TEST REPORT

Part 15 Subpart E 15.407

Equipment under test NETWORK VIDEO RECORDER

Model name TRM-1610S

Derivative model TRM-1610M

FCC ID NLMTRM1610S

Applicant Hanwha Techwin Co., Ltd.

Manufacturer Hanwha Techwin(Tianjin) Co., Ltd.

Date of test(s) 2017.10.16 ~ 2017.10.27, 11,07

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Issued to

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Revision history

Revision	Date of issue	Test report No.	Description
-	2017.11.01	KES-RF-17T0111	Initial
R1	2017.11.07	KES-RF-17T0111-R1	Add average test of radiated emission

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TABLE OF CONTENTS

1. General information 4
1.1. EUT description 4
1.2. Information about derivative model 5
1.3. Test configuration 5
1.4. Accessory information 6
1.5. Device modifications 6
1.6. Frequency/channel operations 6
1.7. Maximum average output power 7
1.8. Using antenna information 7
2. Summary of tests 8
3. Test results 9
3.1. 26 dB bandwidth & 99% Occupied Bandwidth 9
3.2. 6 dB bandwidth 25
3.3. Maximum conducted output power 30
3.4. Power spectral density 34
3.5. Frequency Stability 48
3.6. Radiated restricted band and emissions 53
Appendix A 118
Appendix B 121

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1. General information

Applicant:	Hanwha Techwin Co., Ltd.
Applicant address:	1204, Changwon-daero, Seongsan-gu, Changwon-si Gyeongsangnam-do, South Korea
Test site:	KES Co., Ltd.
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Test Facility	FCC Accreditation Designation No.: KR0100, Registration No.: 444148
FCC rule part(s):	15.407
FCC ID:	NLMTRM1610S
Test device serial No.:	☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test	NETWORK VIDEO RECORDER
Frequency range	2 412 ㎒ ~ 2 462 ㎒ (11n_HT20) 2 422 ㎒ ~ 2 452 ㎒ (11n_HT40) 5 180 ㎒ ~ 5 240 ㎒ (11ac_VHT20) 5 190 ㎒ ~ 5 230 ㎒ (11ac_VHT40) 5 210 ㎒ (11ac_VHT80) 5 260 ㎒ ~ 5 320 ㎒ (11ac_VHT20) 5 270 ㎒ ~ 5 310 ㎒ (11ac_VHT40) 5 290 ㎒ (11ac_VHT80) 5 500 ㎒ ~ 5 720 ㎒ (11ac_VHT20) 5 510 ㎒ ~ 5 710 ㎒ (11ac_VHT40) 5 530 ㎒ ~ 5 690 ㎒ (11ac_VHT80) 5 745 ㎒ ~ 5 825 ㎒ (11ac_VHT20) 5 755 ㎒ ~ 5 795 ㎒ (11ac_VHT40) 5 775 ㎒ (11ac_VHT80) 1 575.42 ㎒ (GPS)
Model:	TRM-1610S
Derivative model	TRM-1610M
Modulation technique	OFDM
Antenna specification	2.4 ㎓ // Dipole Antenna & 3.14 ㏈i 5 ㎓_UNII 1, 2A // Dipole Antenna & 2.72 ㏈i 5 ㎓_UNII 2C // Dipole Antenna & 3.45 ㏈i 5 ㎓_UNII 3 // Dipole Antenna & 5.63 ㏈i
Power source	DC 9V~36V

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Number of channels

2 412 ㎒ ~ 2 462 ㎒ (11n_HT20) : 11ch
2 422 ㎒ ~ 2 452 ㎒ (11n_HT40) : 7ch
5 180 ㎒ ~ 5 240 ㎒ (11ac_VHT20) : 4ch
5 190 ㎒ ~ 5 230 ㎒ (11ac_VHT40) : 2ch
5 210 ㎒ (11ac_VHT80) : 1ch
5 260 ㎒ ~ 5 320 ㎒ (11ac_VHT20) : 4ch
5 270 ㎒ ~ 5 310 ㎒ (11ac_VHT40) : 2ch
5 290 ㎒ (11ac_VHT80) : 1ch
5 500 ㎒ ~ 5 720 ㎒ (11ac_VHT20) : 12ch
5 510 ㎒ ~ 5 710 ㎒ (11ac_VHT40) : 6ch
5 530 ㎒ ~ 5 690 ㎒ (11ac_VHT80) : 3ch
5 745 ㎒ ~ 5 825 ㎒ (11ac_VHT20) : 5ch
5 755 ㎒ ~ 5 795 ㎒ (11ac_VHT40) : 2ch
5 775 ㎒ (11ac_VHT80) : 1ch
1 575.42 ㎒ (GPS) : 1ch

1.2. Information about derivative model

The difference between basic model and derivative is part of rear side, the other circuit diagram and software are fundamentally the same. Please refer to the figure below for details.

Basic model	Derivative model

Note.

1. The output power of the Basic model is worse than derivative model. Conducted and radiated emission were performed with the basic model.

1.3. Test configuration

The **Hanwha Techwin Co., Ltd. NETWORK VIDEO RECORDER FCC ID: NLMTRM1610S** was tested per the guidance of KDB 789033 D02 v01r04 and KDB 644545 D03 v01. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing.

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1.4. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
Control Box	Hanwha Techwin(Tianjin) Co., Ltd.	-	-	-

1.5. Device modifications

N/A

1.6. Frequency/channel operations

UNII-1

Ch.	Frequency (㎒)
36	5 180
44	5 220
48	5 240

UNII-2A

Ch.	Frequency (㎒)
52	5 260
56	5 280
64	5 320

UNII-2C

Ch.	Frequency (㎒)
100	5 500
116	5 580
144	5 720

UNII-3

Ch.	Frequency (㎒)
149	5 745
157	5 785
165	5 825

Table 1.7-1. 802.11ac_VHT20 mode

UNII-1

Ch.	Frequency (㎒)
38	5 190
46	5 230

UNII-2A

Ch.	Frequency (㎒)
54	5 270
62	5 310

UNII-2C

Ch.	Frequency (㎒)
102	5 510
118	5 590
142	5 710

UNII-3

Ch.	Frequency (㎒)
151	5 755
159	5 795

Table 1.7-2. 802.11ac_VHT40 mode

UNII-1

Ch.	Frequency (㎒)
42	5 210

UNII-2A

Ch.	Frequency (㎒)
58	5 290

UNII-2C

Ch.	Frequency (㎒)
106	5 530
122	5 610
138	5 690

UNII-3

Ch.	Frequency (㎒)
155	5 775

Table 1.7-3. 802.11ac_VHT80 mode

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1.7. Maximum average output power

Refer to the average output power.

Note.

1. Radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.
2. Worst-case data rates as provided by the client were:
   UNII-1 ac_VHT20/40/80 : **VHT2MCS0** (MIMO)
   UNII-2A ac_VHT20/40/80 : **VHT2MCS0** (MIMO)
   UNII-2C ac_VHT20/40/80 : **VHT2MCS0** (MIMO)
   UNII-3 ac_VHT20/40/80 : **VHT2MCS0** (MIMO)

1.8. Using antenna information

Mode	Bandwidth (㎒)	Antenna 0	Antenna 1	Antenna 0+1
ac	20	×	×	✓
	40	×	×	✓
	80	×	×	✓

Mode	Antenna 1 gain(dBi)	Antenna 2 gain(dBi)	Total gain(dBi)[Note1]
5 ㎓_UNII 1, 2A	2.72	2.72	5.72
5 ㎓_UNII 2C	3.45	3.45	6.45
5 ㎓_UNII 3	5.63	5.63	8.63

Note.

1. Ant Gain = G_{ANT} + 10log(N_{ANT}) dBi
2. Refer to the KDB 662911 D01 v02r01

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2. Summary of tests

Reference	Parameter	Test results
15.407(a)	26 dB bandwidth & 99 % Occupied Bandwidth	Pass
15.407(e)	6 dB bandwidth	Pass
15.407(a)	Maximum conducted output power	Pass
15.407(a)	Power spectral density	Pass
15.407(g)	Frequency stability	Pass
15.205 15.209	Radiated restricted band and emission	Pass
15.407(d)	General field strength limit (Restricted bands and radiated emission limit)	Pass
15.207	AC power line conducted emissions	N/A Note.1

Note.

1. This device doesn't required AC conducted emission test because only use DC power.

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3. Test results

3.1. 26 dB bandwidth & 99% Occupied Bandwidth

Test procedure

26 dB bandwidth

KDB 789033 D02 v01r04– Section C.1, KDB 644545 D03 v01

1. Set RBW = approximately 1% of the emission bandwidth.
2. Set the VBW > RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.
6. In case of band crossing channels 138, 142 and 144, the measurement is complied with section D of KDB 644545_D03 v01

Limit

N/A

99 % bandwidth

KDB 789033 D02 v01r04– Section D

1. Set span = 1.5 times to 5.0 times the OBW.
2. Set RBW = 1% to 5% of the OBW
3. Set the VBW > 3 x RBW.
4. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak bandwidth function of the instrument (if available).
5. Use the 99% power bandwidth function of the instrument (if available).
6. If the instrument does not have a 99% power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

In the result,

-DFS requirements are not applicable in the 5 150 ㎒ ~ 5 250 ㎒.

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Test results

26 dB bandwidth

Band	Frequency(MHz)	Mode	26 dB bandwidth(MHz)	
			Ant1	Ant2
UNII-1	5 180	VHT20	21.418	21.274
	5 220		21.491	21.780
	5 240		21.346	21.491
	5 190	VHT40	43.650	41.490
	5 230		43.650	43.420
	5 210	VHT80	82.840	81.450
UNII-2A	5 260	VHT20	21.274	21.418
	5 280		21.418	21.418
	5 320		21.274	21.346
	5 270	VHT40	44.460	42.490
	5 310		43.530	42.140
	5 290	VHT80	81.790	81.100
UNII-3	5 500	VHT20	24.023	21.274
	5 580		22.648	21.274
	5 720		21.056	20.984
	5 510	VHT40	45.730	42.260
	5 590		43.300	42.950
	5 710		43.880	42.260
	5 530	VHT80	81.970	81.270
	5 610		81.970	80.750
	5 690		82.140	81.100
UNII-3	5 745	VHT20	21.056	21.201
	5 785		21.201	21.274
	5 825		21.346	21.563
	5 755	VHT40	43.880	42.720
	5 795		43.880	42.260
	5 775	VHT80	82.320	80.580
UNII-2C (Band-crossing channel)	5 720	VHT20	15.564	15.564
	5 710	VHT40	37.230	35.960
	5 690	VHT80	75.980	75.290

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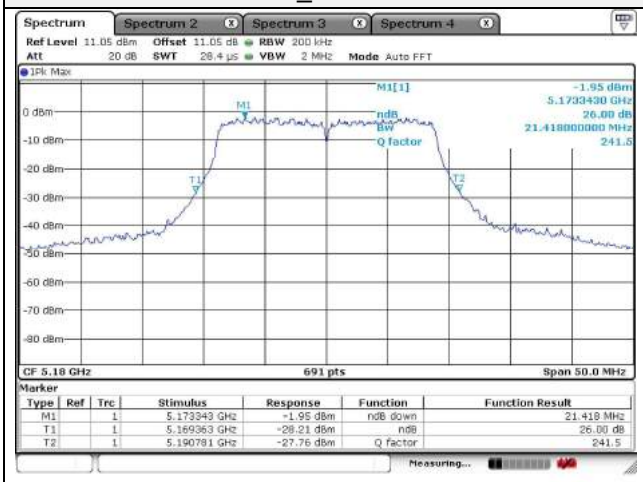
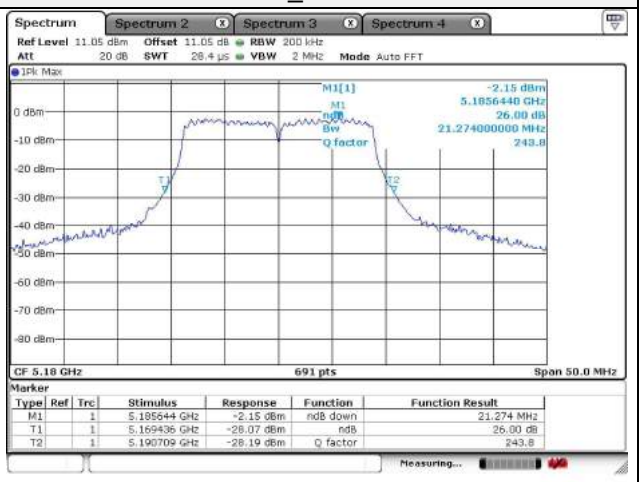
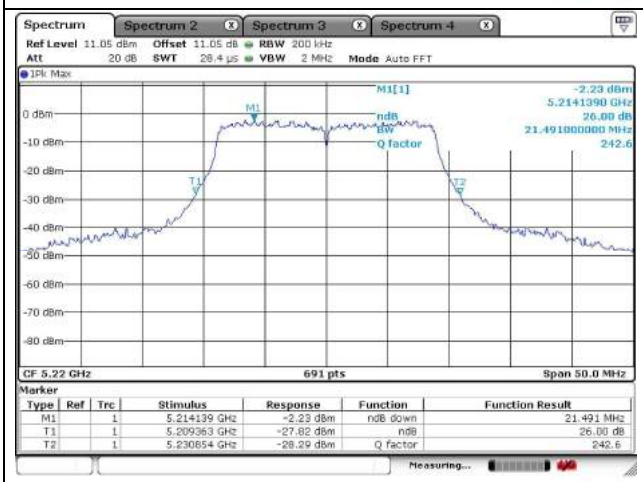
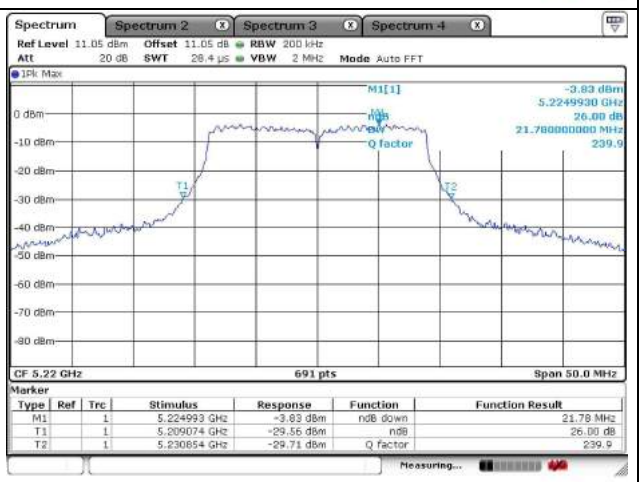
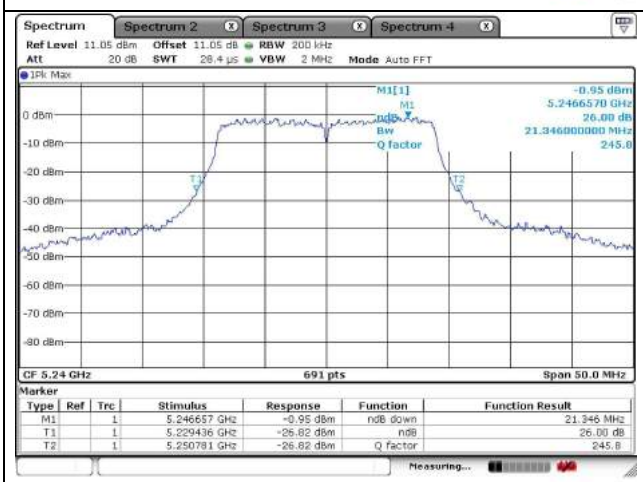
Test plots

26 dB bandwidth

UNII-1 // ac_VHT20 // Ant 1	UNII-1 // ac_VHT20 // Ant 2
	
	
	

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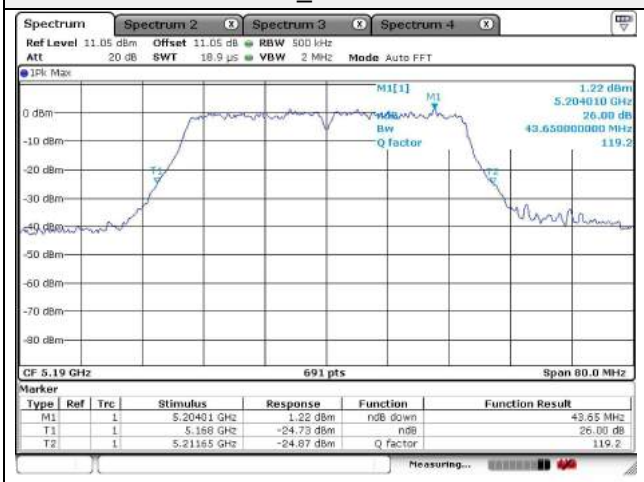
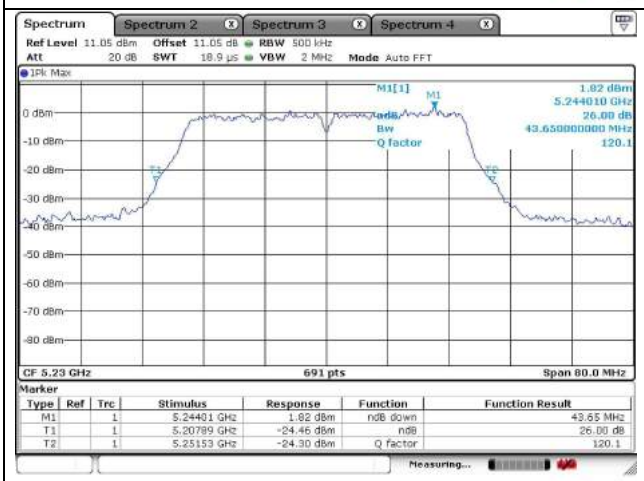
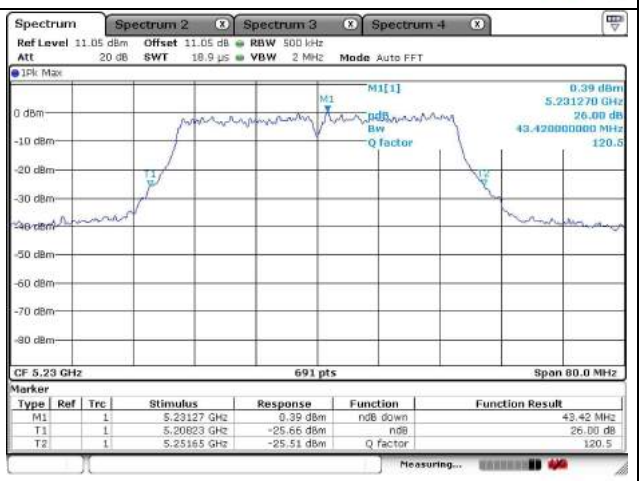
UNII-1 // ac_VHT40 // Ant 1

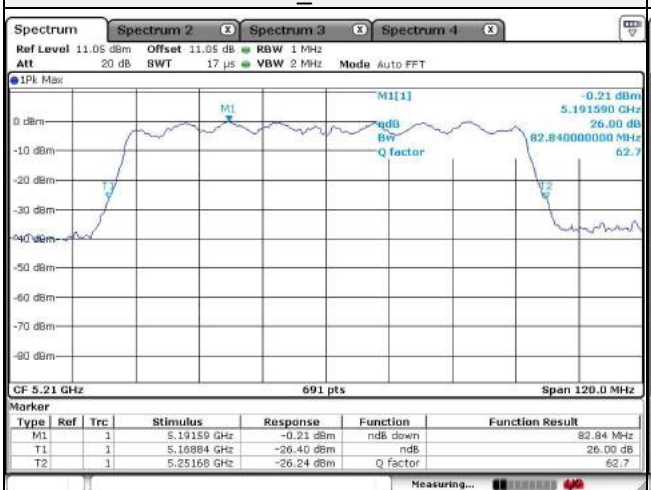


UNII-1 // ac_VHT40 // Ant 2





UNII-1 // ac_VHT80 // Ant 1



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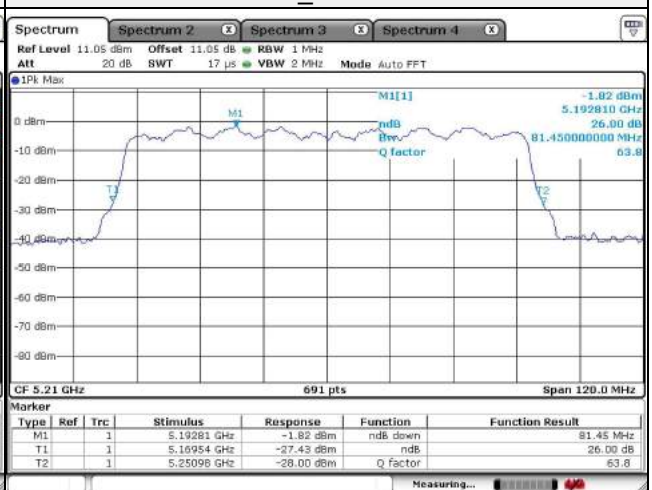

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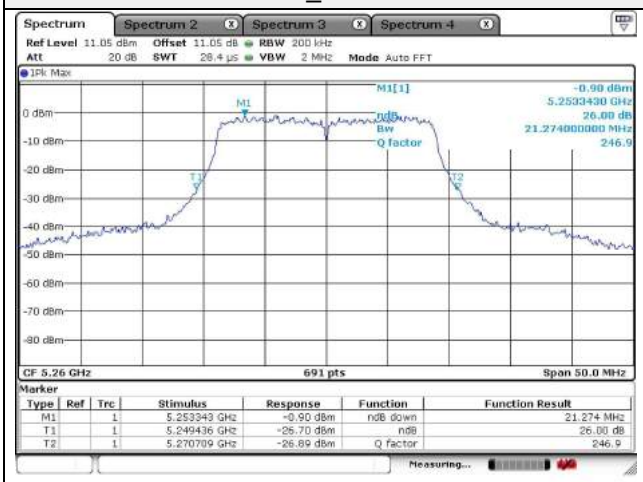
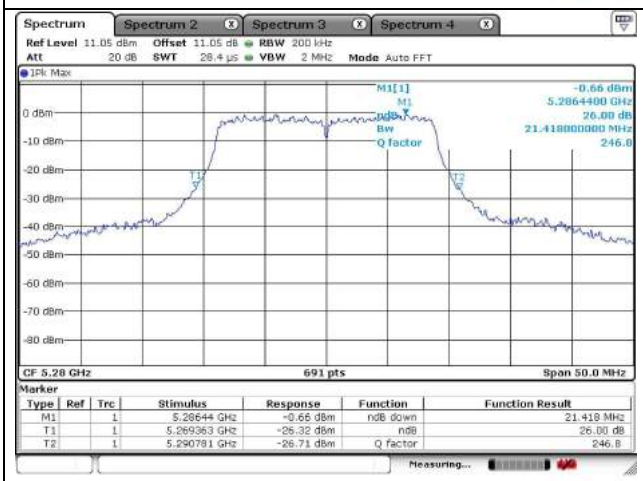
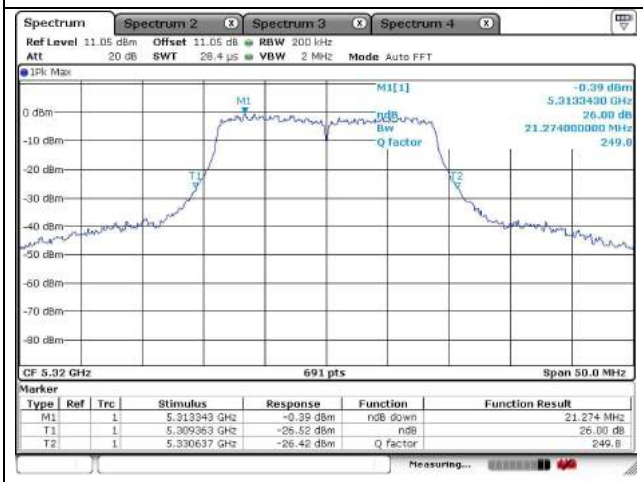
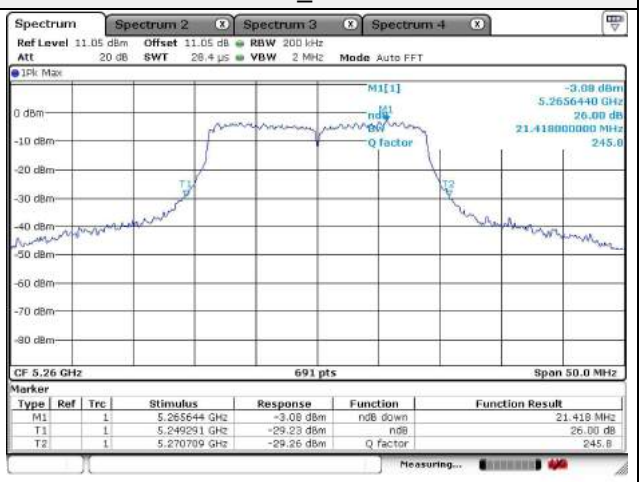
UNII-2A // ac_VHT20 // Ant 1

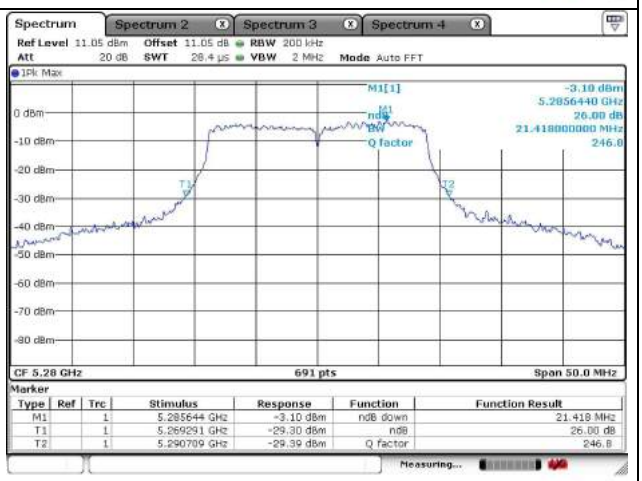


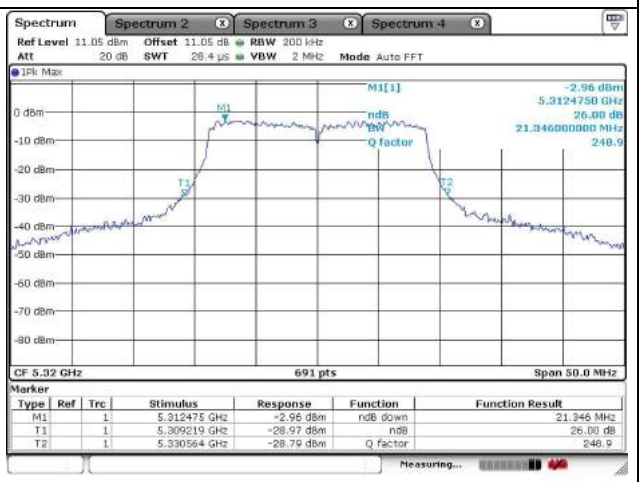




UNII-2A // ac_VHT20 // Ant 2







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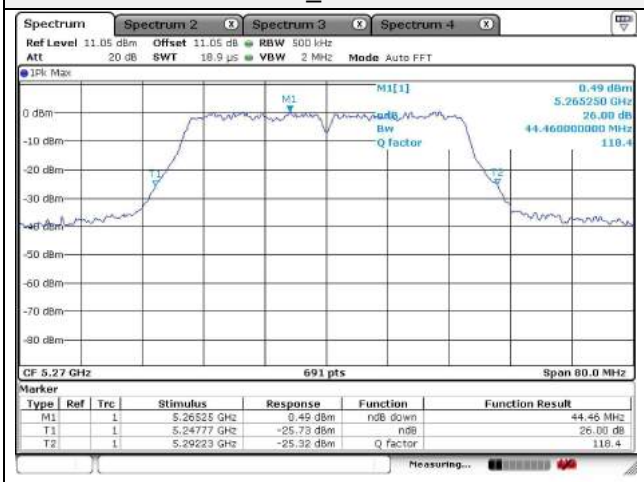
UNII-2A // ac_VHT40 // Ant 1



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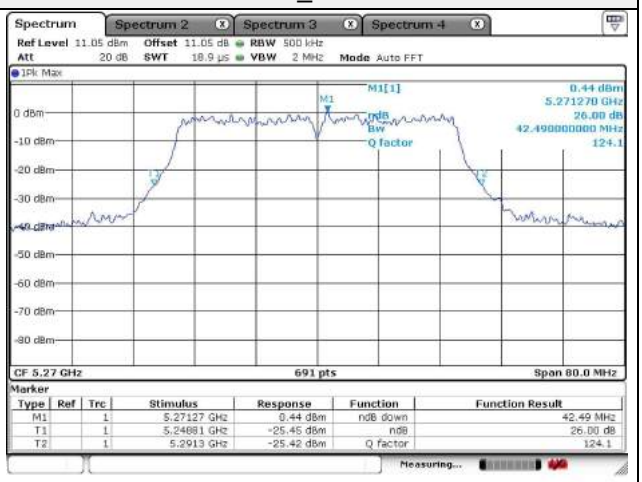
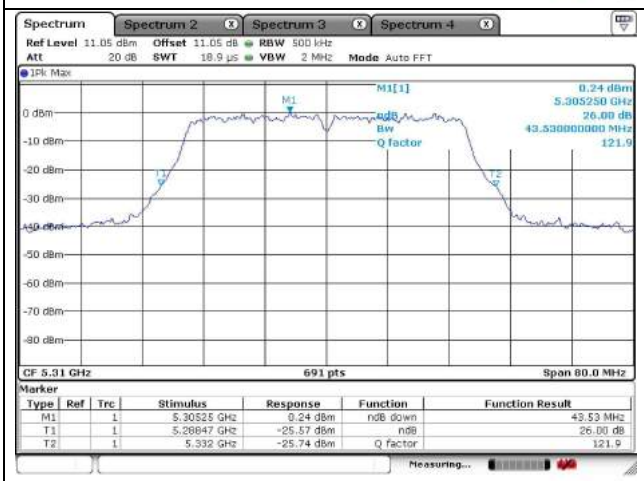
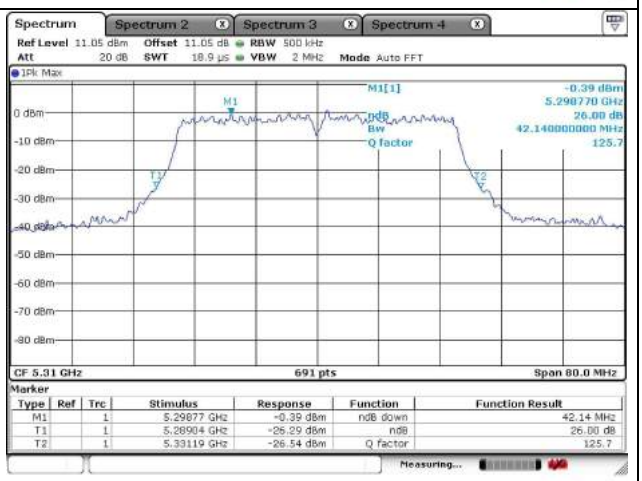
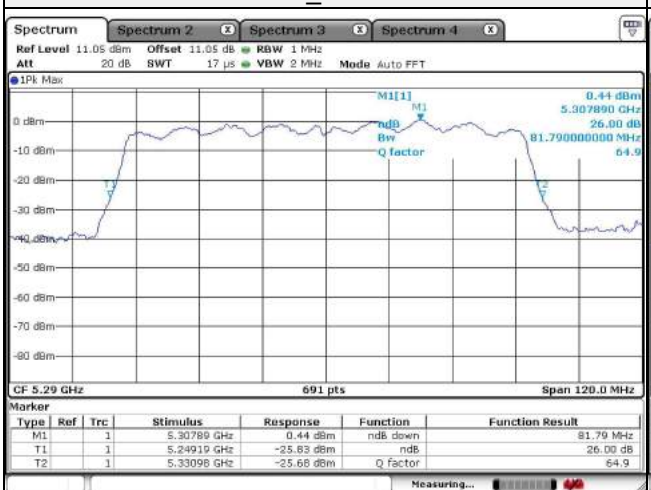


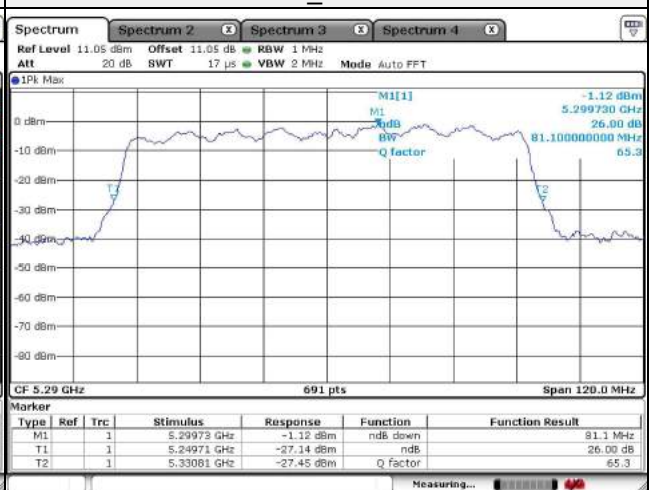




UNII-2A // ac_VHT80 // Ant 1



UNII-2A // ac_VHT80 // Ant 2



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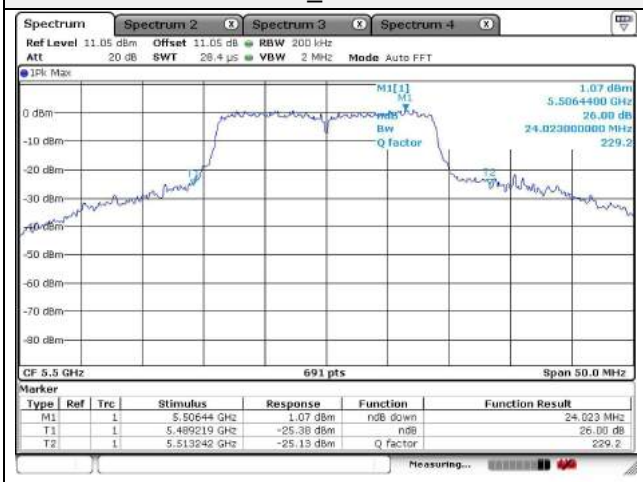
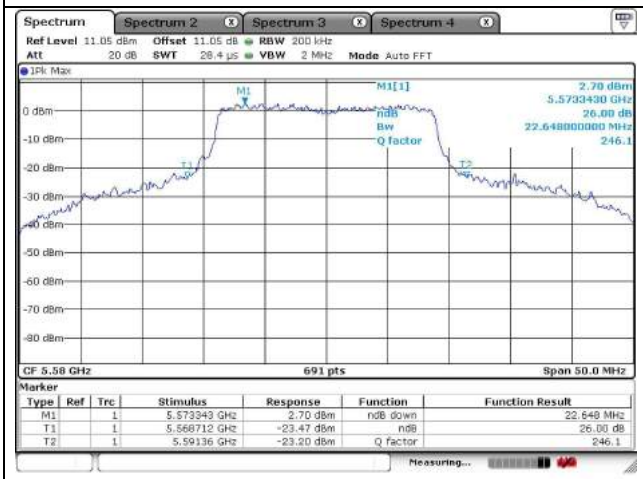
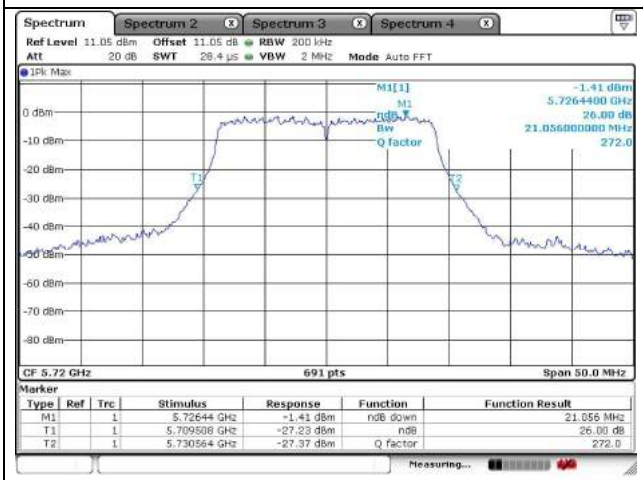
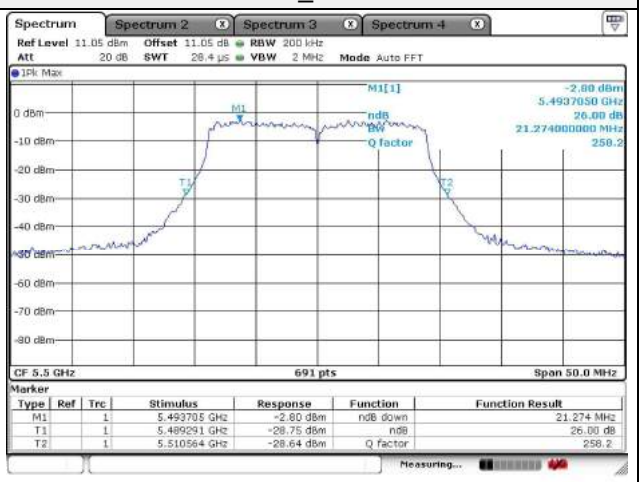
UNII-2C // ac_VHT20 // Ant 1

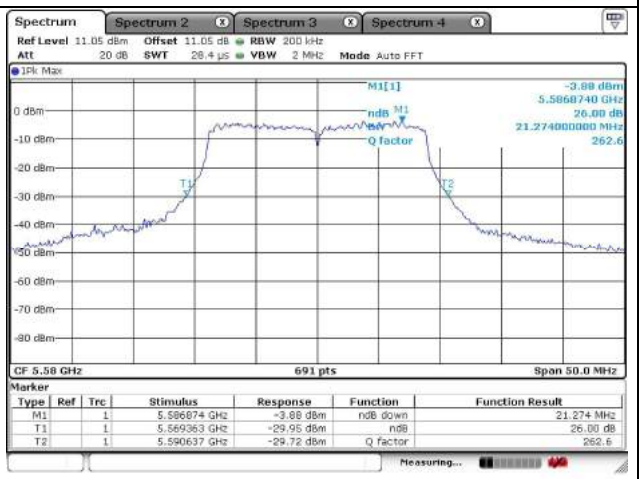


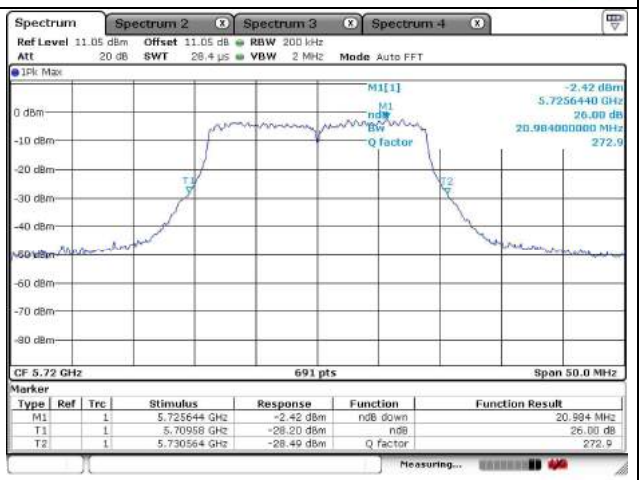




UNII-2C // ac_VHT20 // Ant 2







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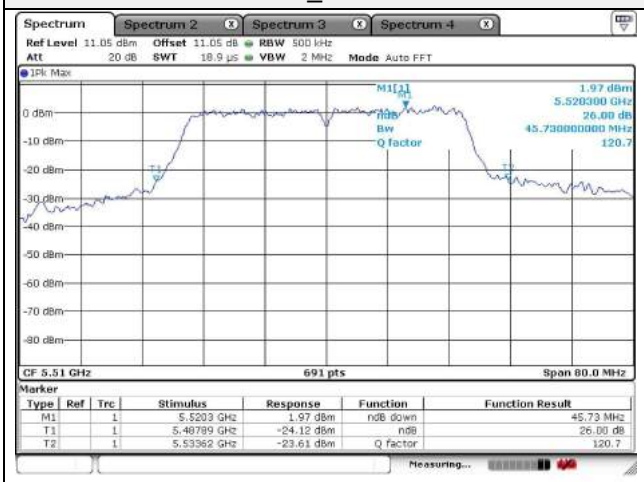
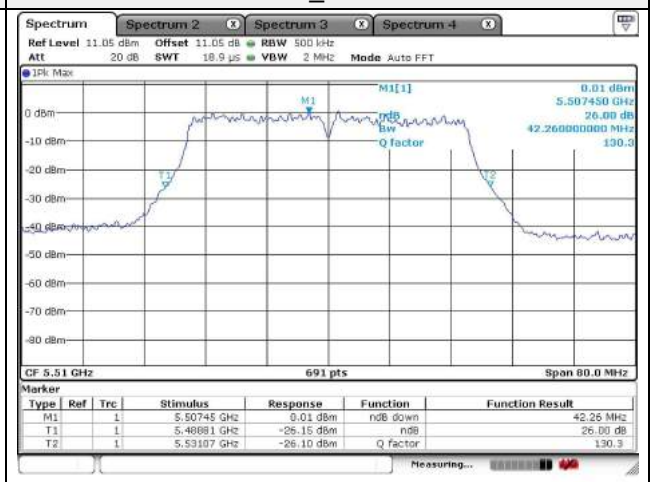
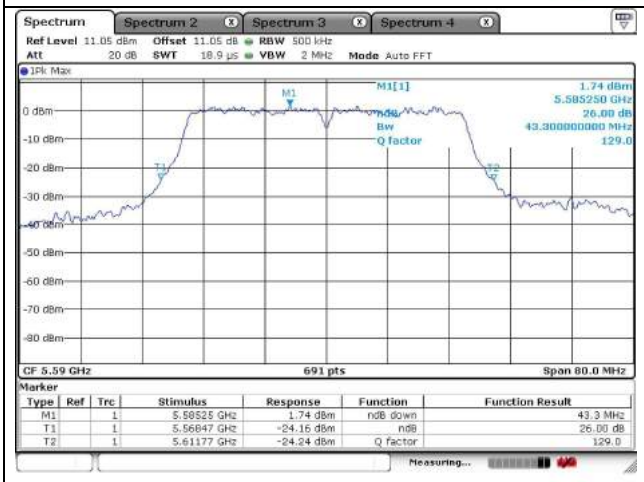
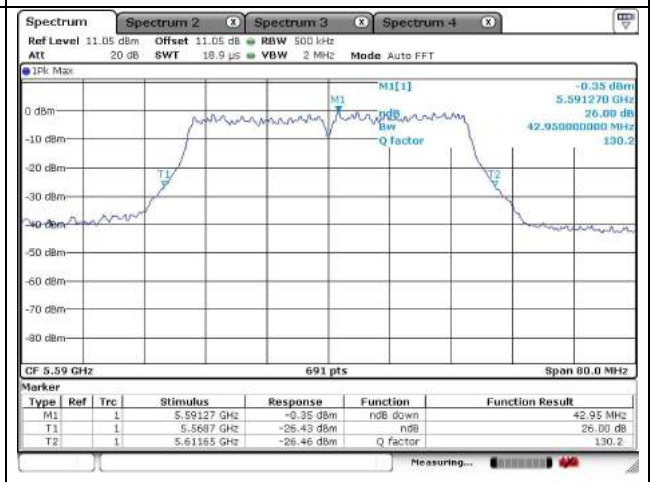
UNII-2C // ac_VHT40 // Ant 1

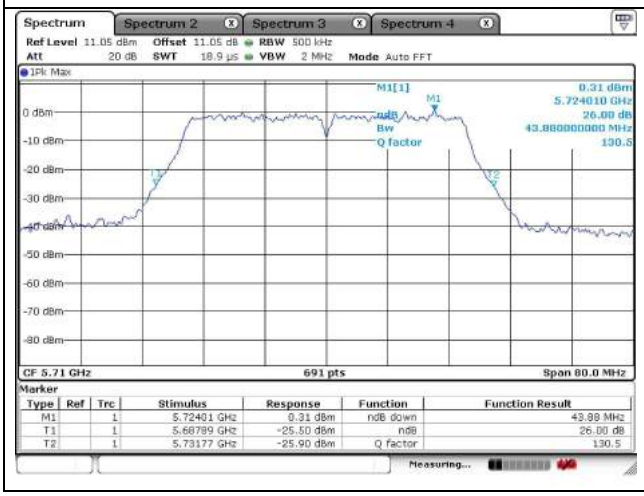


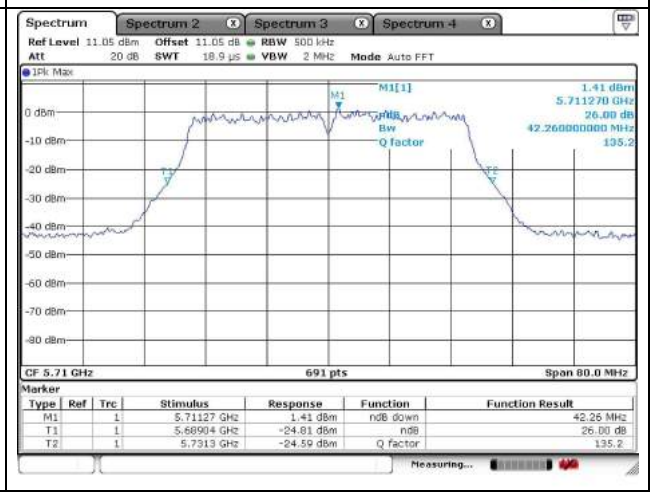
UNII-2C // ac_VHT40 // Ant 2











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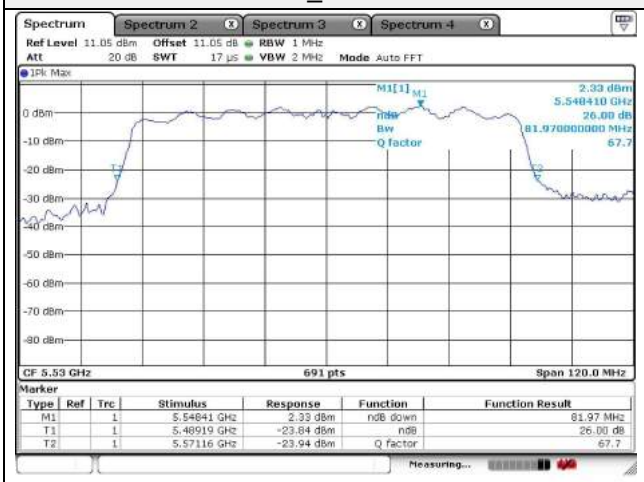
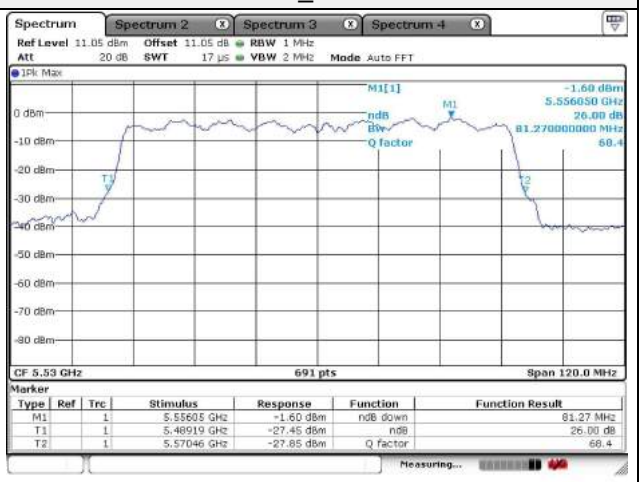
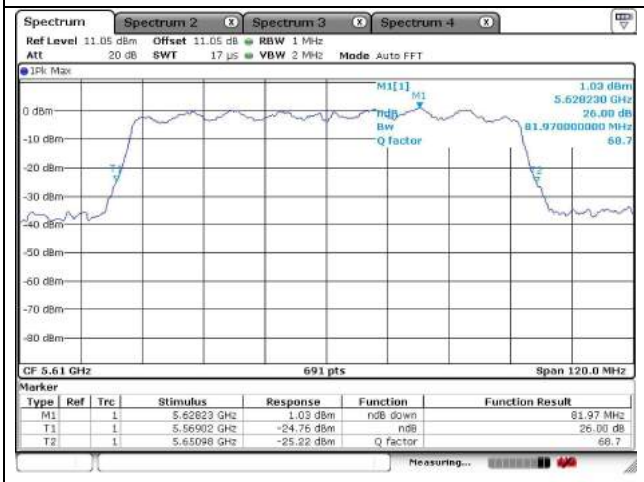
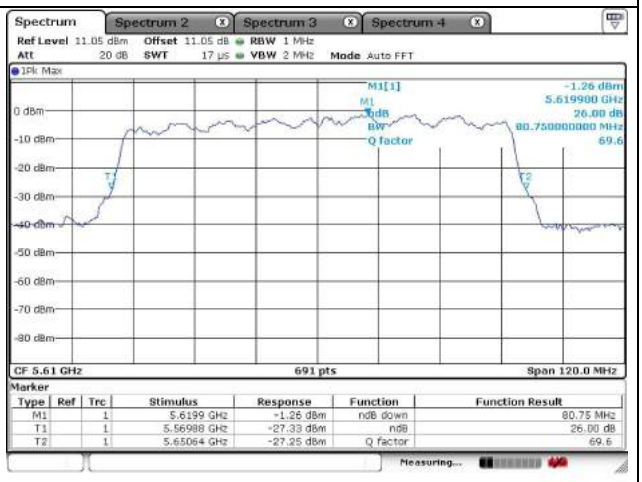
UNII-2C // ac_VHT80 // Ant 1

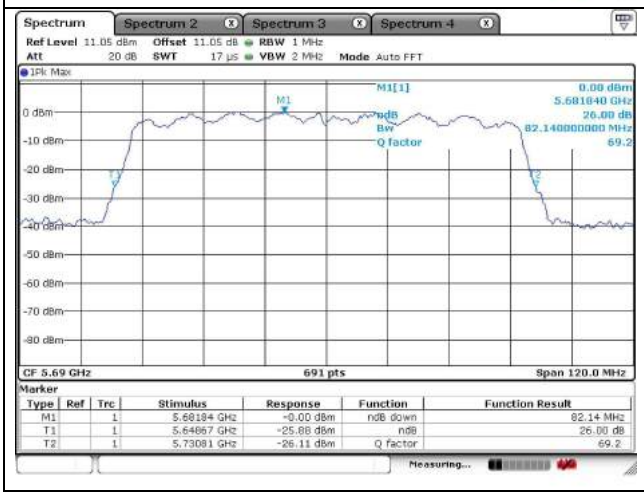


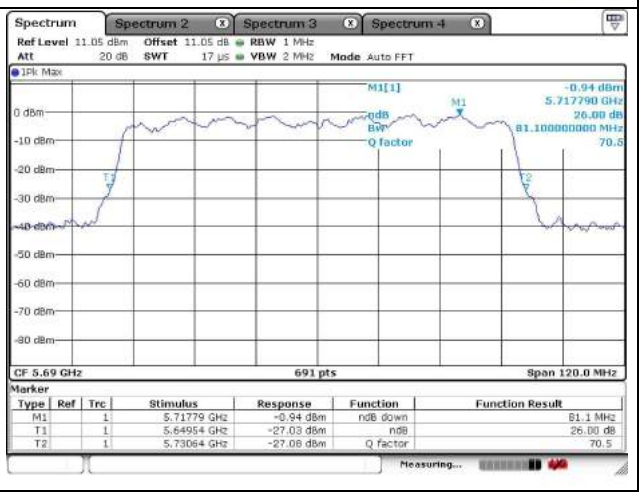
UNII-2C // ac_VHT80 // Ant 2











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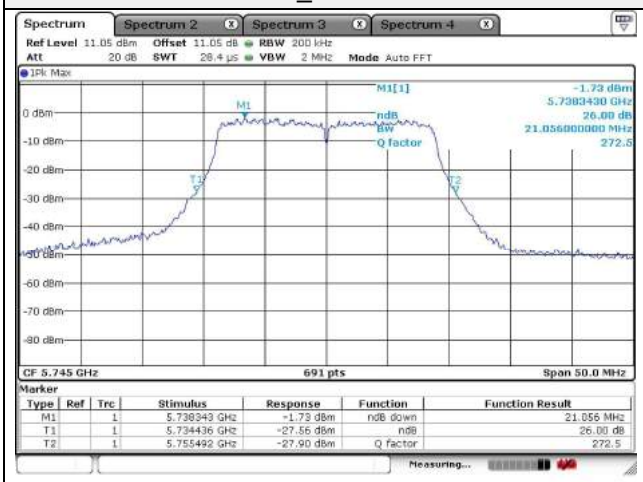
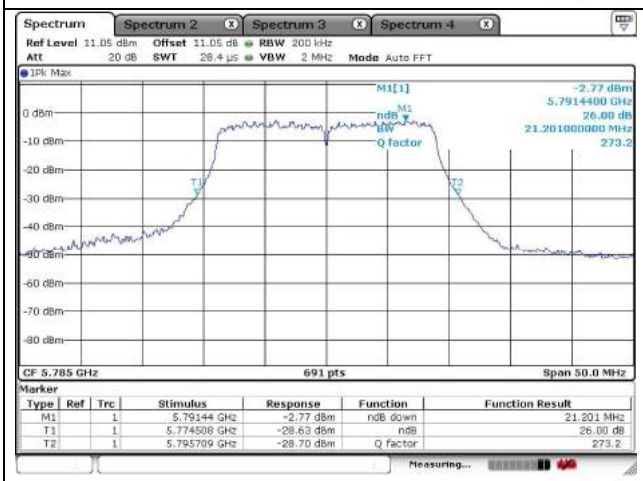
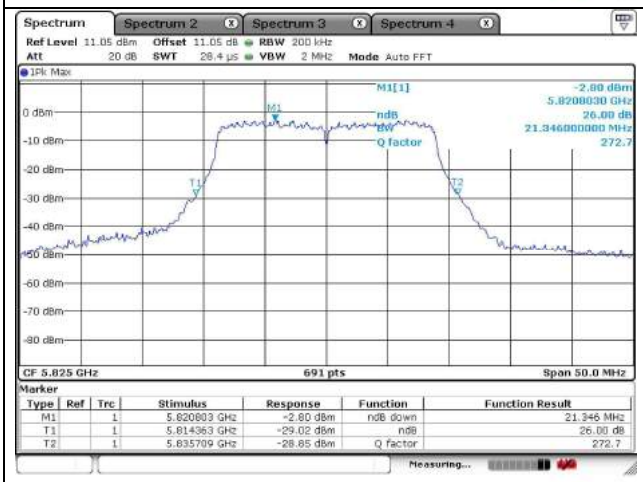
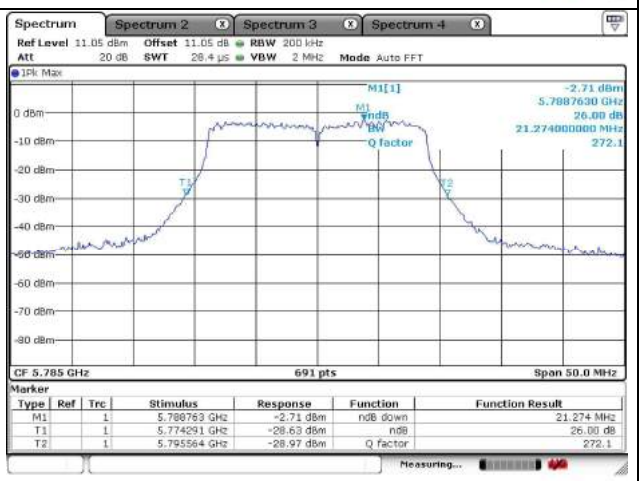
UNII-3 // ac_VHT20 // Ant 1

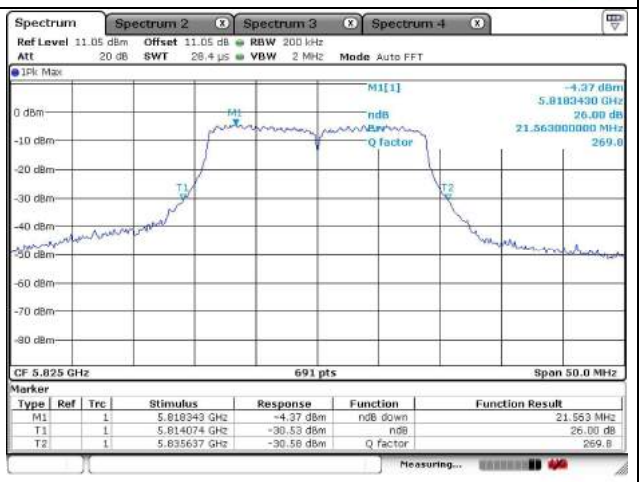






UNII-3 // ac_VHT20 // Ant 2





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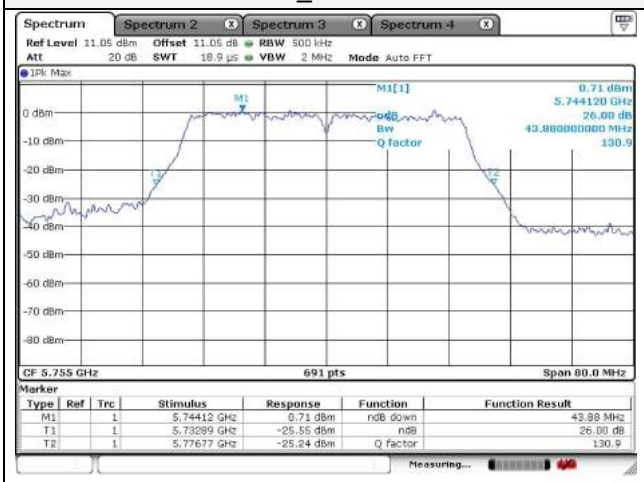
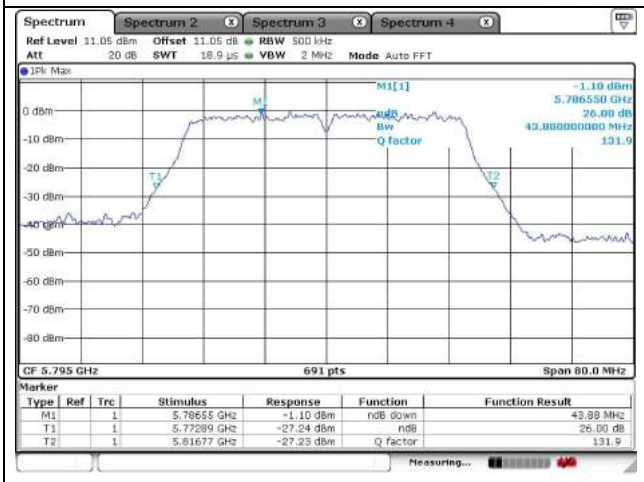
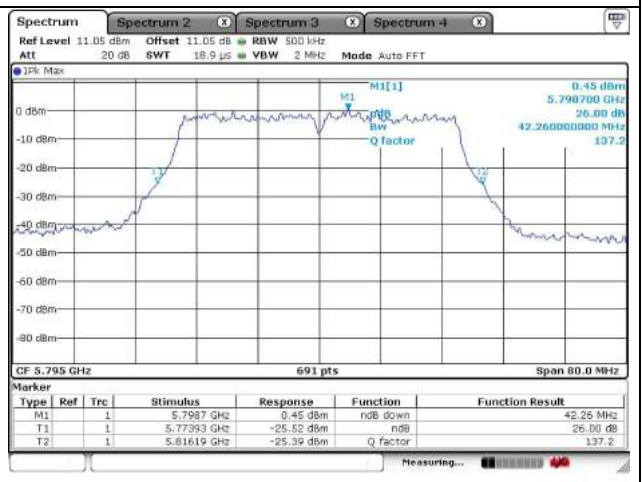
UNII-3 // ac_VHT40 // Ant 1

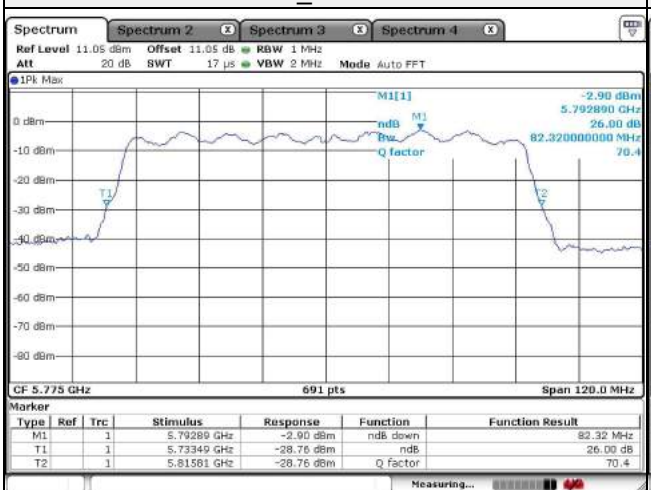


UNII-3 // ac_VHT40 // Ant 2

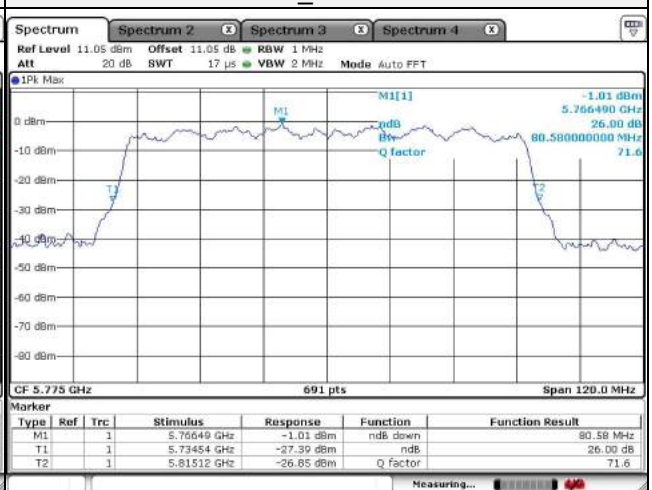




UNII-3 // ac_VHT80 // Ant 1



UNII-3 // ac_VHT80 // Ant 2



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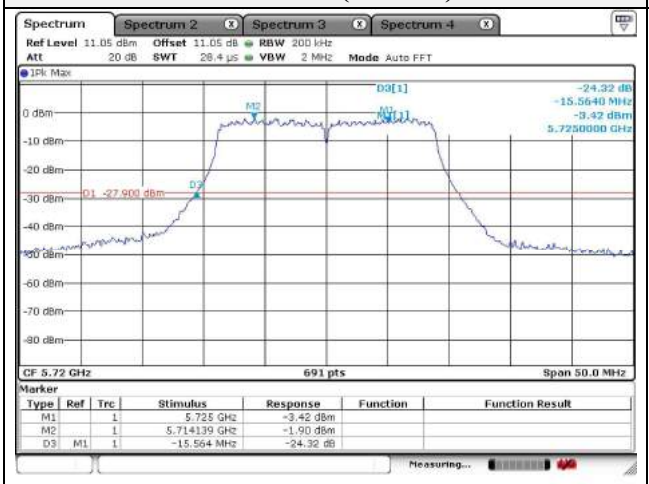
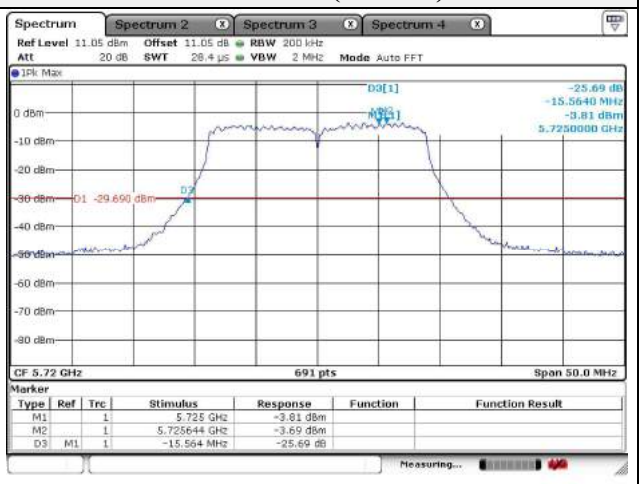
Band-crossing channels

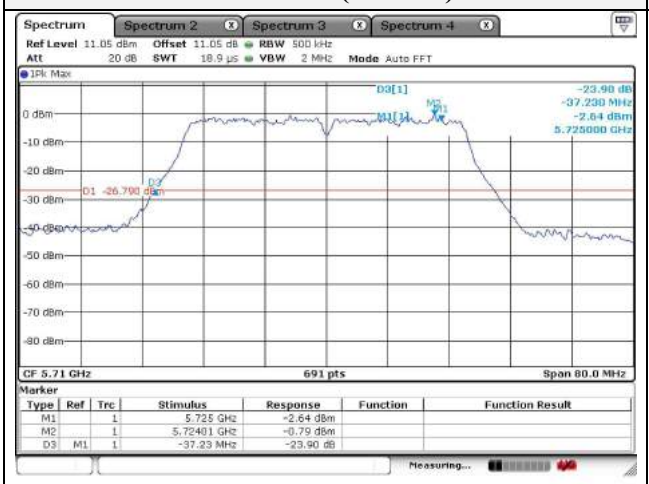
UNII-2C // VHT20 (Ch. 144) // Ant 1



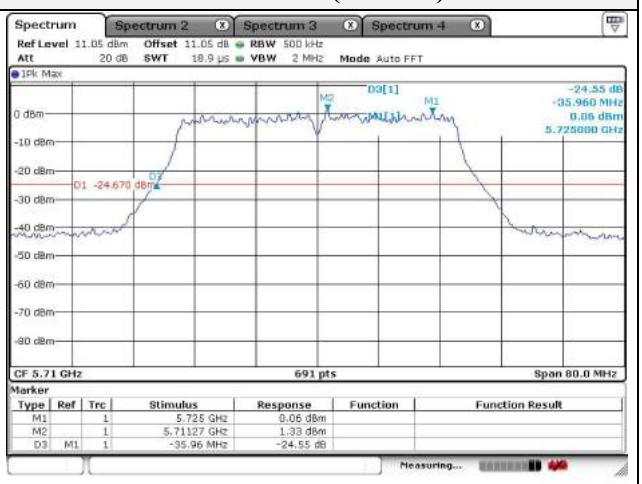
UNII-2C // VHT20 (Ch. 144) // Ant 2



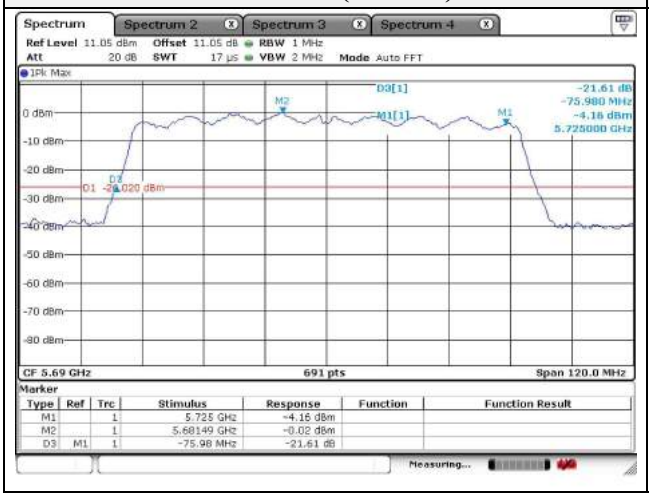
UNII-2C // VHT40 (Ch. 142) // Ant 1



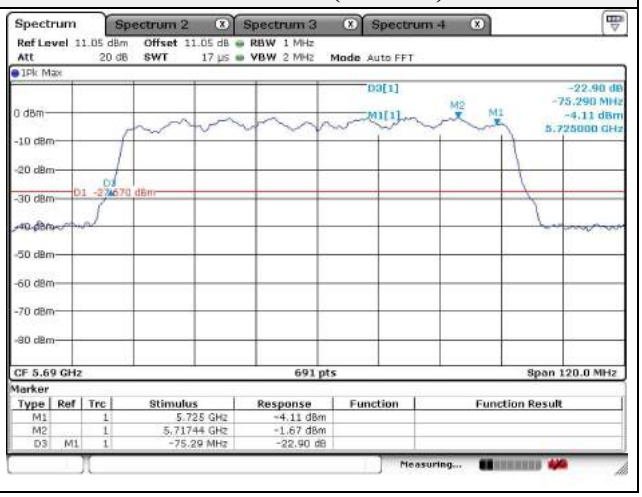
UNII-2C // VHT40 (Ch. 142) // Ant 2



UNII-2C // VHT80 (Ch. 138) // Ant 1



UNII-2C // VHT80 (Ch. 138) // Ant 2



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Test results
99 % bandwidth

Band	Frequency(㎒)	Mode	99 % bandwidth(㎒)	
			Ant1	Ant2
UNII-1	5 240	VHT20	17.873	17.728
UNII-2A	5 260		17.873	17.728
UNII-1	5 230	VHT40	37.279	36.932
UNII-2A	5 270		37.164	36.816
UNII-1	5 210	VHT80	75.253	75.253
UNII-2A	5 290		72.022	75.022

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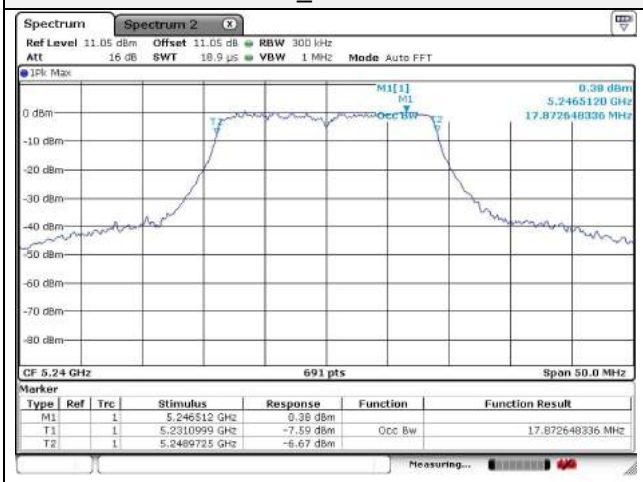
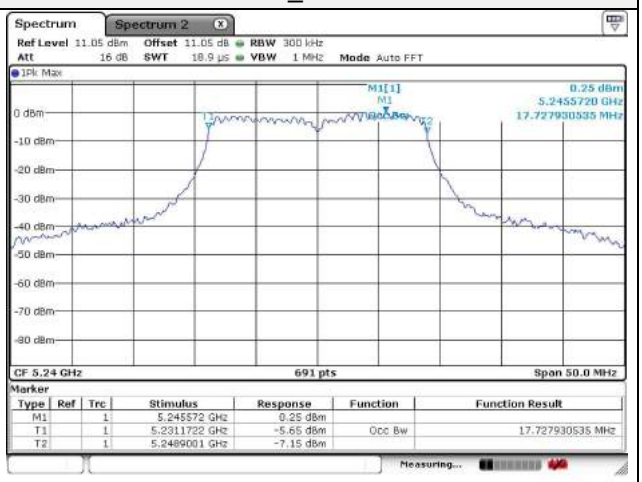
Test plots
99% bandwidth

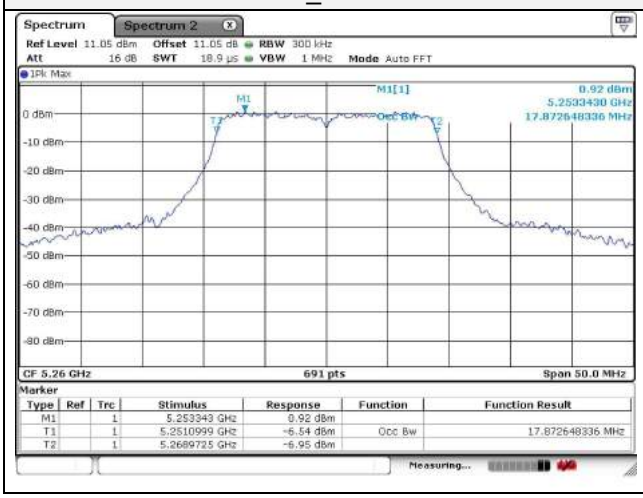
UNII-1 // ac_VHT20 // Ant 1



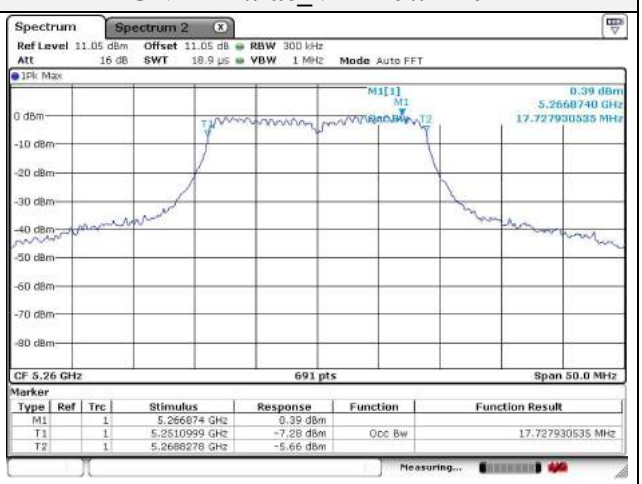
UNII-1 // ac_VHT20 // Ant 2



UNII-2A // ac_VHT20 // Ant 1



UNII-2A // ac_VHT20 // Ant 2



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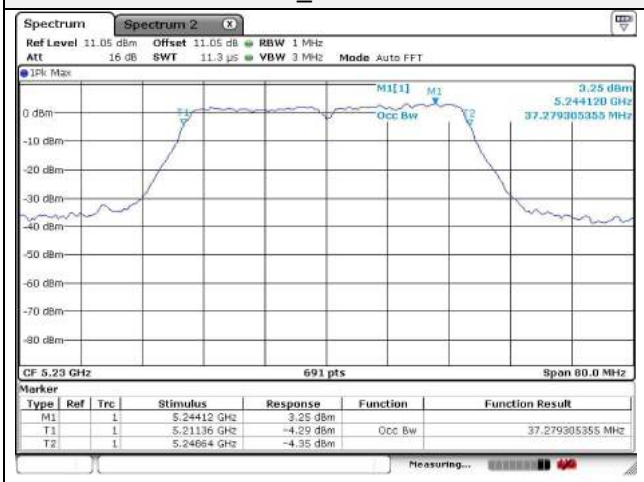
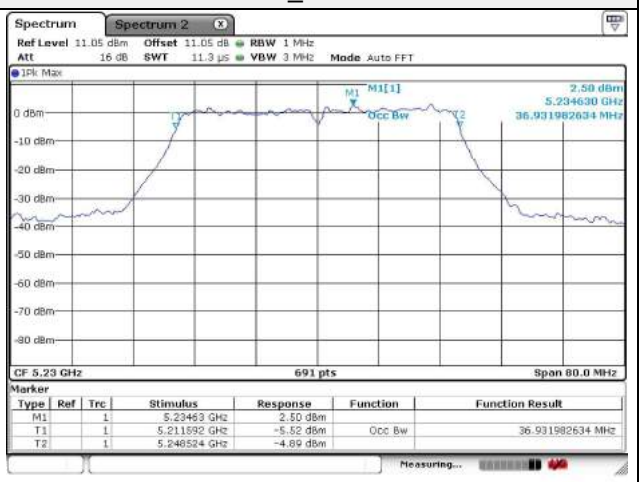
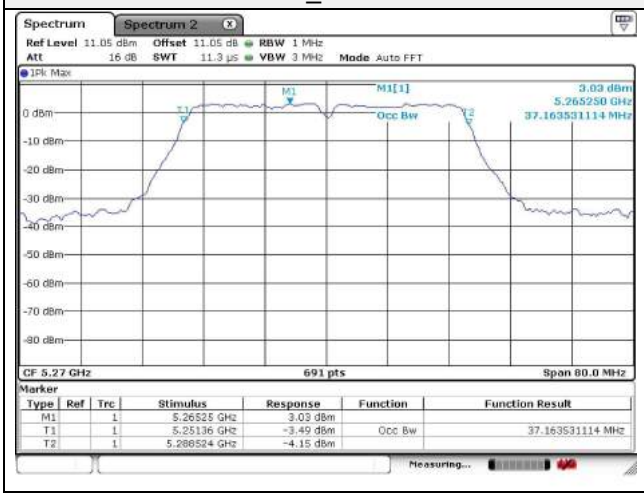
UNII-1 // ac_VHT40 // Ant 1



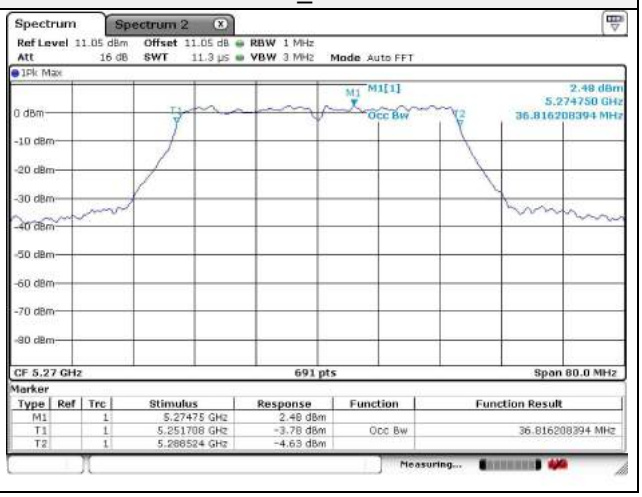
UNII-1 // ac_VHT40 // Ant 2



UNII-2A // ac_VHT40 // Ant 1



UNII-2A // ac_VHT40 // Ant 2



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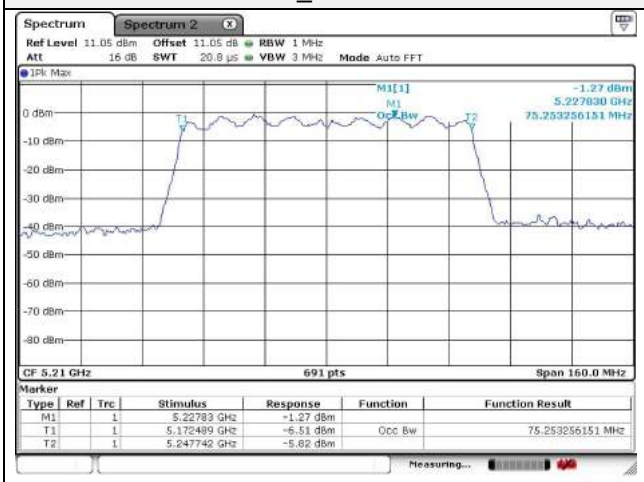
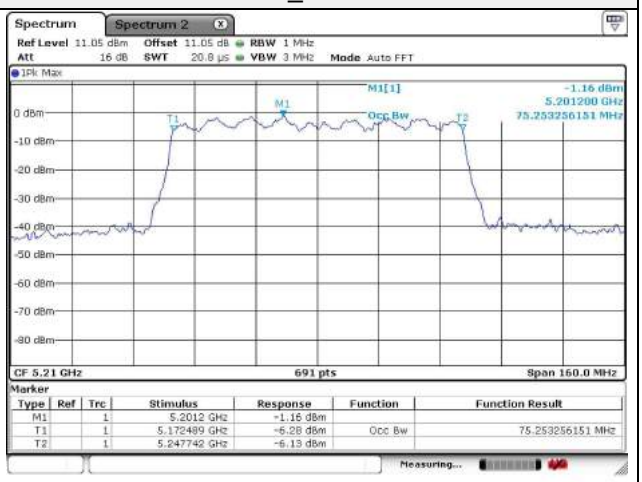
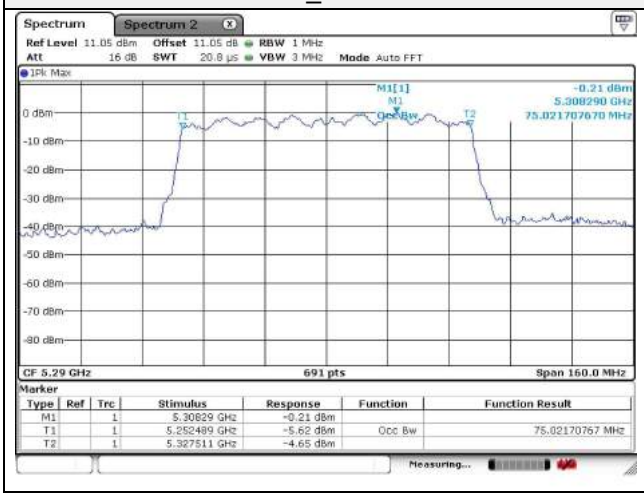
UNII-1 // ac_VHT80 // Ant 1



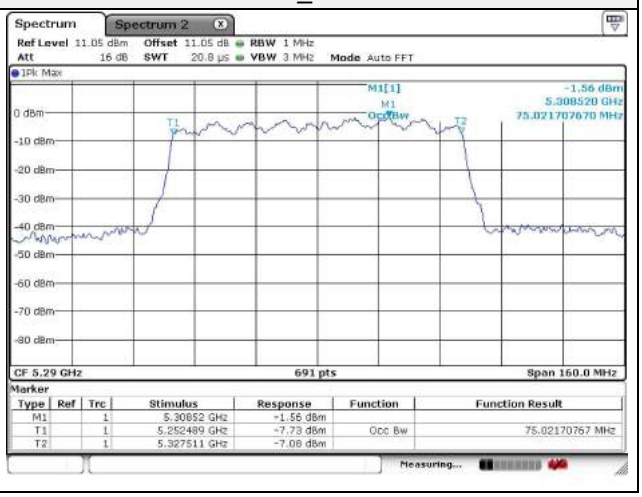
UNII-1 // ac_VHT80 // Ant 2



UNII-2A // ac_VHT80 // Ant 1



UNII-2A // ac_VHT80 // Ant 2



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3.2. 6 dB bandwidth

Test procedure

KDB 789033 D02 v01r04– Section C.2, KDB 644545 D03 v01

1. Set RBW = 100 ㎑
2. Set the video bandwidth (VBW) ≥ 3 × RBW.
3. Detector = peak.
4. Sweep = auto couple.
5. Allow the trace to stabilize
6. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
7. In case of band crossing channels 138, 142 and 144, the measurement is complied with section D of KDB 644545_D03 v01.

Limit

Within the 5.725-5.85 ㎓ band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 ㎑.

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Test results

Band	Frequency(㎒)	Mode	Ant1	Ant2
UNII-3	5 745	VHT20	17.728	17.583
	5 785		17.728	17.656
	5 825		17.800	17.656
	5 755	VHT40	36.470	36.350
	5 795		36.350	36.350
	5 775	VHT80	75.540	75.020
UNII-3 (Band-crossing channels)	5 720	VHT20	3.900	3.828
	5 710	VHT40	3.180	3.180
	5 690	VHT80	2.510	3.030

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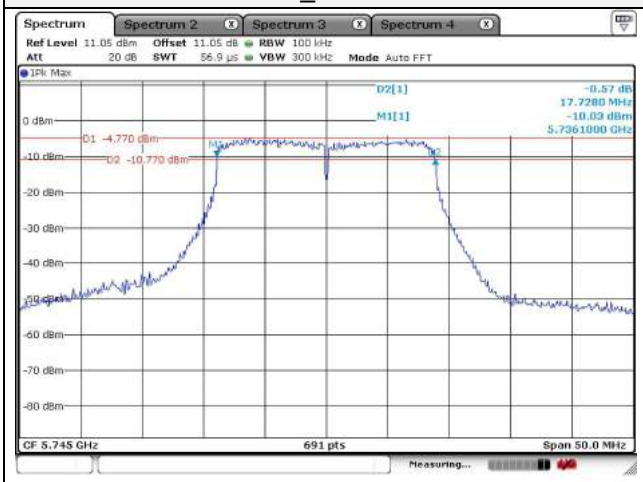
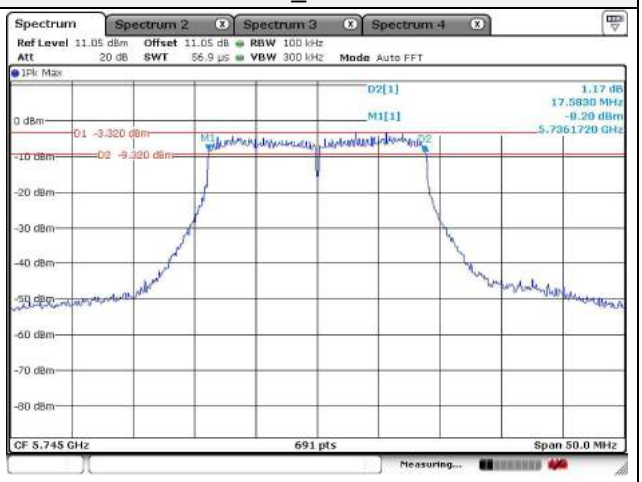
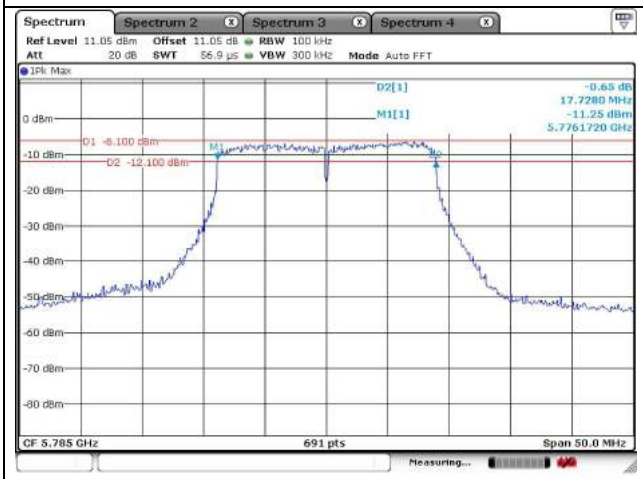
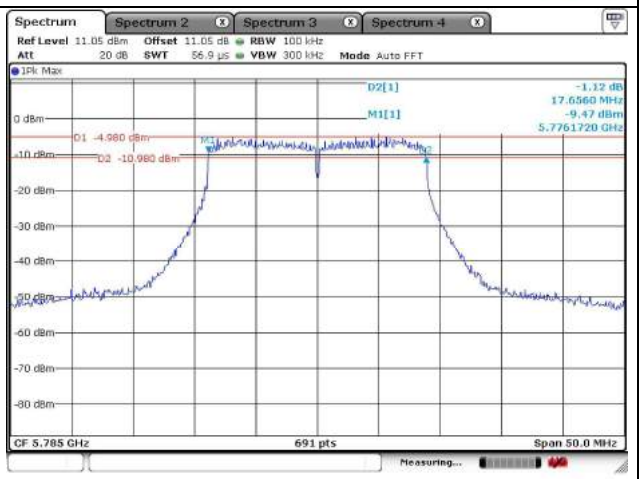
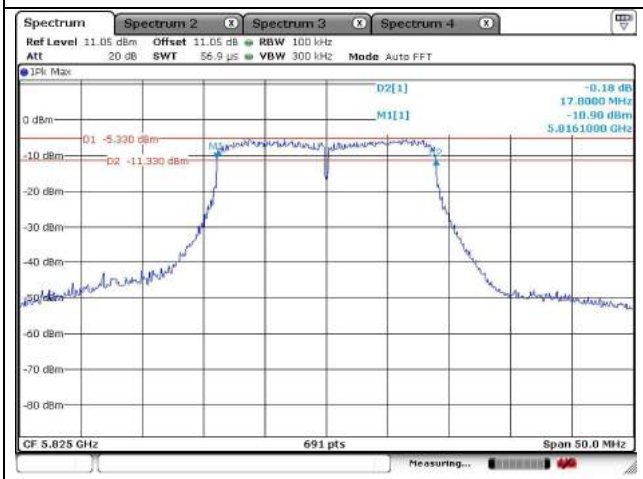
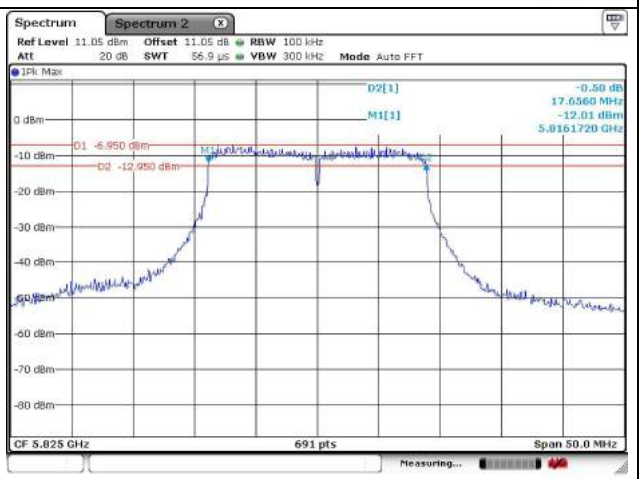
Test plots

UNII-3 // ac_VHT20 // Ant1	UNII-3 // ac_VHT20 // Ant2
	
	
	

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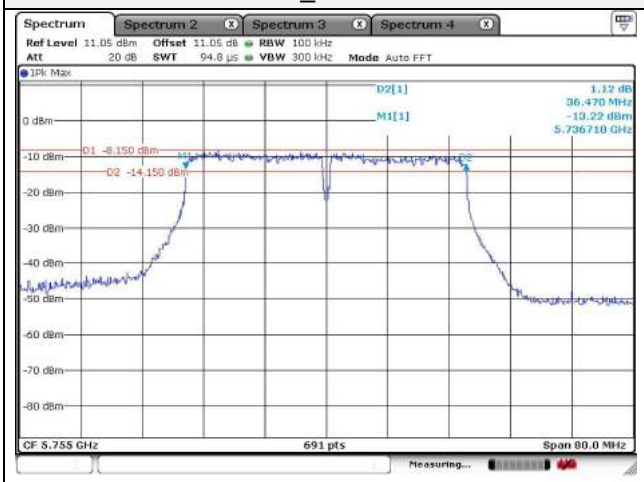
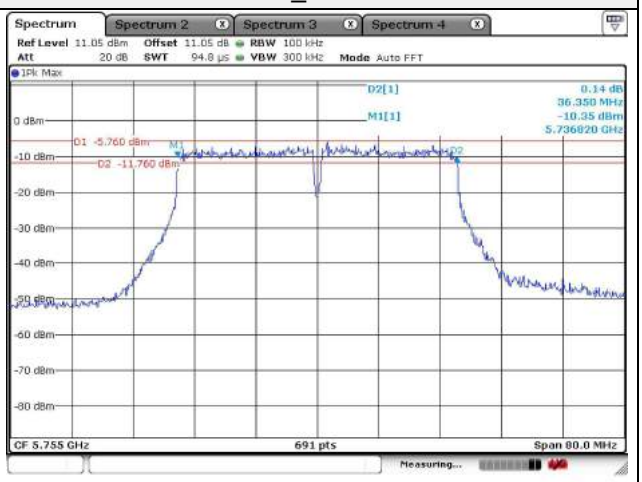
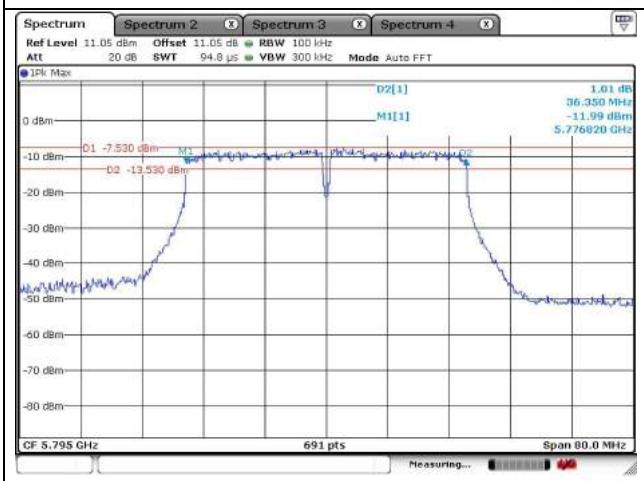
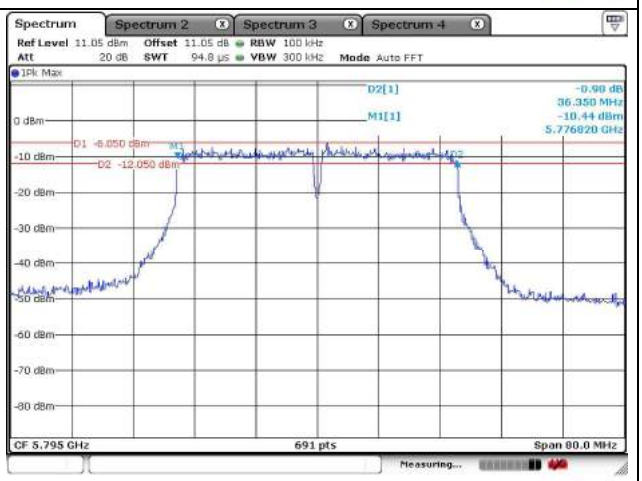
UNII-3 // ac_VHT40 // Ant1



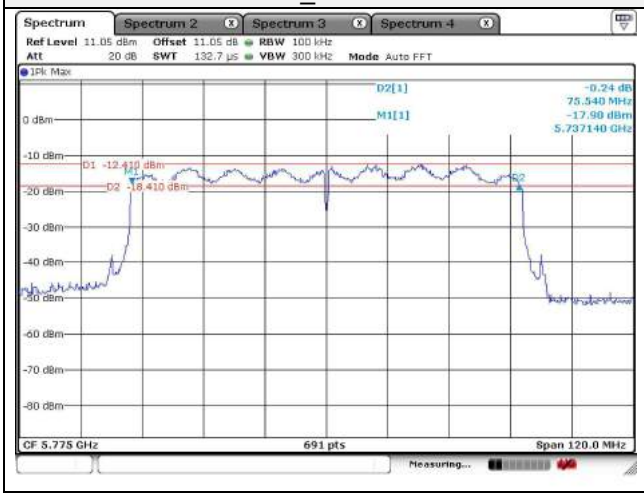
UNII-3 // ac_VHT40 // Ant2



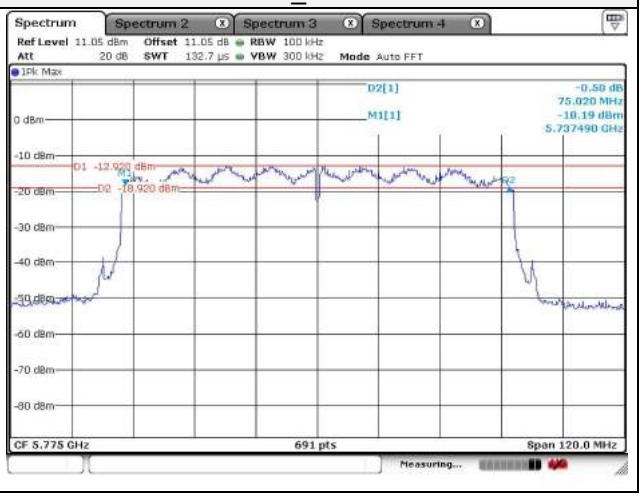




UNII-3 // ac_VHT80 // Ant1



UNII-3 // ac_VHT80 // Ant2



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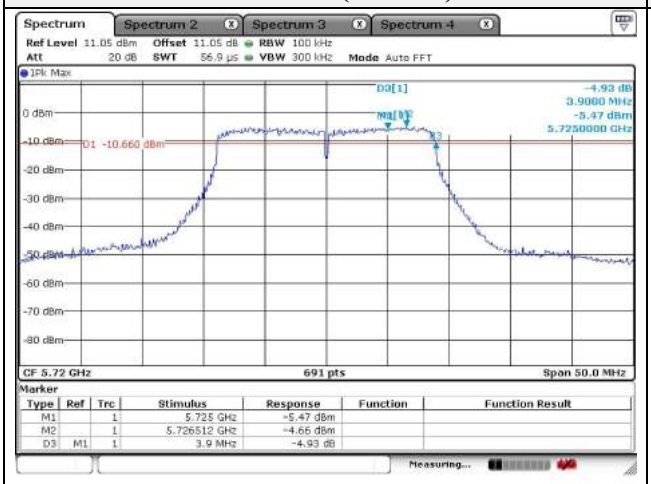
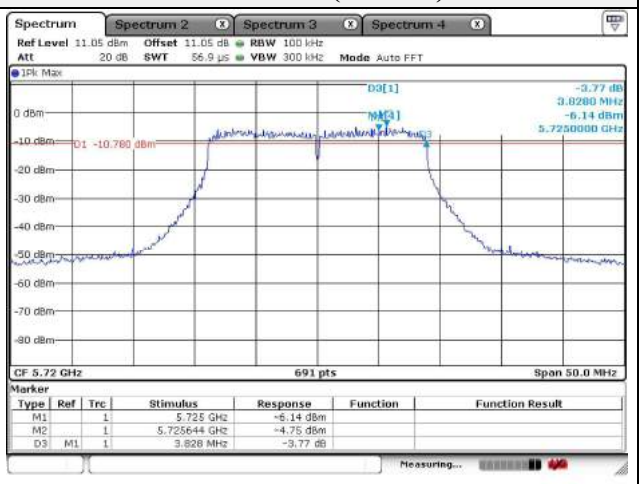
Band-crossing channels

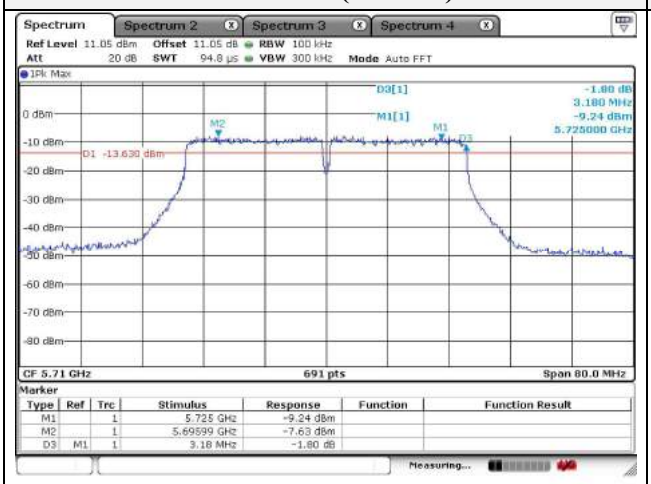
UNII-2C // VHT20 (Ch. 144) // Ant 1



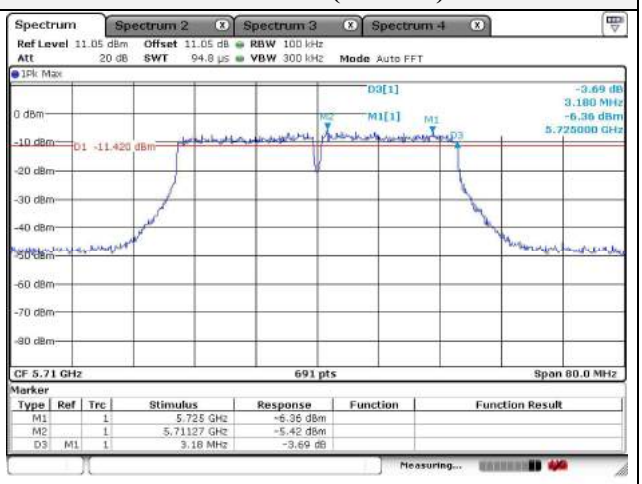
UNII-2C // VHT20 (Ch. 144) // Ant 2



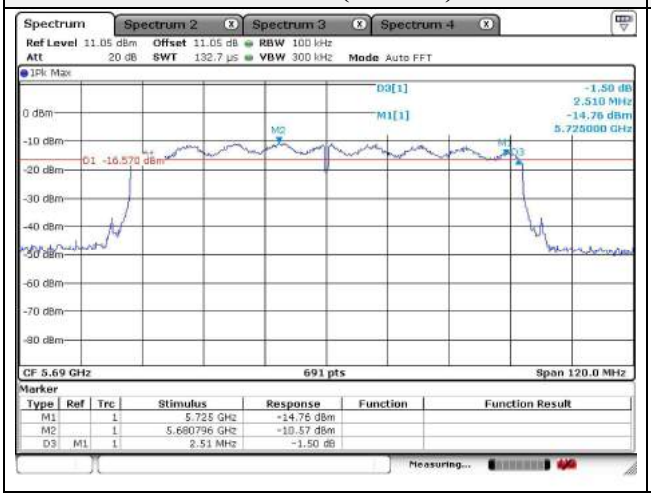
UNII-2C // VHT40 (Ch. 142) // Ant 1



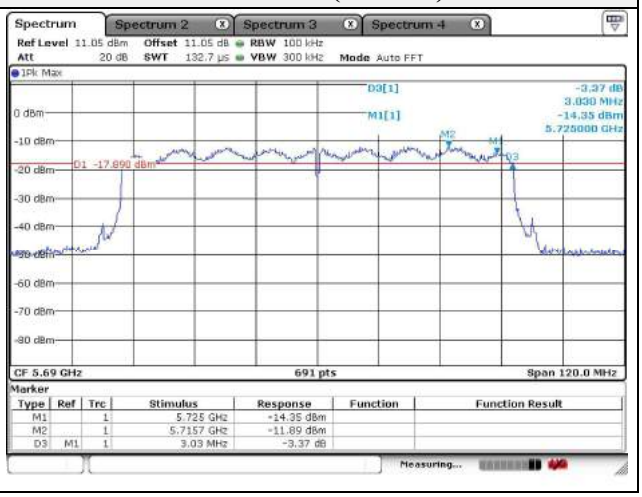
UNII-2C // VHT40 (Ch. 142) // Ant 2



UNII-2C // VHT80 (Ch. 138) // Ant 1



UNII-2C // VHT80 (Ch. 138) // Ant 2



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3.3. Maximum conducted output power

Test procedure

KDB 789033 D02 v01r04– Section E.3.a) or b), KDB 644545 D03 v01

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 %).

v. In case of band crossing channels 138, 142 and 144, the measurement is complied with section E.2.d of KDB 644545_D03 v01

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.

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. B is the 26 dB emission bandwidth.

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Test results

Band	mode	Frequency (㎒)	Detector mode	DCF Note1	Output power(dBm)			Limit (dBm) Note2
					Ant 1	Ant 2	Ant 1+2	
UNII-1	ac_20	5 180	AV	-	10.85	11.15	14.01	24.00
		5 220			10.15	9.65	12.92	
		5 240			11.05	10.45	13.77	
	ac_40	5 190		-	11.06	11.27	14.18	
		5 230			10.70	10.47	13.60	
	ac_80	5 210		-	8.73	8.50	11.63	
UNII-2A	ac_20	5 260	AV	-	11.26	10.47	13.89	24.00
		5 280			11.22	10.44	13.86	
		5 320			11.41	10.25	13.88	
	ac_40	5 270		-	11.19	10.56	13.90	
		5 310			11.70	10.43	14.12	
	ac_80	5 290		-	9.44	8.60	12.05	
UNII-2C	ac_20	5 500	AV	-	10.27	10.31	13.30	23.55
		5 580			9.45	9.08	12.28	
		5 720			8.99	10.18	12.64	
	ac_40	5 510		-	10.23	10.26	13.26	
		5 590			9.45	9.87	12.68	
		5 710			9.34	10.85	13.17	
	ac_80	5 530		-	8.02	8.06	11.05	
		5 610			7.36	8.05	10.73	
		5 690			7.95	8.12	11.05	
UNII-3	ac_20	5 745	AV	-	8.85	10.50	12.76	21.37
		5 785			7.45	9.92	11.87	
		5 825			6.18	8.67	10.61	
	ac_40	5 755		-	8.22	10.55	12.55	
		5 795			7.36	9.96	11.86	
	ac_80	5 775		-	6.15	7.86	10.10	

Band-crossing channels

Band	mode	Frequency (㎒)	Detector mode	DCF Note1	Output power(dBm)			Limit (dBm) Note2
					Ant 1	Ant 2	Ant 1+2	
UNII-2C	ac_20	5 720	AV	-	7.70	7.39	10.56	23.55
	ac_40	5 710		-	9.09	8.20	11.68	
	ac_80	5 690		-	7.32	6.78	10.07	
UNII-3	ac_20	5 720	AV	-	2.71	2.17	5.46	21.37
	ac_40	5 710		-	-1.39	-1.84	1.40	
	ac_80	5 690		-	-8.85	-7.71	-5.23	

Note.

1. Refer to the page 58 on this report.
2. The limit is the reduction value for the antenna gain. Refer to the page 7 on this report.

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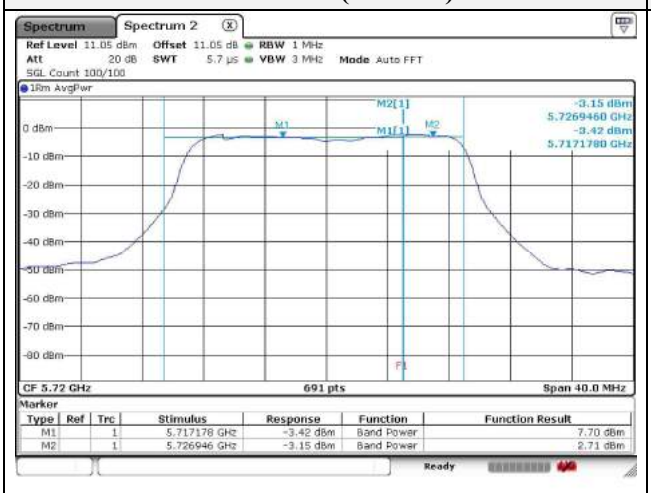
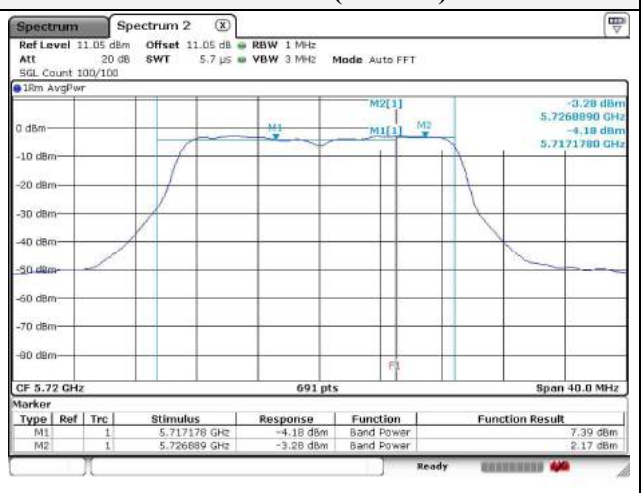
Band-crossing channels

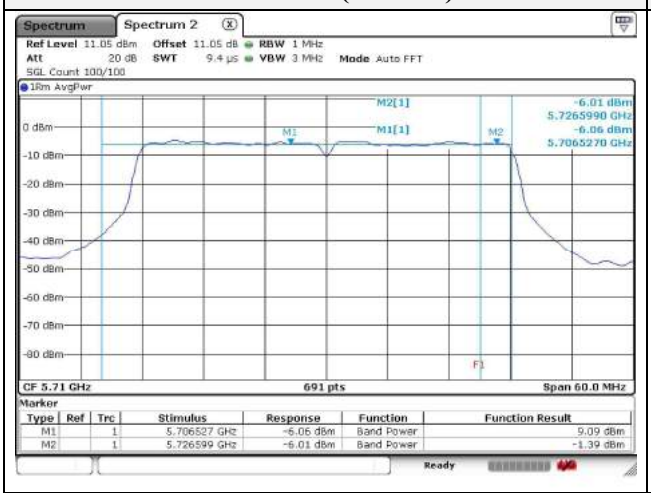
UNII-2C // VHT20 (Ch. 144) // Ant 1



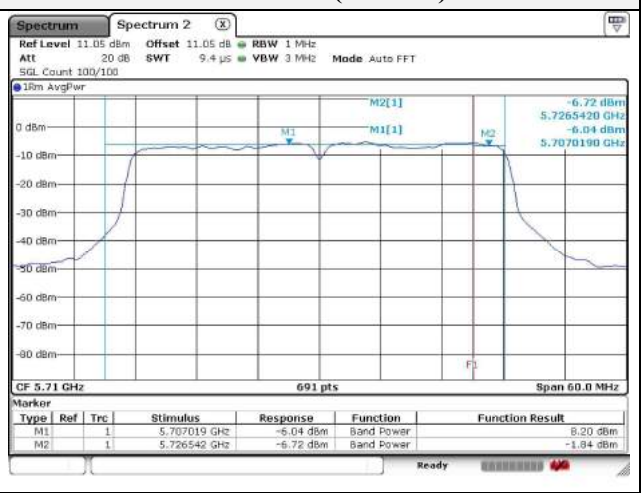
UNII-2C // VHT20 (Ch. 144) // Ant 2



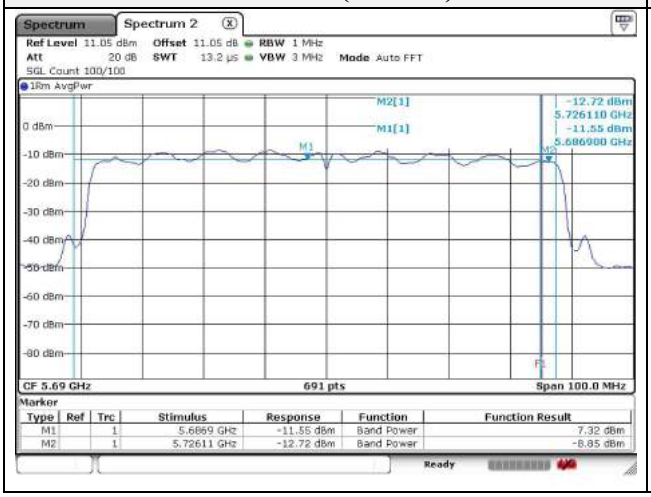
UNII-2C // VHT40 (Ch. 142) // Ant 1



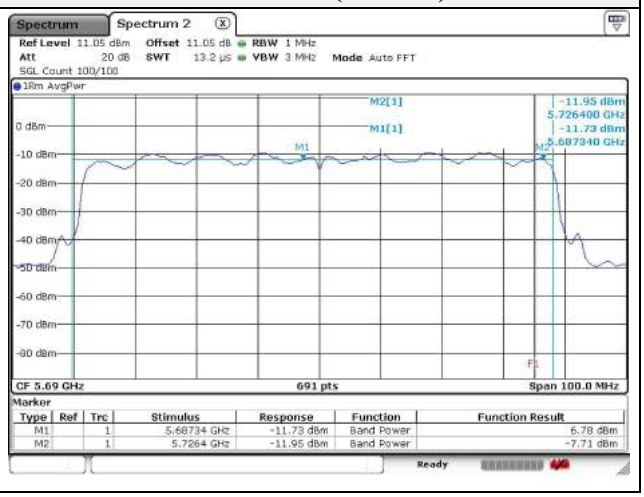
UNII-2C // VHT40 (Ch. 142) // Ant 2



UNII-2C // VHT80 (Ch. 138) // Ant 1



UNII-2C // VHT80 (Ch. 138) // Ant 2



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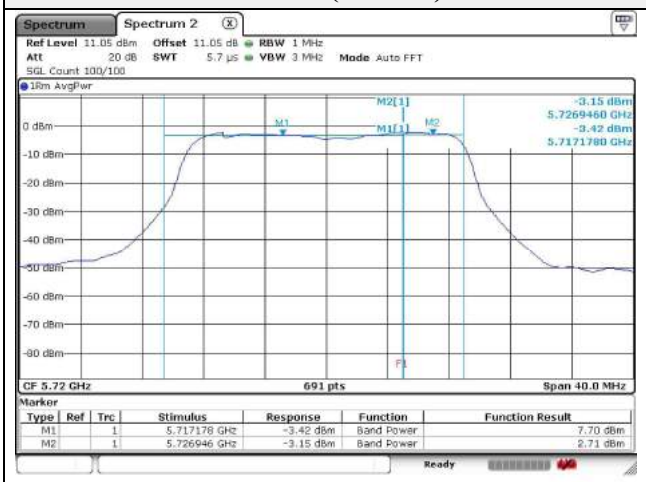
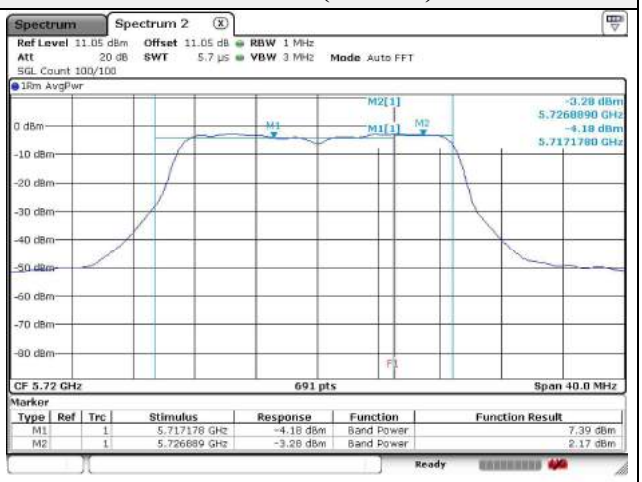
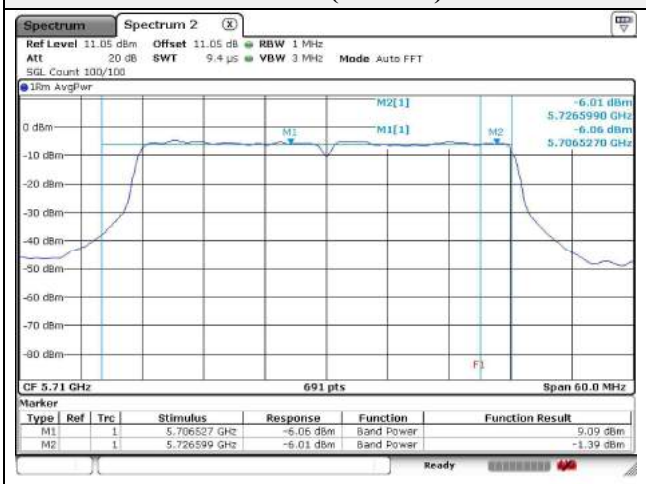
UNII-3 // VHT20 (Ch. 144) // Ant 1



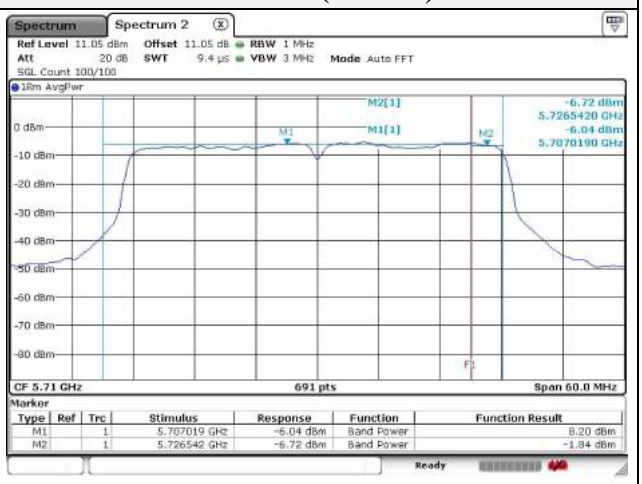
UNII-3 // VHT20 (Ch. 144) // Ant 2



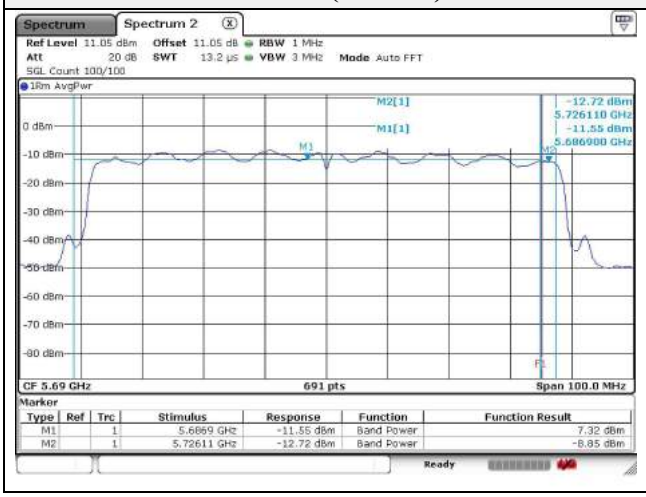
UNII-3 // VHT40 (Ch. 142) // Ant 1



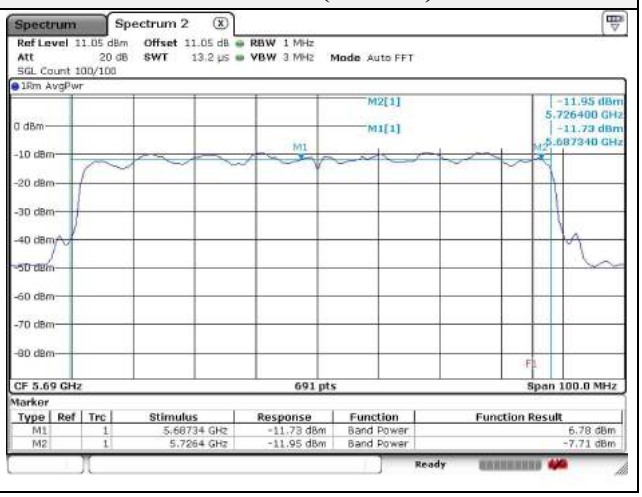
UNII-3 // VHT40 (Ch. 142) // Ant 2



UNII-3 // VHT80 (Ch. 138) // Ant 1



UNII-3 // VHT80 (Ch. 138) // Ant 2



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3.4. Power spectral density

Test procedure

KDB 789033 D02 v01r04 – Section F, KDB 644545 D03 v01

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.
6. In case of band crossing channels 138, 142 and 144, the measurement is complied with section D of KDB 644545_D03 v01.

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 ㎑

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Test results

Band	mode	Frequency (㎒)	Measured PSD(dBm)			Limit Note1
			Ant 1	Ant 2	Ant 1+2	
UNII-1	ac_20	5 180	-0.23	-2.91	1.64	11.00 dBm/㎒
		5 220	-1.74	-3.45	0.50	
		5 240	-1.02	-3.40	0.96	
	ac_40	5 190	-3.69	-4.41	-1.02	
		5 230	-4.03	-5.25	-1.59	
	ac_80	5 210	-7.62	-10.03	-5.65	
UNII-2A	ac_20	5 260	-1.45	-2.04	1.28	11.00 dBm/㎒
		5 280	-1.85	-2.90	0.67	
		5 320	-1.21	-2.71	1.11	
	ac_40	5 270	-4.93	-6.58	-2.67	
		5 310	-3.46	-5.16	-1.22	
	ac_80	5 290	-8.30	-9.35	-5.78	
UNII-2C	ac_20	5 500	0.30	-2.04	2.30	10.55 dBm/㎒
		5 580	1.10	-3.80	2.32	
		5 720	-1.99	-2.08	0.98	
	ac_40	5 510	-2.08	-5.17	-0.35	
		5 590	-2.35	-5.49	-0.63	
		5 710	-3.60	-4.90	-1.19	
	ac_80	5 530	-5.22	-9.83	-3.93	
		5 610	-6.79	-8.93	-4.72	
		5 690	-6.71	-8.25	-4.40	
UNII-3	ac_20	5 745	-4.77	-4.97	-1.86	27.37 dBm/500㎑
		5 785	-5.61	-5.73	-2.66	
		5 825	-6.45	-6.44	-3.43	
	ac_40	5 755	-7.98	-7.79	-4.87	
		5 795	-7.77	-9.26	-5.44	
	ac_80	5 775	-13.24	-12.42	-9.80	

Band-crossing channels

Band	mode	Frequency (㎒)	Measured PSD(dBm)			Limit Note1
			Ant 1	Ant 2	Ant 1+2	
UNII-2C	ac_20	5 720	-2.03	-3.51	0.30	10.55 dBm/㎒
	ac_40	5 710	-7.51	-4.35	-2.64	
	ac_80	5 690	-10.32	-9.59	-6.93	
UNII-3	ac_20	5 720	-5.23	-5.94	-2.56	27.37 dBm/500㎑
	ac_40	5 710	-11.19	-8.47	-6.61	
	ac_80	5 690	-10.32	-14.82	-9.00	

Note.

1. The limit is the reduction value for the antenna gain. Refer to the page 7 on this report.

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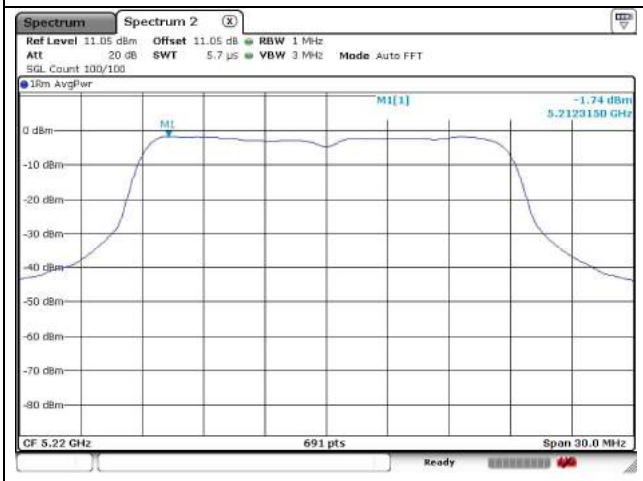
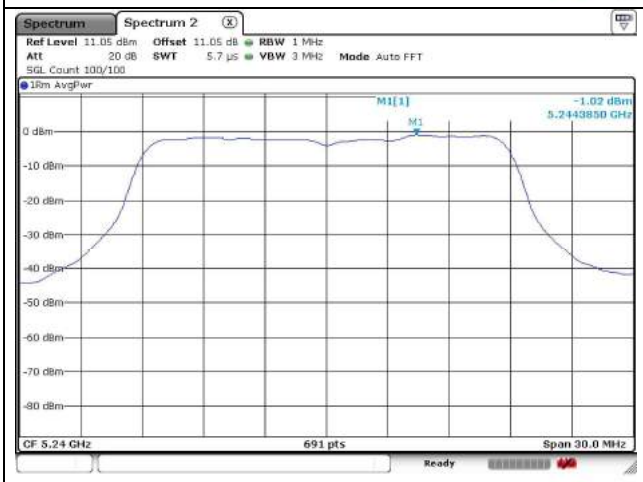
Test plots

UNII-1 // ac_VHT20 // Ant 1	UNII-1 // ac_VHT20 // Ant 2
	
	

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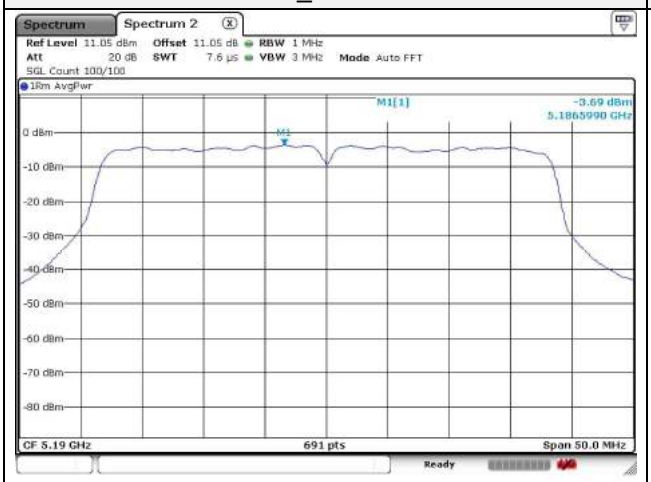
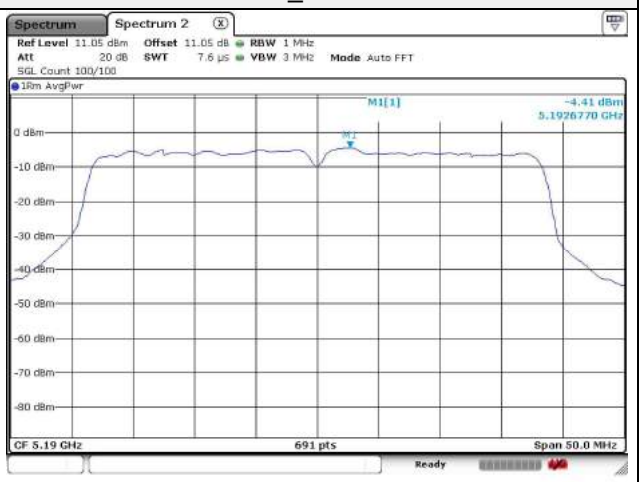
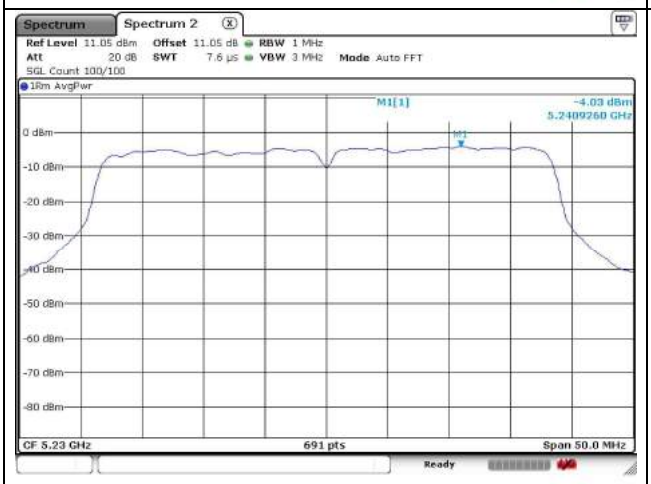
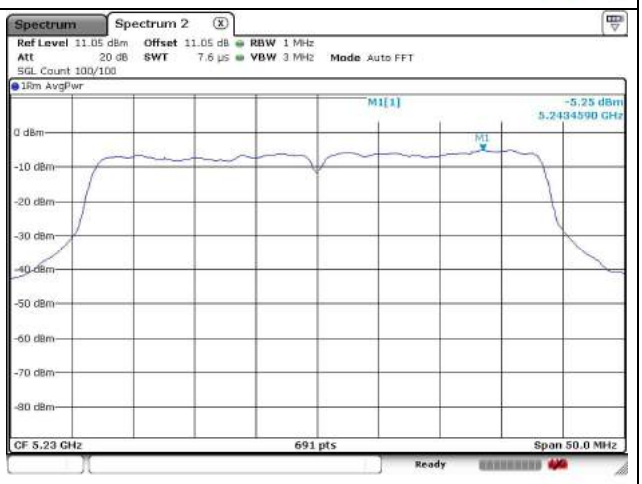
UNII-1 // ac_VHT40 // Ant 1



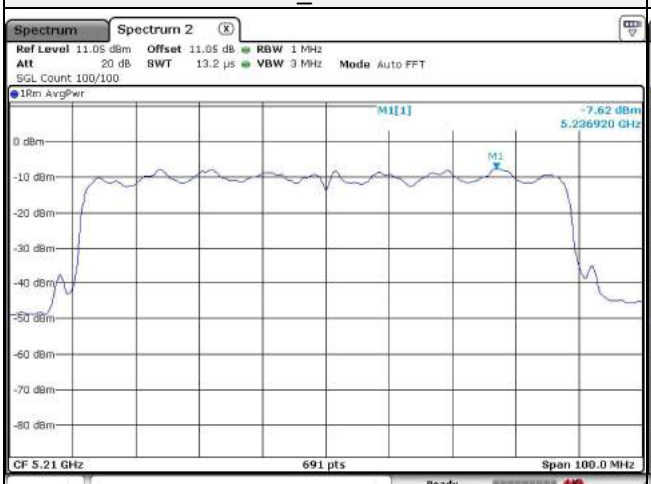
UNII-1 // ac_VHT40 // Ant 2



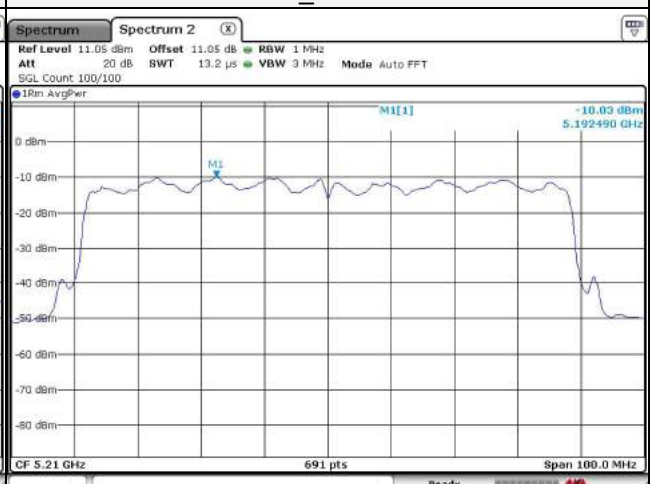




UNII-1 // ac_VHT80 // Ant 1



UNII-1 // ac_VHT80 // Ant 2



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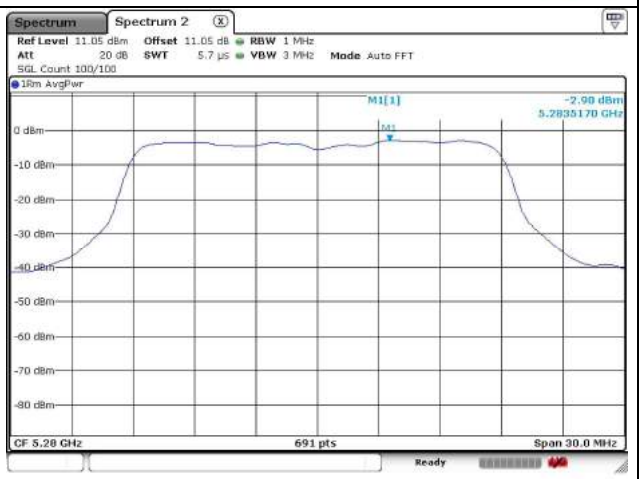
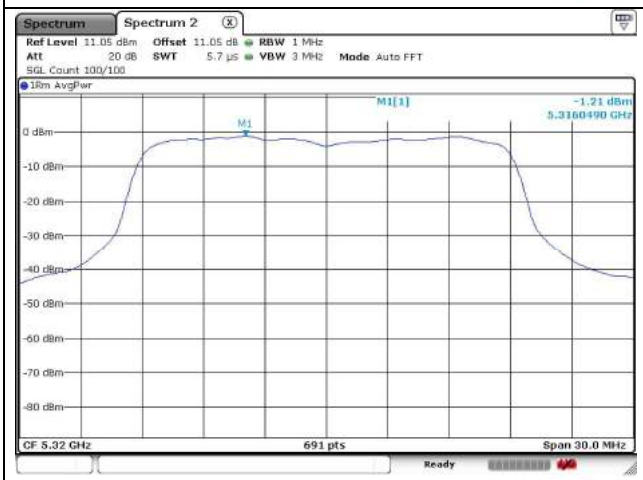
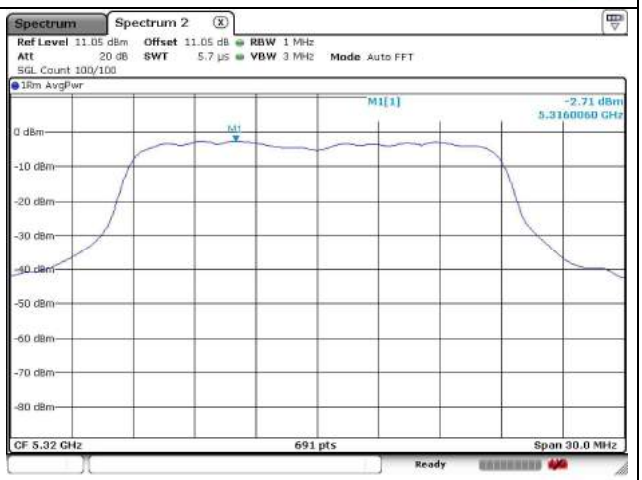
UNII-2A // ac_VHT20 // Ant 1	UNII-2A // ac_VHT20 // Ant 2
	
	

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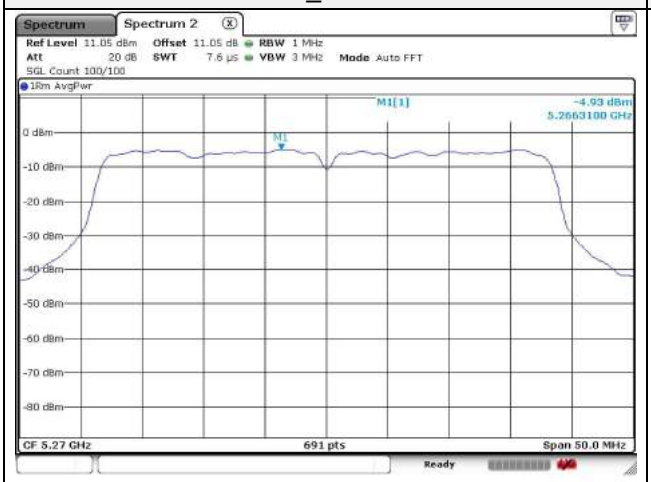
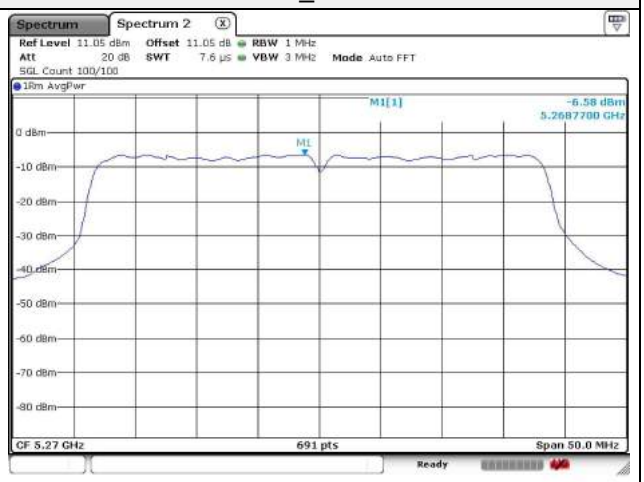
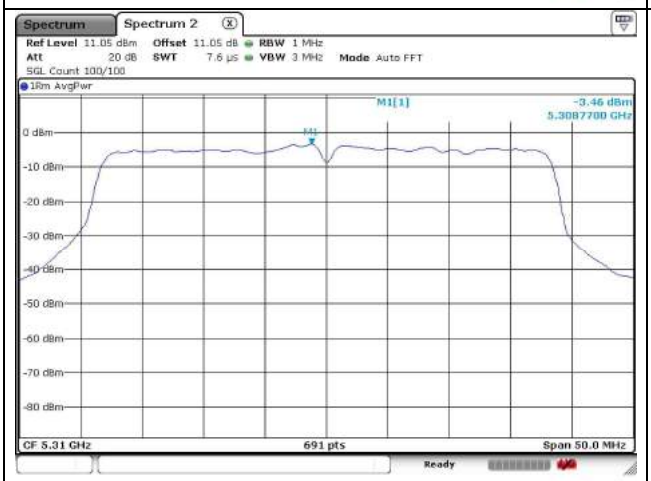
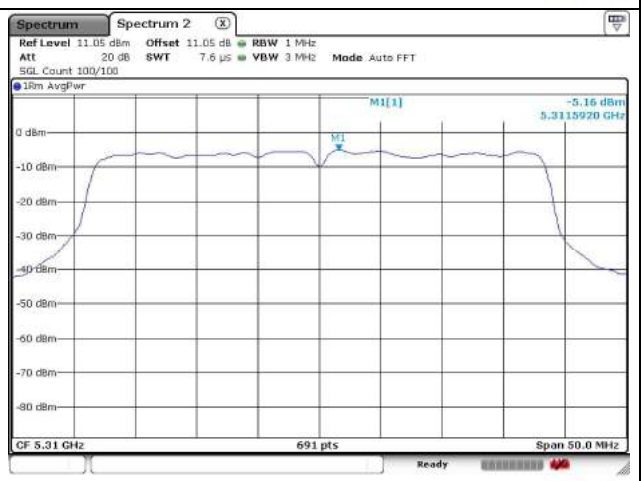
UNII-2A // ac_VHT40 // Ant 1



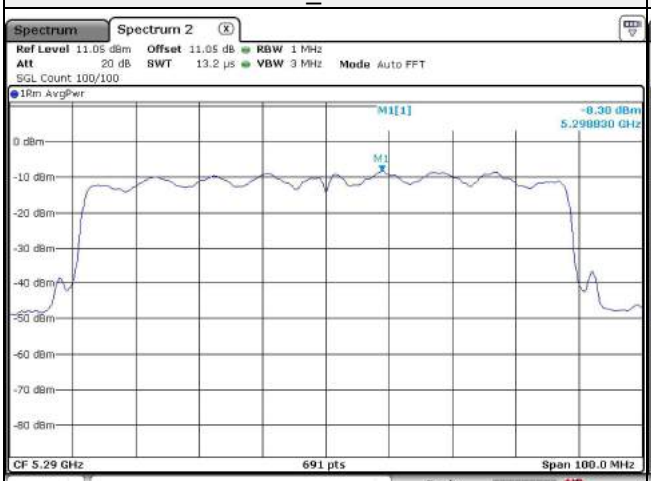
UNII-2A // ac_VHT40 // Ant 2



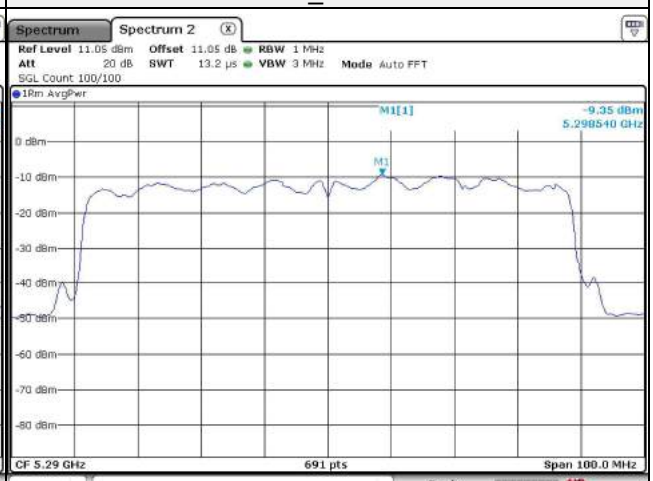




UNII-2A // ac_VHT80 // Ant 1



UNII-2A // ac_VHT80 // Ant 2



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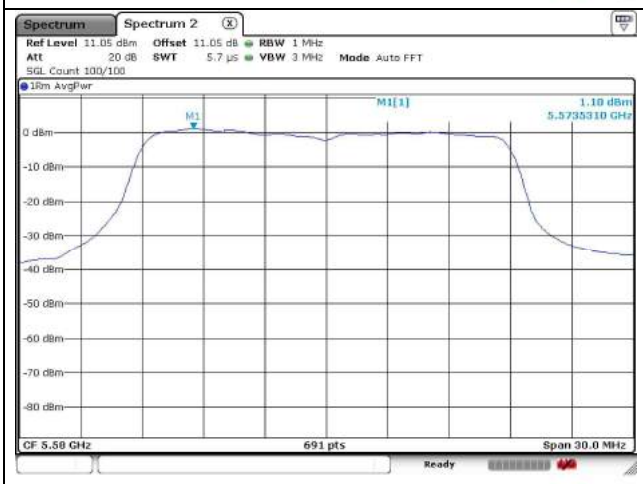
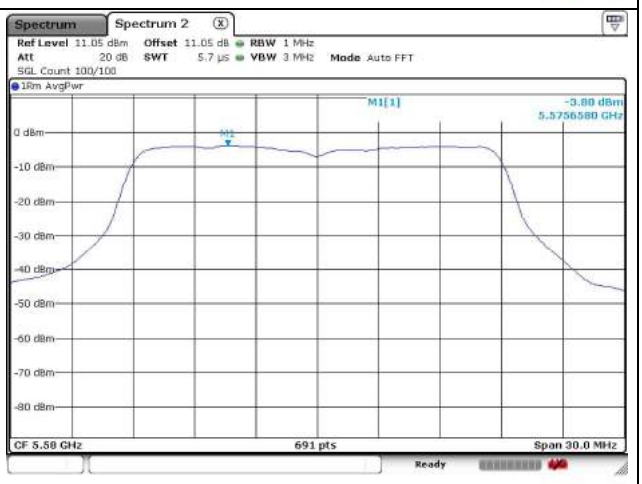
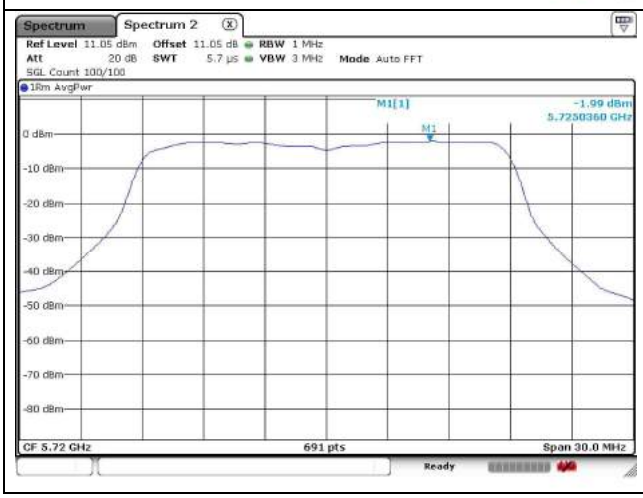
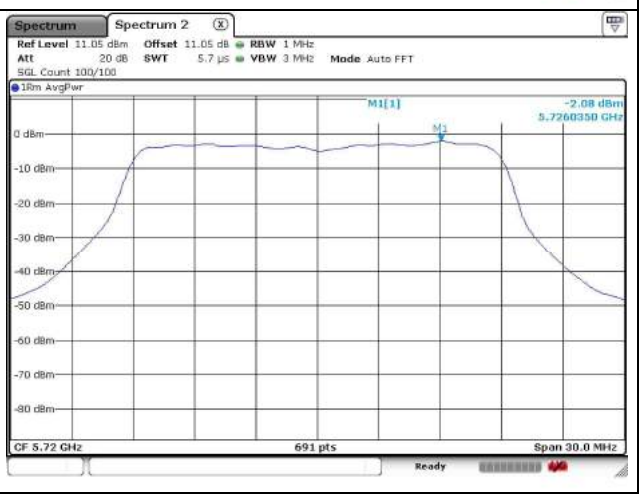
UNII-2C // ac_VHT20 // Ant 1	UNII-2C // ac_VHT20 // Ant 2
	
	

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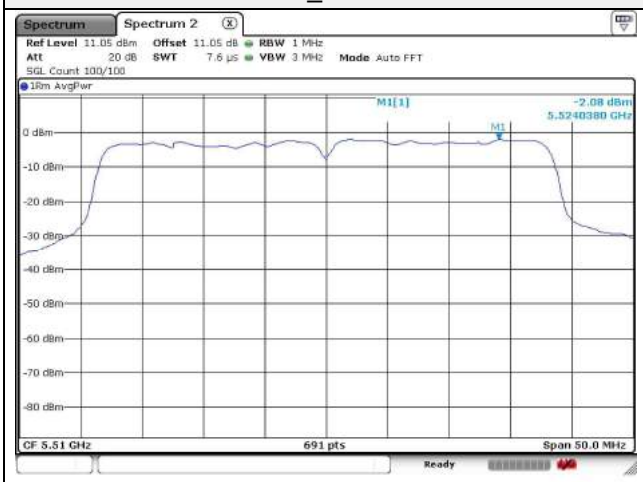
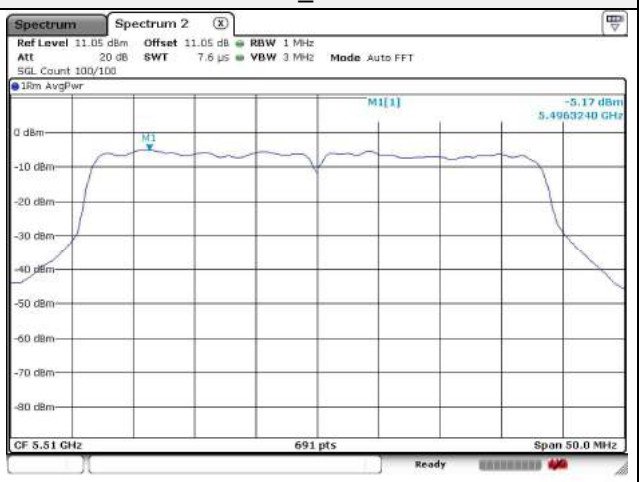
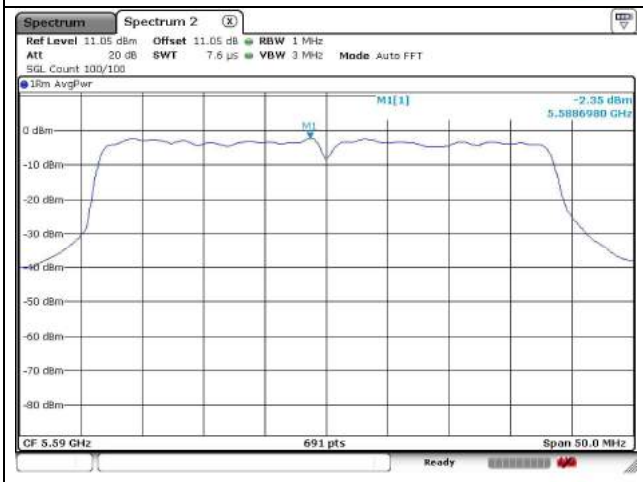
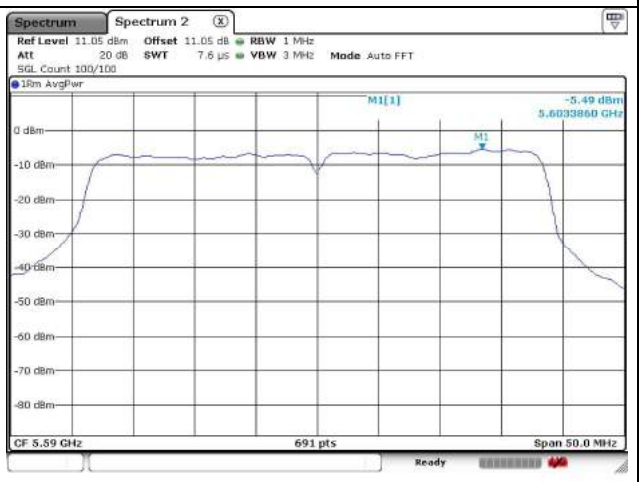
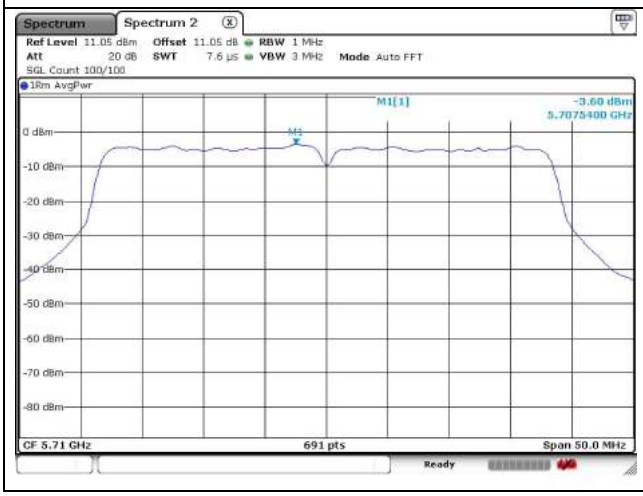
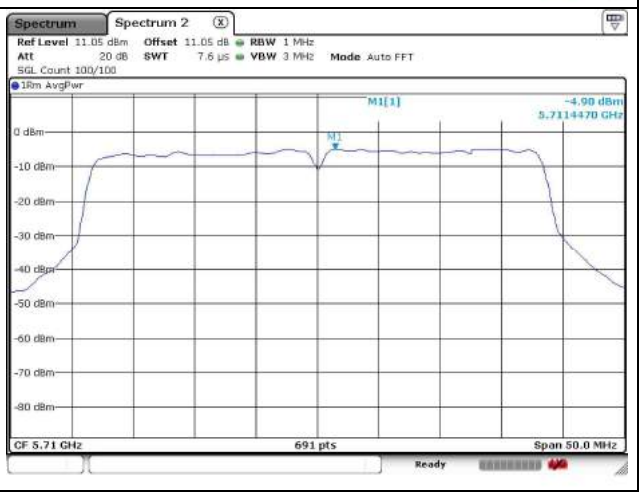
UNII-2C // ac_VHT40 // Ant 1	UNII-2C // ac_VHT40 // Ant 2
	
	
	

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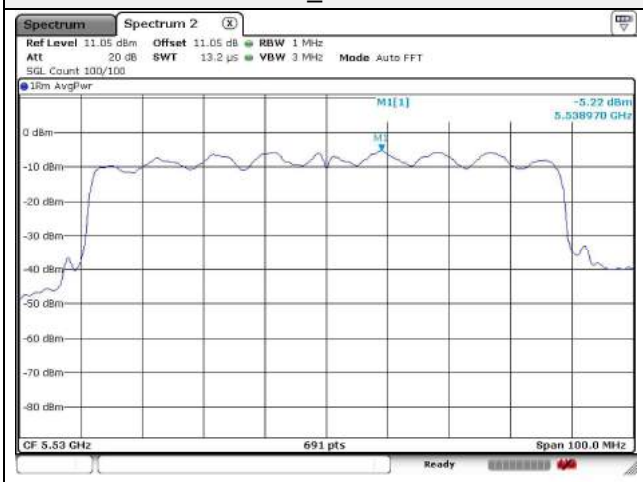
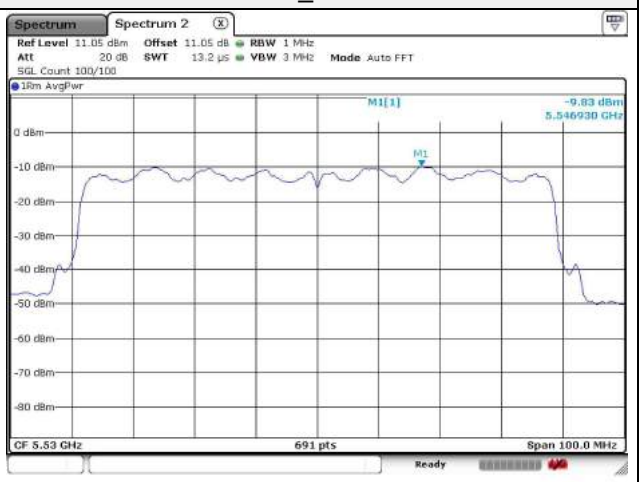
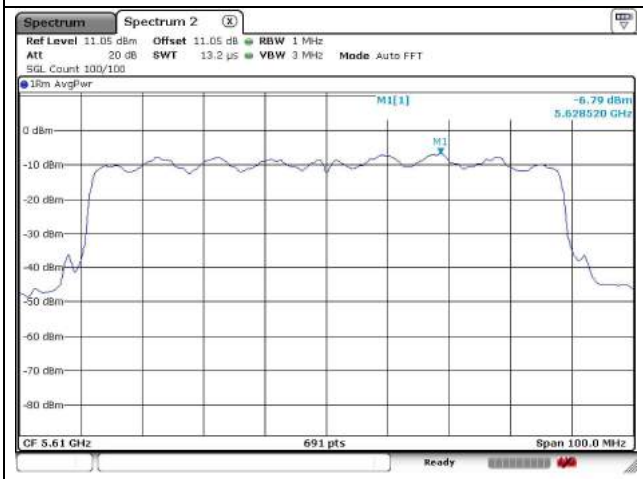
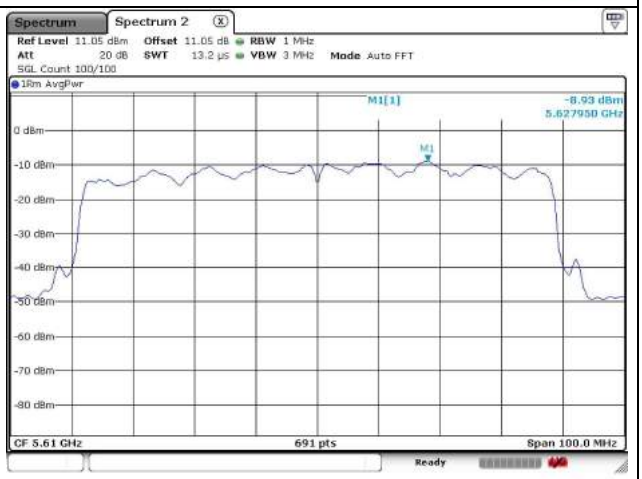
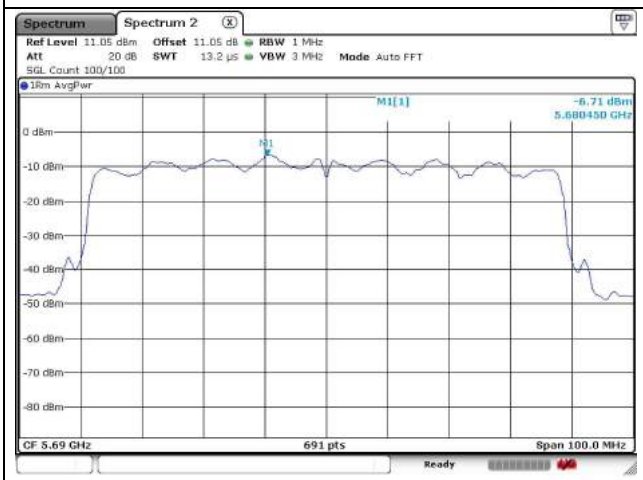
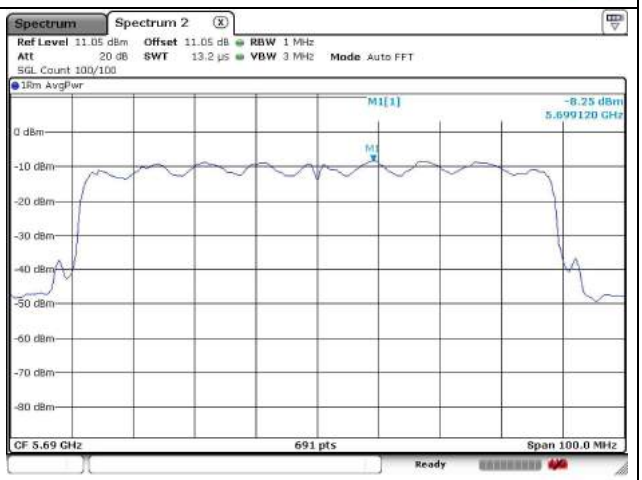
UNII-2C // ac_VHT80 // Ant 1	UNII-2C // ac_VHT80 // Ant 2
	
	
	

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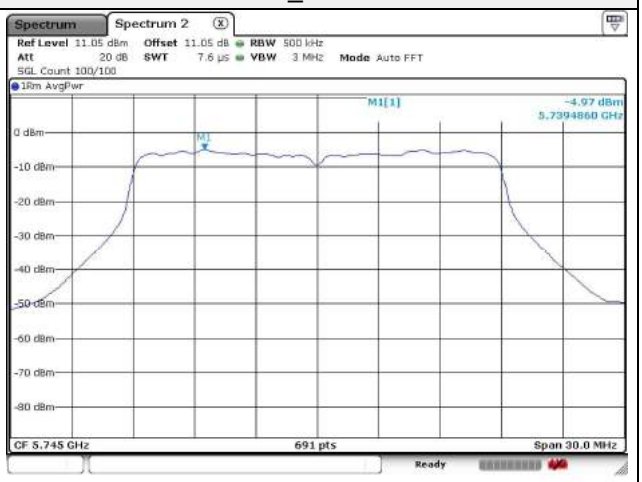
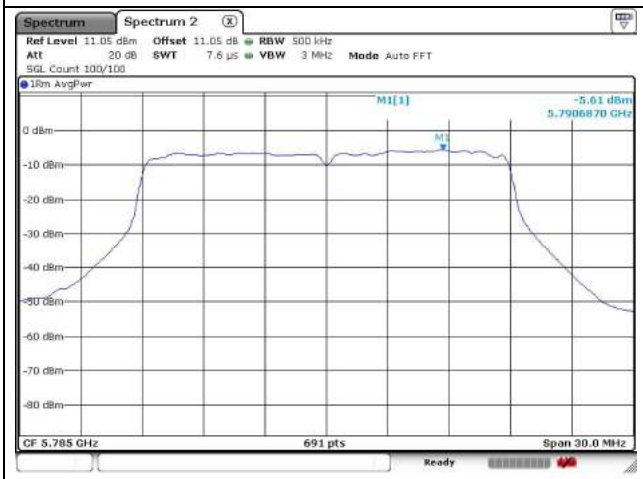
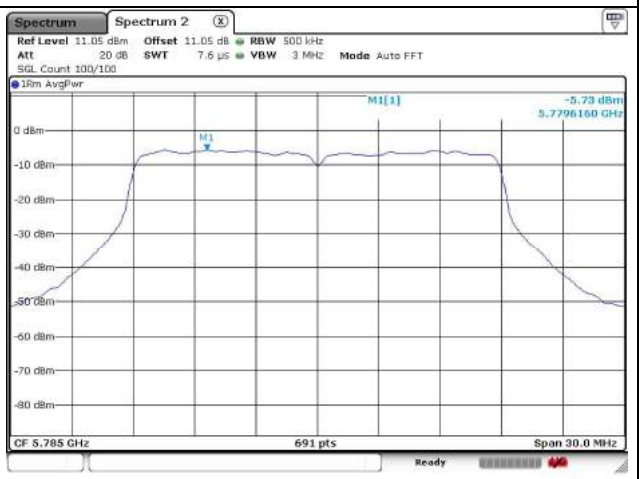
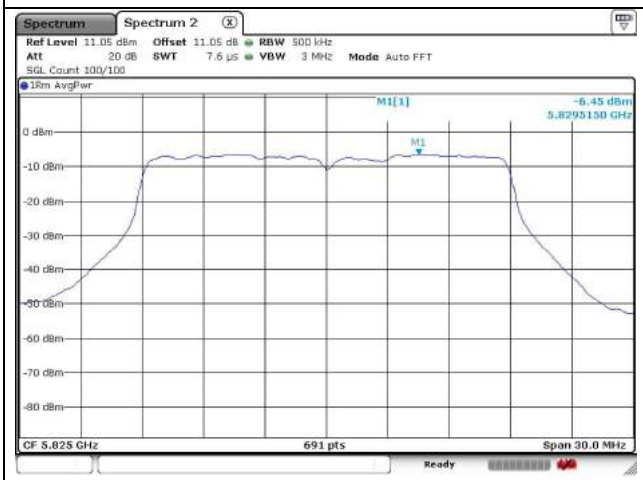
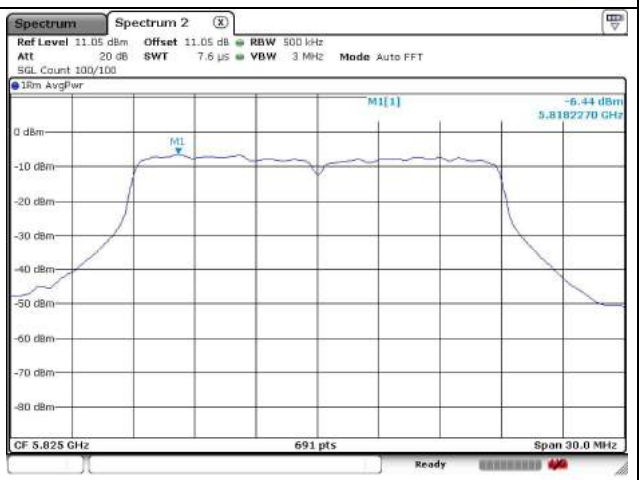
UNII-3 // ac_VHT20 // Ant 1	UNII-3 // ac_VHT20 // Ant 2
	
	
	

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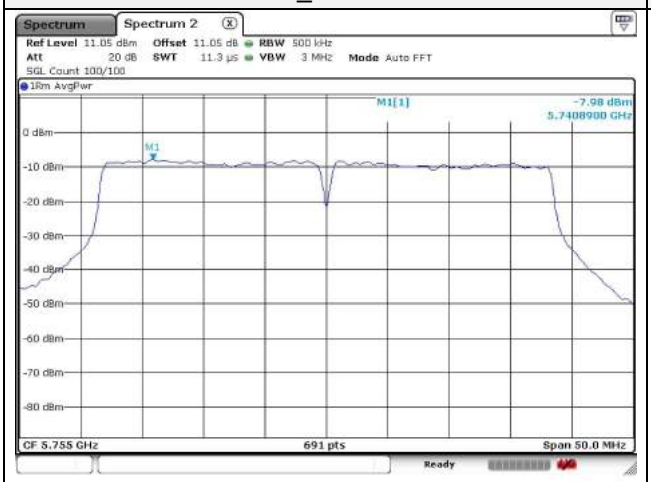
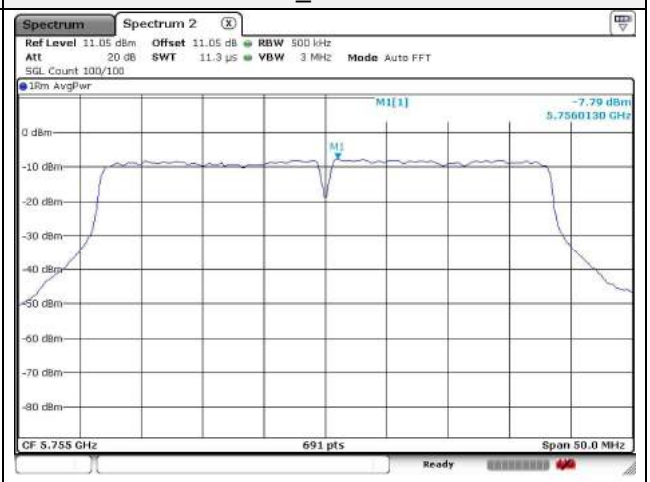
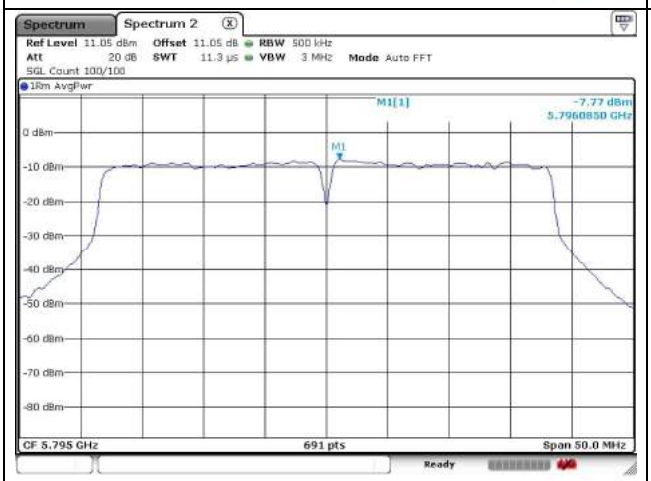
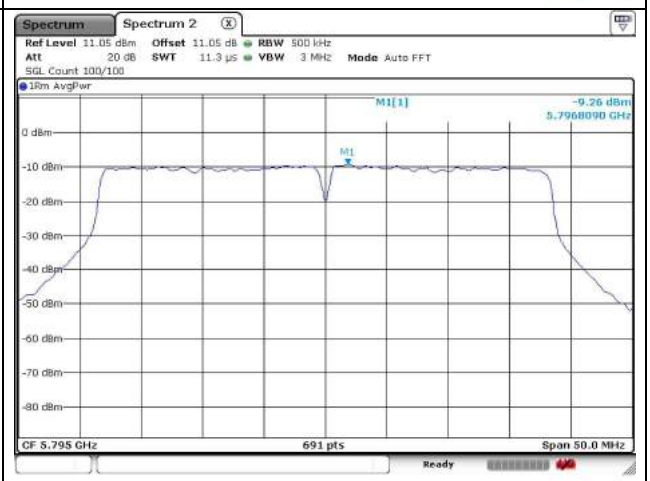
UNII-3 // ac_VHT40 // Ant 1



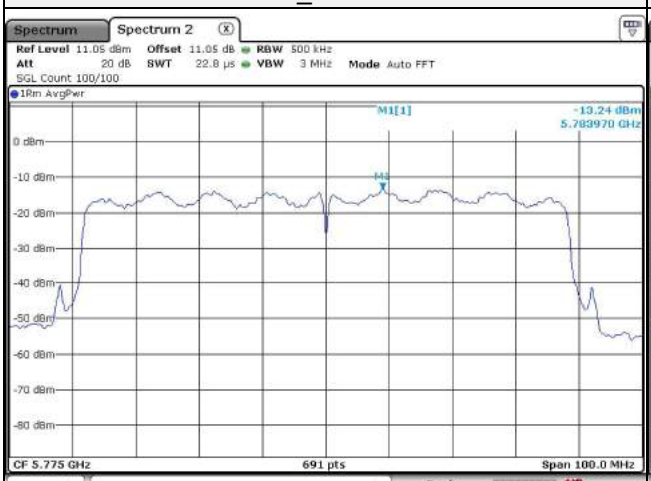
UNII-3 // ac_VHT40 // Ant 2



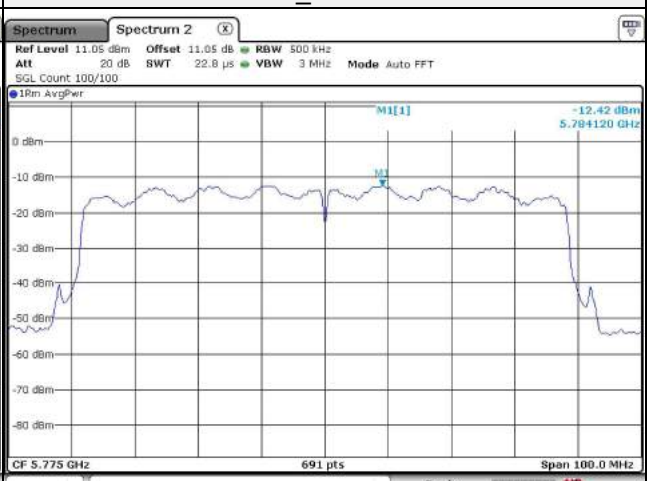




UNII-3 // ac_VHT80 // Ant 1



UNII-3 // ac_VHT80 // Ant 2



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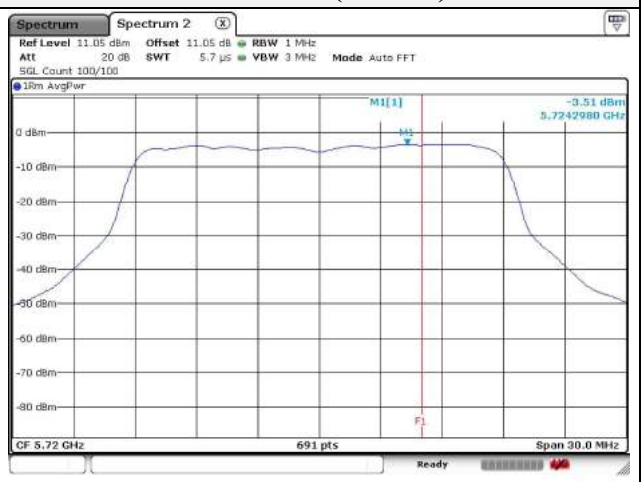
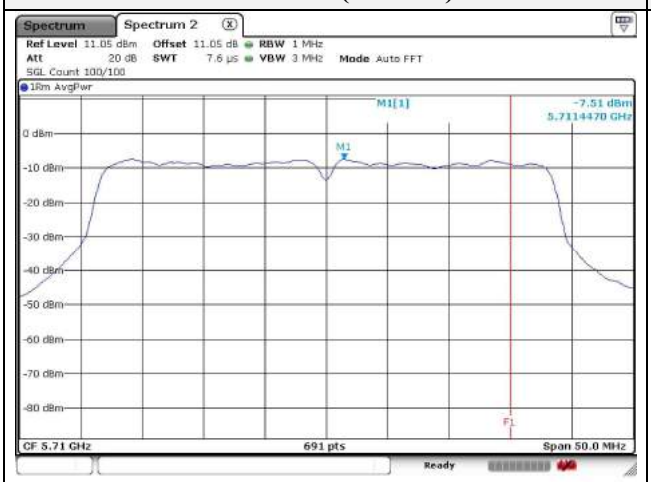
Band-crossing channels

UNII-2C // VHT20 (Ch. 144) // Ant 1

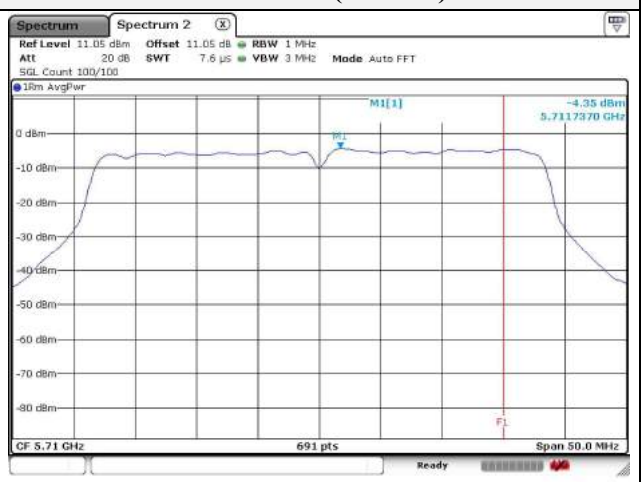
UNII-2C // VHT20 (Ch. 144) // Ant 2



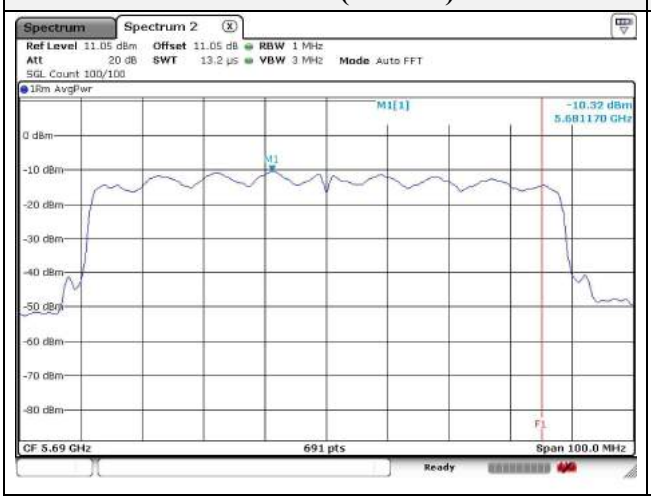
UNII-2C // VHT40 (Ch. 142) // Ant 1



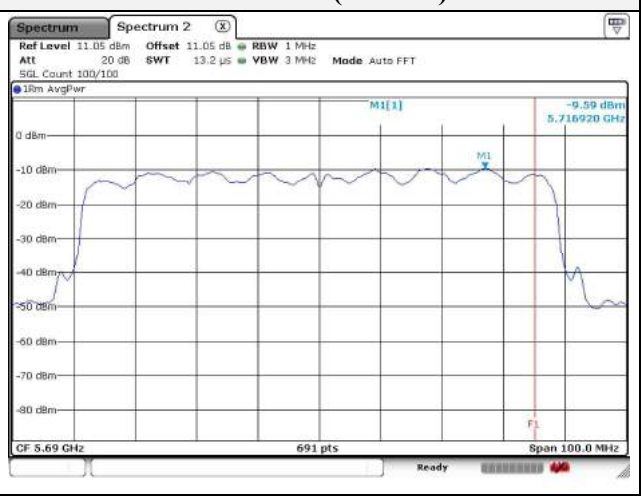
UNII-2C // VHT40 (Ch. 142) // Ant 2



UNII-2C // VHT80 (Ch. 138) // Ant 1



UNII-2C // VHT80 (Ch. 138) // Ant 2



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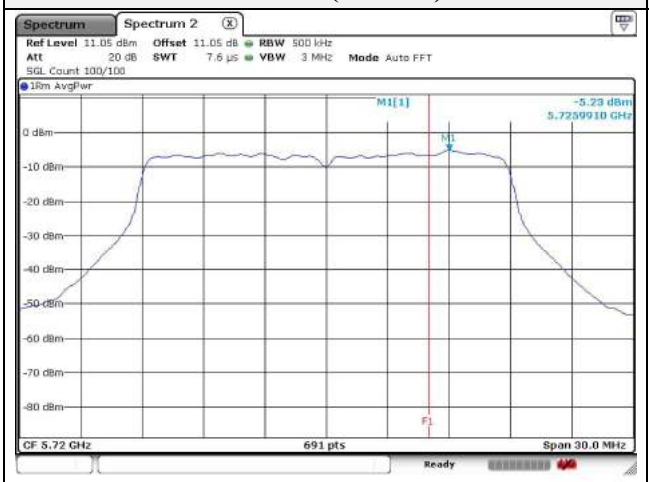
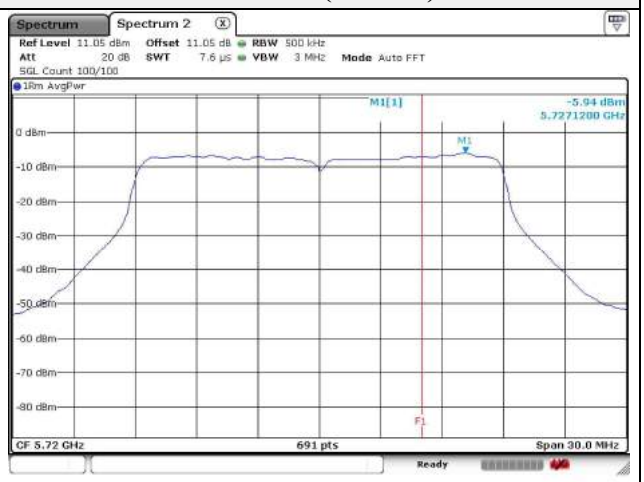
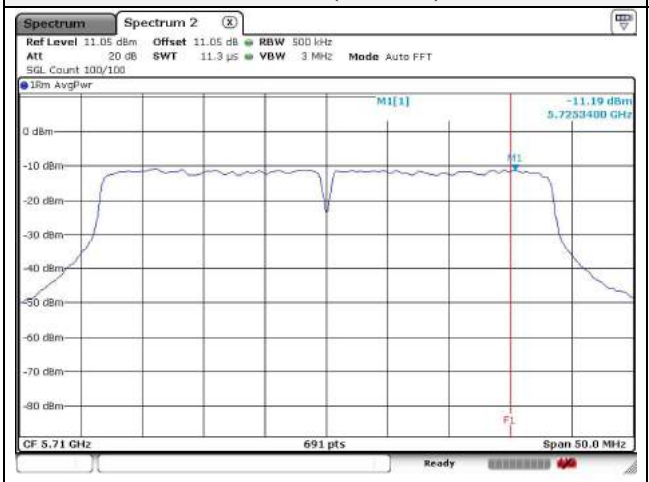
UNII-3 // VHT20 (Ch. 144) // Ant 1



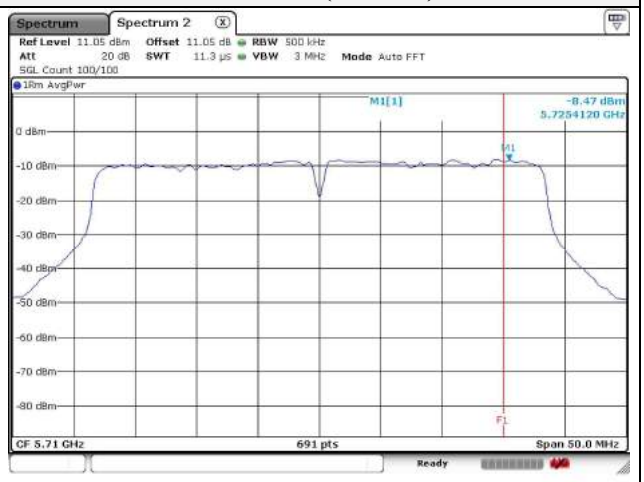
UNII-3 // VHT20 (Ch. 144) // Ant 2



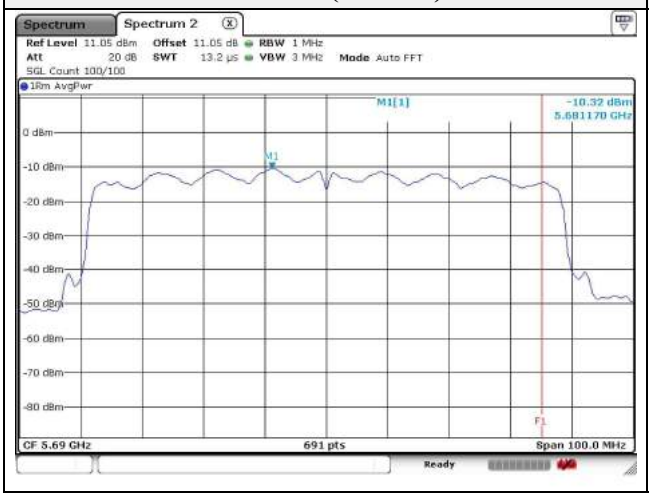
UNII-3 // VHT40 (Ch. 142) // Ant 1



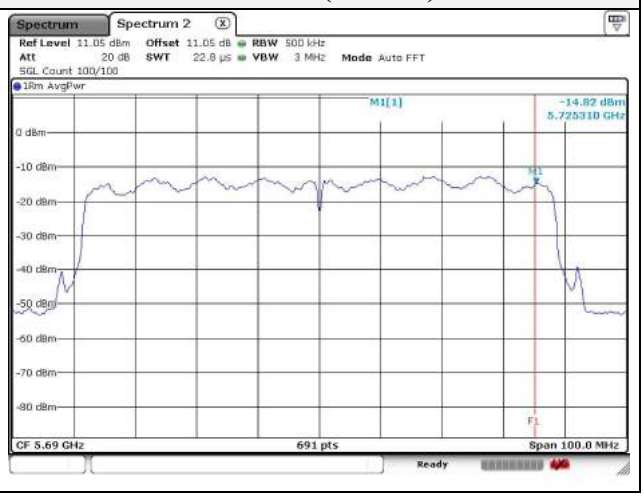
UNII-3 // VHT40 (Ch. 142) // Ant 2



UNII-3 // VHT80 (Ch. 138) // Ant 1



UNII-3 // VHT80 (Ch. 138) // Ant 2



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3.5. Frequency Stability

Test procedure

ANSI C63.10-2013, clause 6.8.1

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: 5180 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	DC 24	-20	Startup	5 180.026 248	26248	0.000 507
			2 minutes	5 180.025 844	25844	0.000 499
			5 minutes	5 180.025 004	25004	0.000 483
			10 minutes	5 180.024 793	24793	0.000 479
100 %		-10	Startup	5 180.022 124	22124	0.000 427
			2 minutes	5 180.022 042	22042	0.000 426
			5 minutes	5 180.021 564	21564	0.000 416
			10 minutes	5 180.021 295	21295	0.000 411
100 %		0	Startup	5 180.014 541	14541	0.000 281
			2 minutes	5 180.014 468	14468	0.000 279
			5 minutes	5 180.014 385	14385	0.000 278
			10 minutes	5 180.012 994	12994	0.000 251
100 %		10	Startup	5 180.007 248	7248	0.000 140
			2 minutes	5 180.007 158	7158	0.000 138
			5 minutes	5 180.007 063	7063	0.000 136
			10 minutes	5 180.006 488	6488	0.000 125
100 %		20	Startup	5 180.005 906	5906	0.000 114
			2 minutes	5 180.005 311	5311	0.000 103
			5 minutes	5 180.005 024	5024	0.000 097
			10 minutes	5 180.004 327	4327	0.000 084
100 %		23	Startup	5 180.004 568	4568	0.000 088
			2 minutes	5 180.004 362	4362	0.000 084
			5 minutes	5 180.003 405	3405	0.000 066
			10 minutes	5 180.003 080	3080	0.000 059
100 %		30	Startup	5 180.003 708	3708	0.000 072
			2 minutes	5 180.003 368	3368	0.000 065
			5 minutes	5 180.003 054	3054	0.000 059
			10 minutes	5 180.002 106	2106	0.000 041
100 %		40	Startup	5 179.988 120	-11880	-0.000 229
			2 minutes	5 179.987 978	-12022	-0.000 232
			5 minutes	5 179.987 859	-12141	-0.000 234
			10 minutes	5 179.987 029	-12971	-0.000 250
100 %		50	Startup	5 179.984 673	-15327	-0.000 296
			2 minutes	5 179.984 530	-15470	-0.000 299
			5 minutes	5 179.984 182	-15818	-0.000 305
			10 minutes	5 179.983 888	-16112	-0.000 311
85 %	DC 20.4	23	Startup	5 180.005 137	5137	0.000 099
			2 minutes	5 180.004 819	4819	0.000 093
			5 minutes	5 180.004 535	4535	0.000 088
			10 minutes	5 180.004 496	4496	0.000 087
115 %	DC 27.6	23	Startup	5 180.005 748	5748	0.000 111
			2 minutes	5 180.005 240	5240	0.000 101
			5 minutes	5 180.005 228	5228	0.000 101
			10 minutes	5 180.004 386	4386	0.000 085

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Mode: UNII-2A

Operating frequency: 5260 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	DC 24	-20	Startup	5 260.026 125	26125	0.000 497
			2 minutes	5 260.026 003	26003	0.000 494
			5 minutes	5 260.025 614	25614	0.000 487
			10 minutes	5 260.024 660	24660	0.000 469
100 %		-10	Startup	5 260.022 950	22950	0.000 436
			2 minutes	5 260.022 786	22786	0.000 433
			5 minutes	5 260.022 298	22298	0.000 424
			10 minutes	5 260.021 455	21455	0.000 408
100 %		0	Startup	5 260.014 093	14093	0.000 268
			2 minutes	5 260.013 387	13387	0.000 255
			5 minutes	5 260.012 989	12989	0.000 247
			10 minutes	5 260.012 874	12874	0.000 245
100 %		10	Startup	5 260.007 990	7990	0.000 152
			2 minutes	5 260.007 002	7002	0.000 133
			5 minutes	5 260.006 625	6625	0.000 126
			10 minutes	5 260.006 503	6503	0.000 124
100 %		20	Startup	5 260.005 563	5563	0.000 106
			2 minutes	5 260.005 549	5549	0.000 105
			5 minutes	5 260.004 751	4751	0.000 090
			10 minutes	5 260.004 107	4107	0.000 078
100 %		23	Startup	5 260.004 937	4937	0.000 094
			2 minutes	5 260.004 807	4807	0.000 091
			5 minutes	5 260.003 923	3923	0.000 075
			10 minutes	5 260.003 284	3284	0.000 062
100 %		30	Startup	5 260.002 358	2358	0.000 045
			2 minutes	5 260.002 240	2240	0.000 043
			5 minutes	5 260.002 002	2002	0.000 038
			10 minutes	5 260.001 010	1010	0.000 019
100 %		40	Startup	5 259.988 162	-11838	-0.000 225
			2 minutes	5 259.987 786	-12214	-0.000 232
			5 minutes	5 259.987 717	-12283	-0.000 234
			10 minutes	5 259.987 260	-12740	-0.000 242
100 %		50	Startup	5 259.985 249	-14751	-0.000 280
			2 minutes	5 259.985 129	-14871	-0.000 283
			5 minutes	5 259.984 468	-15532	-0.000 295
			10 minutes	5 259.984 198	-15802	-0.000 300
85 %	DC 20.4	23	Startup	5 260.005 613	5613	0.000 107
			2 minutes	5 260.005 146	5146	0.000 098
			5 minutes	5 260.005 050	5050	0.000 096
			10 minutes	5 260.004 782	4782	0.000 091
115 %	DC 27.6	23	Startup	5 260.006 169	6169	0.000 117
			2 minutes	5 260.005 419	5419	0.000 103
			5 minutes	5 260.005 353	5353	0.000 102
			10 minutes	5 260.005 318	5318	0.000 101

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Mode: UNII-2C

Operating frequency: 5500 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	DC 24	-20	Startup	5 500.026 538	26538	0.000 483
			2 minutes	5 500.026 438	26438	0.000 481
			5 minutes	5 500.025 052	25052	0.000 455
			10 minutes	5 500.024 767	24767	0.000 450
100 %		-10	Startup	5 500.022 692	22692	0.000 413
			2 minutes	5 500.021 622	21622	0.000 393
			5 minutes	5 500.021 504	21504	0.000 391
			10 minutes	5 500.021 450	21450	0.000 390
100 %		0	Startup	5 500.014 469	14469	0.000 263
			2 minutes	5 500.014 053	14053	0.000 256
			5 minutes	5 500.013 996	13996	0.000 254
			10 minutes	5 500.012 721	12721	0.000 231
100 %		10	Startup	5 500.008 259	8259	0.000 150
			2 minutes	5 500.007 889	7889	0.000 143
			5 minutes	5 500.007 418	7418	0.000 135
			10 minutes	5 500.006 629	6629	0.000 121
100 %		20	Startup	5 500.005 438	5438	0.000 099
			2 minutes	5 500.004 894	4894	0.000 089
			5 minutes	5 500.004 518	4518	0.000 082
			10 minutes	5 500.004 126	4126	0.000 075
100 %		23	Startup	5 500.004 769	4769	0.000 087
			2 minutes	5 500.004 137	4137	0.000 075
			5 minutes	5 500.003 739	3739	0.000 068
			10 minutes	5 500.003 092	3092	0.000 056
100 %		30	Startup	5 500.003 677	3677	0.000 067
			2 minutes	5 500.002 846	2846	0.000 052
			5 minutes	5 500.002 844	2844	0.000 052
			10 minutes	5 500.001 753	1753	0.000 032
100 %		40	Startup	5 499.987 600	-12400	-0.000 225
			2 minutes	5 499.987 199	-12801	-0.000 233
			5 minutes	5 499.986 995	-13005	-0.000 236
			10 minutes	5 499.986 698	-13302	-0.000 242
100 %		50	Startup	5 499.984 961	-15039	-0.000 273
			2 minutes	5 499.984 778	-15223	-0.000 277
			5 minutes	5 499.984 449	-15551	-0.000 283
			10 minutes	5 499.984 426	-15574	-0.000 283
85 %	DC 20.4	23	Startup	5 500.005 138	5138	0.000 093
			2 minutes	5 500.004 526	4526	0.000 082
			5 minutes	5 500.004 386	4386	0.000 080
			10 minutes	5 500.004 231	4231	0.000 077
115 %	DC 27.6	23	Startup	5 500.005 020	5020	0.000 091
			2 minutes	5 500.004 653	4653	0.000 085
			5 minutes	5 500.004 585	4585	0.000 083
			10 minutes	5 500.004 355	4355	0.000 079

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Mode: UNII-3

Operating frequency: 5745 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	DC 24	-20	Startup	5 745.026 139	26139	0.000 455
			2 minutes	5 745.025 921	25921	0.000 451
			5 minutes	5 745.024 705	24705	0.000 430
			10 minutes	5 745.024 549	24549	0.000 427
100 %		-10	Startup	5 745.023 001	23001	0.000 400
			2 minutes	5 745.022 326	22326	0.000 389
			5 minutes	5 745.021 662	21662	0.000 377
			10 minutes	5 745.021 626	21626	0.000 376
100 %		0	Startup	5 745.014 444	14444	0.000 251
			2 minutes	5 745.014 267	14267	0.000 248
			5 minutes	5 745.013 209	13209	0.000 230
			10 minutes	5 745.012 924	12924	0.000 225
100 %		10	Startup	5 745.008 208	8208	0.000 143
			2 minutes	5 745.008 147	8147	0.000 142
			5 minutes	5 745.006 714	6714	0.000 117
			10 minutes	5 745.006 537	6537	0.000 114
100 %		20	Startup	5 745.005 970	5970	0.000 104
			2 minutes	5 745.004 508	4508	0.000 078
			5 minutes	5 745.004 460	4460	0.000 078
			10 minutes	5 745.004 143	4143	0.000 072
100 %		23	Startup	5 745.004 662	4662	0.000 081
			2 minutes	5 745.004 129	4129	0.000 072
			5 minutes	5 745.004 115	4115	0.000 072
			10 minutes	5 745.003 967	3967	0.000 069
100 %		30	Startup	5 745.003 682	3682	0.000 064
			2 minutes	5 745.002 482	2482	0.000 043
			5 minutes	5 745.002 428	2428	0.000 042
			10 minutes	5 745.002 165	2165	0.000 038
100 %		40	Startup	5 744.988 366	-11634	-0.000 203
			2 minutes	5 744.988 221	-11779	-0.000 205
			5 minutes	5 744.986 613	-13387	-0.000 233
			10 minutes	5 744.986 436	-13564	-0.000 236
100 %		50	Startup	5 744.984 161	-15839	-0.000 276
			2 minutes	5 744.984 159	-15841	-0.000 276
			5 minutes	5 744.984 039	-15961	-0.000 278
			10 minutes	5 744.983 708	-16292	-0.000 284
85 %	DC 20.4	23	Startup	5 745.005 382	5382	0.000 094
			2 minutes	5 745.005 328	5328	0.000 093
			5 minutes	5 745.005 199	5199	0.000 090
			10 minutes	5 745.004 614	4614	0.000 080
115 %	DC 27.6	23	Startup	5 745.005 801	5801	0.000 101
			2 minutes	5 745.005 241	5241	0.000 091
			5 minutes	5 745.004 929	4929	0.000 086
			10 minutes	5 745.004 379	4379	0.000 076

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