutes	5 745.006 830	6 830	0.000 119
			10 minutes	5 745.006 513	6 513	0.000 113
100 %		23	Startup	5 7 45.007 032	7 032	0.000 122
			2 minutes	5 745.006 499	6 499	0.000 113
			5 minutes	5 745.006 485	6 485	0.000 113
			10 minutes	5 745.006 337	6 337	0.000 110
100 %		30	Startup	5 745.006 052	6 052	0.000 105
			2 minutes	5 745.005 864	5 864	0.000 102
			5 minutes	5 745.005 810	5 810	0.000 101
			10 minutes	5 745.005 547	5 547	0.000 097
100 %		40	Startup	5 744.991 748	-825 3	-0.000 144
			2 minutes	5 744.991 603	-839 8	-0.000 146
			5 minutes	5 744.989 995	-100 06	-0.000 174
			10 minutes	5 744.989 818	-101 83	-0.000 177
100 %		50	Startup	5 744.987 543	-124 58	-0.000 217
			2 minutes	5 744.987 541	-124 60	-0.000 217
			5 minutes	5 744.987 421	-125 80	-0.000 219
			10 minutes	5 744.987 090	-129 11	-0.000 225
85 %	DC 20.4	23	Startup	5 745.008 764	8 764	0.000 153
			2 minutes	5 745.008 710	8 710	0.000 152
			5 minutes	5 745.008 581	8 581	0.000 149
			10 minutes	5 745.007 996	7 996	0.000 139
115 %	DC 27.6	23	Startup	5 745.009 183	9 183	0.000 160
			2 minutes	5 745.008 623	8 623	0.000 150
			5 minutes	5 745.008 311	8 311	0.000 145
			10 minutes	5 745.007 761	7 761	0.000 135