TEST REPORT

Part 15E & RSS-247 (Issue 2)

Equipment under test	SMARTCAM D1
Model name	SNH-V6435DN
FCC ID	NLMSNHV6435DN
IC	21482- SNHV6435DN
Applicant	Hanwha Techwin Co., Ltd.
Manufacturer	Hanwha Techwin(Tianjin) Co., Ltd
Date of test(s)	2017.05.18 ~ 2017.05.31
Date of issue	2017.06.07

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Test and report completed by :	**Report approval by :**
Hyeon-su Jang Test engineer	Kwang-yeol Choo Technical manager

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Revision history

Revision	Date of issue	Test report No.	Description
-	2017.06.07	KES-RF-17T0058	Initial

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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.
Test site address:	C-3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea
FCC / IC rule part(s):	15.407 / RSS-247
FCC ID:	NLMSNHV6435DN
IC Certification:	21482- SNHV6435DN
Test device serial No.:	☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test	SMARTCAM D1	
Model:	SNH-V6435DN	
Frequency range		2 412 ㎒ ~ 2 462 ㎒ (11b/g/n_HT20)
		2 422 ㎒ ~ 2 452 ㎒ (11n_HT40)
	UNII-1	5 180 ㎒ ~ 5 240 ㎒ (11a/n_HT20, 11ac_VHT20)
		5 190 ㎒ ~ 5 230 ㎒ (11n_HT40, 11ac_VHT40)
		5 210 ㎒ (11ac_VHT80)
	UNII-2A	5 260 ㎒ ~ 5 320 ㎒ (11a/n_HT20, 11ac_VHT20)
		5 270 ㎒ ~ 5 310 ㎒ (11n_HT40, 11ac_VHT40)
		5 290 ㎒ (11ac_VHT80)
	UNII-2C	5 500 ㎒ ~ 5 720 ㎒ (11a/n_HT20, 11ac_VHT20)
		5 510 ㎒ ~ 5 710 ㎒ (11n_HT40, 11ac_VHT40)
		5 530 ㎒ ~ 5 690 ㎒ (11ac_VHT80)
	UNII-3	5 745 ㎒ ~ 5 825 ㎒ (11a/n_HT20, 11ac_VHT20)
		5 755 ㎒ ~ 5 795 ㎒ (11n_HT40, 11ac_VHT40)
		5 775 ㎒ (11ac_VHT80)
Modulation technique	DSSS, OFDM	
Number of channels	11 ch : 2 412 ㎒ ~ 2 462 ㎒, 7 ch : 2 422 ㎒ ~ 2 452 ㎒ 4 ch : 5 180 ㎒ ~ 5 240 ㎒, 2 ch : 5 190 ㎒ ~ 5 230 ㎒, 1 ch : 5 210 ㎒ 4 ch : 5 260 ㎒ ~ 5 320 ㎒, 2 ch : 5 270 ㎒ ~ 5 310 ㎒, 1 ch : 5 290 ㎒ 12 ch : 5 500 ㎒ ~ 5 720 ㎒, 6 ch : 5 510 ㎒ ~ 5 710 ㎒, 3 ch : 5 530 ㎒ ~ 5 690 ㎒ 5 ch : 5 745 ㎒ ~ 5 825 ㎒, 2 ch : 5 755 ㎒ ~ 5795 ㎒, 1 ch : 5 775 ㎒	

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Antenna specification	11b/g/n_HT20/40	: Chip antenna & 2.92 dBi
	UNII-1	: Chip antenna & 5.08 dBi
	UNII-2A	: Chip antenna & 4.85 dBi
	UNII-2C	: Chip antenna & 6.89 dBi
	UNII-3	: Chip antenna & 6.89 dBi
Power source	AC 16V ~ 24V	

1.2. Test configuration

The **Hanwha Techwin Co., Ltd. SMARTCAM D1 FCC ID: NLMSNHV6435DN IC: 21482-SNHV6435DN** was tested according to the specification of EUT, the EUT must comply with following standards and KDB documents.

FCC Part 15.407
IC RSS-247 Issue 2 and RSS-Gen Issue 4
KDB 789033 D02 v01r04
KDB 644545 D03 v01
KDB 662911 D01 v02r01
ANSI C63.10-2013

1.3. Device modifications

N/A

1.4. Information about derivative model

N/A

1.5. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
-	-	-	-	-

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1.6. Frequency/channel operations

UNII-1

Ch.	Frequency ([redacted])
36	5 180
44	5 220
48	5 240

UNII-2A

Ch.	Frequency ([redacted])
52	5 260
56	5 280
64	5 320

UNII-2C

Ch.	Frequency ([redacted])
100	5 500
116	5 580
144	5 720

UNII-3

Ch.	Frequency ([redacted])
149	5 745
157	5 785
165	5 825

Table 1.6-1. 802.11a/n/ac_HT20/VHT20 mode

UNII-1

Ch.	Frequency ([redacted])
38	5 190
46	5 230

UNII-2A

Ch.	Frequency ([redacted])
54	5 270
62	5 310

UNII-2C

Ch.	Frequency ([redacted])
102	5 510
118	5 590
142	5 710

UNII-3

Ch.	Frequency ([redacted])
151	5 755
159	5 795

Table 1.6-2. 802.11a/n/ac_HT40/VHT40 mode

UNII-1

Ch.	Frequency ([redacted])
42	5 210

UNII-2A

Ch.	Frequency ([redacted])
58	5 290

UNII-2C

Ch.	Frequency ([redacted])
106	5 530
122	5 610
138	5 690

UNII-3

Ch.	Frequency ([redacted])
155	5 775

Table 1.6-3 802.11ac_VHT80 mode

1.7. Maximum average output power

Refer to the average output power.

Note.

1. Radiated emission and power line conducted 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 a : **6 Mbps** , n/ac_HT20/40/VHT20/40/80 : **MCS0**
   UNII-2A a : **6 Mbps** , n/ac_HT20/40/VHT20/40/80 : **MCS0**
   UNII-2C a : **6 Mbps** , n/ac_HT20/40/VHT20/40/80 : **MCS0**
   UNII-3 a : **6 Mbps** , n/ac_HT20/40/VHT20/40/80 : **MCS0**
3. This report contains the worst case data from the following mode of the test in 20/40/80 MHz signal bandwidth.

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2. Summary of tests

Section in FCC Part 15	Section in RSS-247 & Gen	Parameter	Test results
15.407(a)	RSS-247 6.2 RSS-Gen 6.6	26 dB bandwidth & 99 % bandwidth	Pass
15.407(e)	RSS-247 6.2.4	6 dB bandwidth (UNII-3)	Pass
15.407(a)	RSS-247 6.2	Maximum conducted output power	Pass
15.407(a)	RSS-247 6.2	Power spectral density	Pass
15.407(g)	-	Frequency stability	Pass
15.205 15.209 15.407(d)	RSS-247 6.2 RSS-Gen 8.9, 8.10	Radiated restricted band and emission	Pass
15.207	RSS-Gen 8.8	AC power line conducted emissions	Pass

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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

Band	Frequency([redacted])	Mode	26 [redacted] bandwidth([redacted])	99 % bandwidth([redacted])
UNII-1	5 180	a	20.912	16.787
	5 220		20.767	16.860
	5 240		20.478	16.787
UNII-2A	5 260		20.984	16.787
	5 280		20.550	16.860
	5 320		20.839	16.860
UNII-2C	5 500		20.767	16.860
	5 580		20.478	16.787
	5 720		20.333	16.715
UNII-3	5 745		20.767	16.787
	5 785		20.622	16.787
	5 825		20.839	16.860
UNII-1	5 180	HT20	21.201	17.800
	5 220		21.201	17.945
	5 240		20.767	17.873
UNII-2A	5 260		20.695	17.873
	5 280		21.274	17.873
	5 320		21.274	17.873
UNII-2C	5 500		21.201	17.873
	5 580		21.129	17.873
	5 720		21.491	17.873
UNII-3	5 745		21.418	17.800
	5 785		21.563	17.873
	5 825		21.563	17.873
UNII-1	5 190	HT40	44.340	37.279
	5 230		44.230	37.395
UNII-2A	5 270		44.460	37.279
	5 310		44.460	37.395
UNII-2C	5 510		44.460	37.395
	5 590		44.340	37.395
	5 710		44.570	37.395
UNII-3	5 755		43.990	37.511
	5 795		44.230	37.395

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Band	Frequency([redacted])	Mode	26 [redacted] bandwidth([redacted])	99 % bandwidth([redacted])
UNII-1	5 180	VHT20	21.346	17.945
	5 220		21.563	17.873
	5 240		21.418	17.945
UNII-2A	5 260		20.550	17.945
	5 280		21.129	17.945
	5 320		21.418	17.945
UNII-2C	5 500		21.635	17.873
	5 580		21.346	17.873
	5 720		21.056	17.945
UNII-3	5 745		21.346	17.945
	5 785		21.274	17.945
	5 825		21.274	17.873
UNII-1	5 190	VHT40	44.110	37.395
	5 230		44.340	37.395
UNII-2A	5 270		44.340	37.395
	5 310		44.340	37.395
UNII-2C	5 510		44.460	37.395
	5 590		44.340	37.279
	5 710		44.340	37.279
UNII-3	5 755		44.230	37.279
	5 795		44.460	37.395
UNII-1	5 210	VHT80	82.660	75.195
UNII-2A	5 290		82.840	75.195
UNII-2C	5 530		83.010	75.195
	5 610		82.840	75.195
	5 690		83.010	75.195
UNII-3	5 775		81.790	75.195
UNII-2C (Band-crossing channel)	5 720	a	15.854	-
	5 720	HT20	15.854	-
	5 710	HT40	37.110	-
	5 720	VHT20	15.781	-
	5 710	VHT40	37.200	-
	5 690	VHT80	76.360	-

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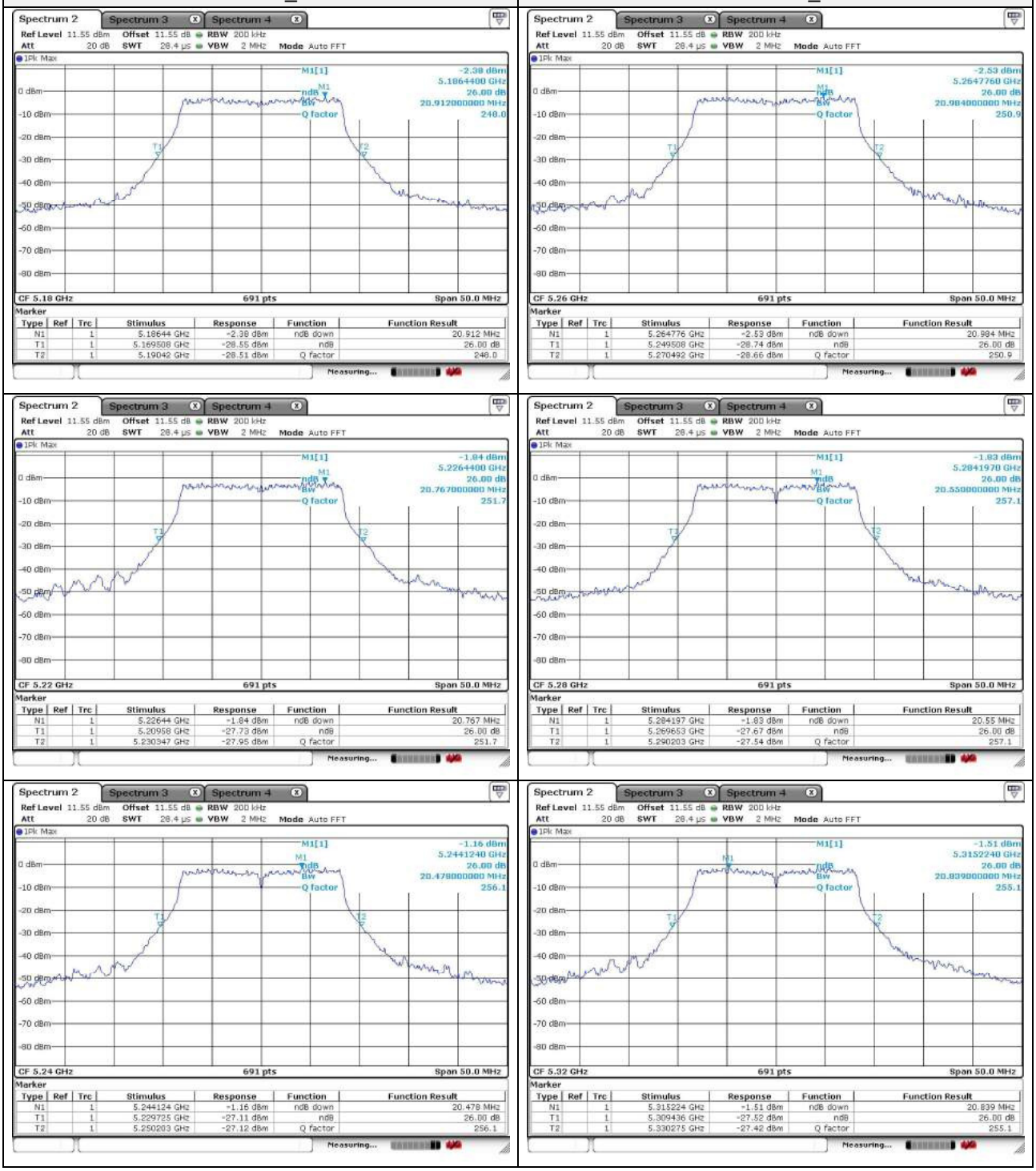
26 dB bandwidth

UNII-1_a	UNII-2A_a



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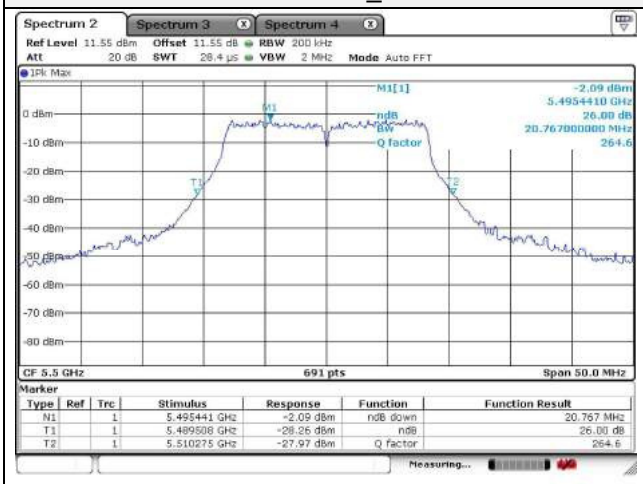
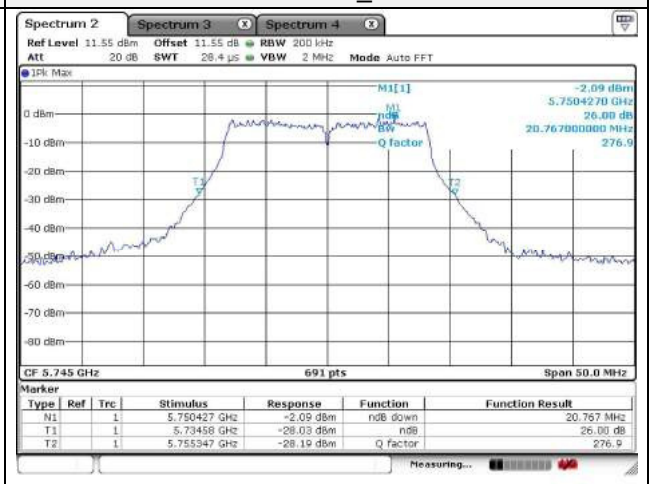
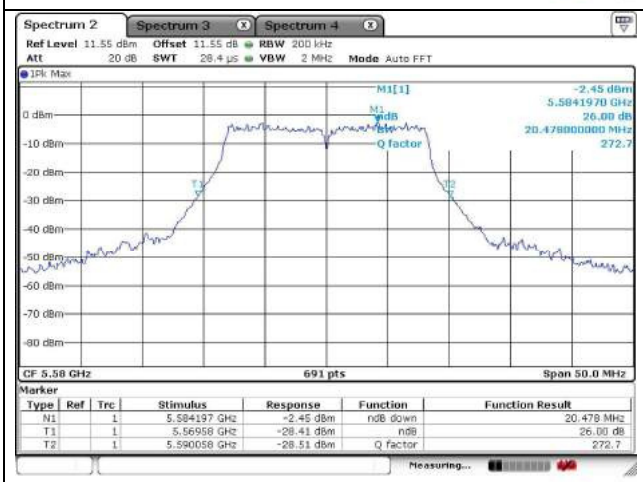
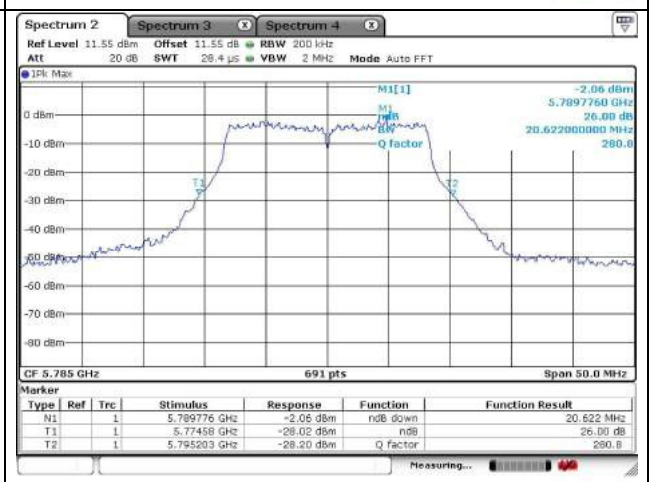
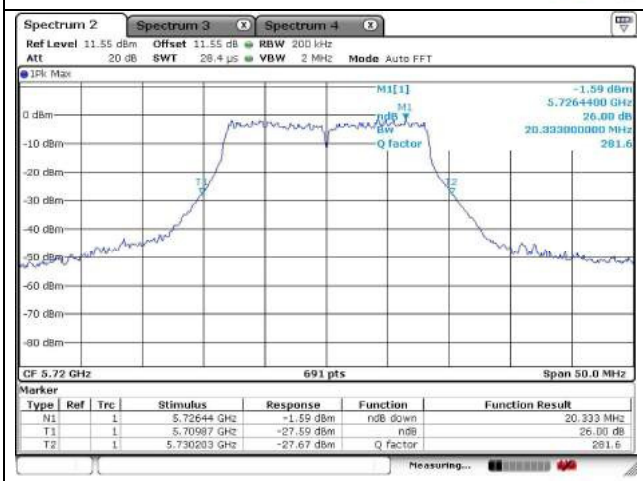
UNII-2C_a	UNII-3_a

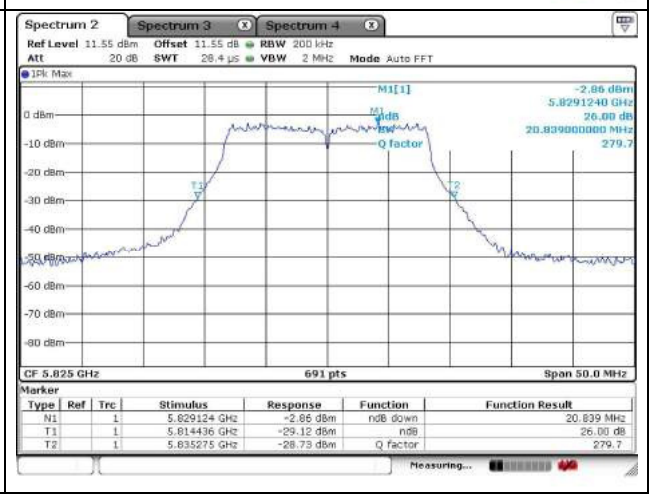












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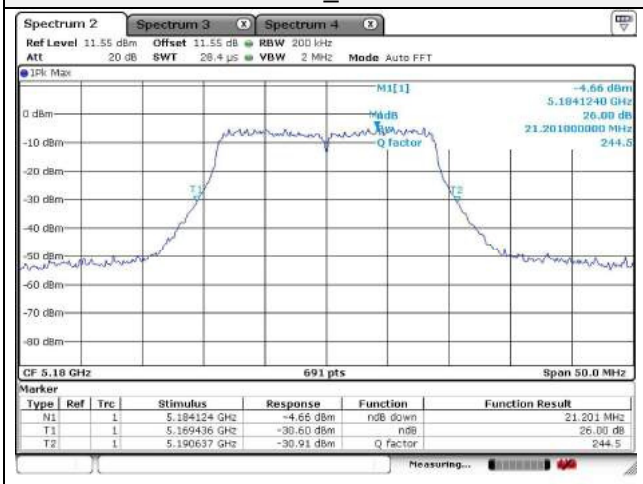
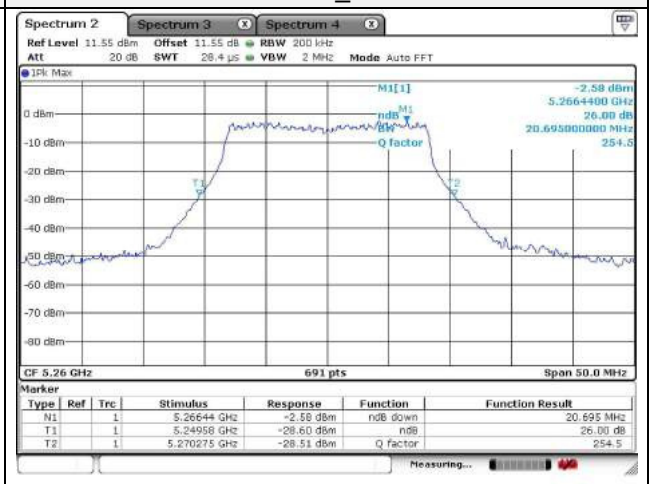
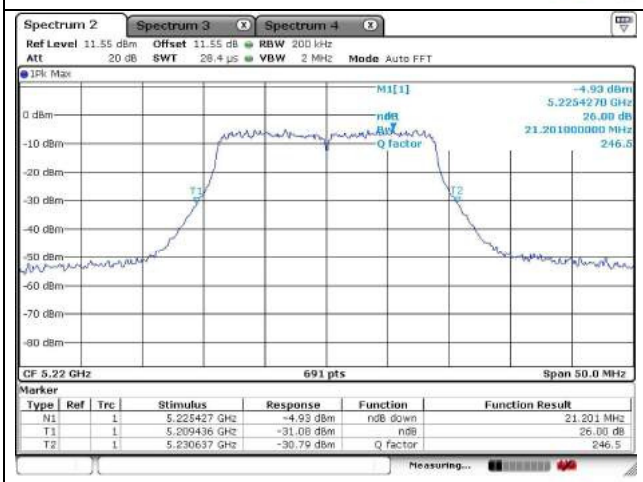
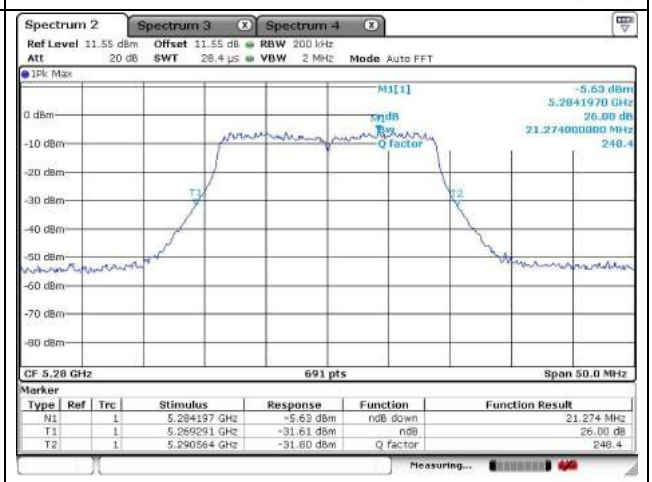
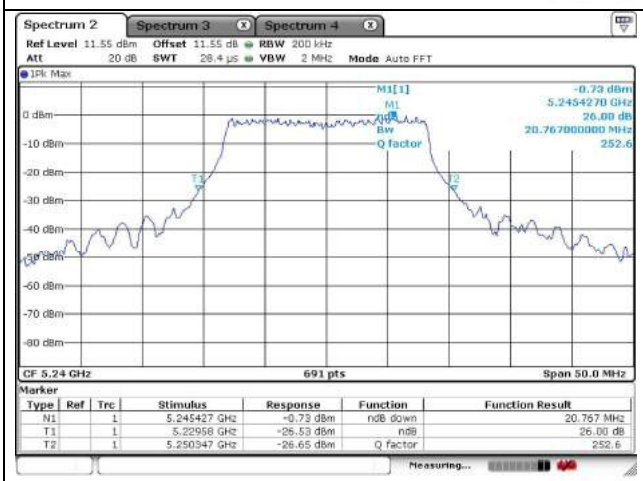
UNII-1_ HT20	UNII-2A_ HT20

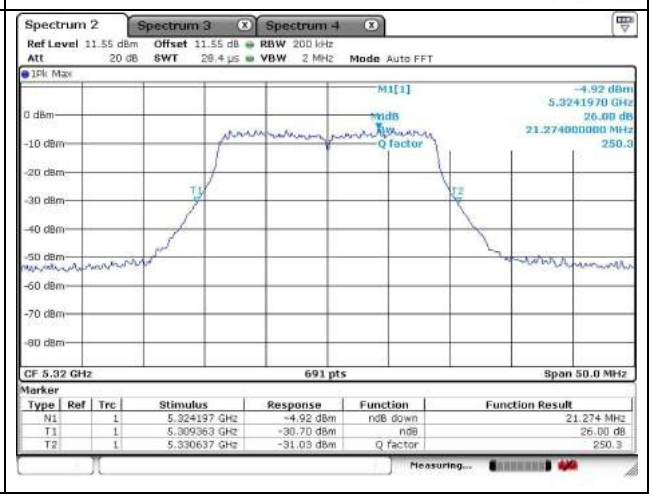












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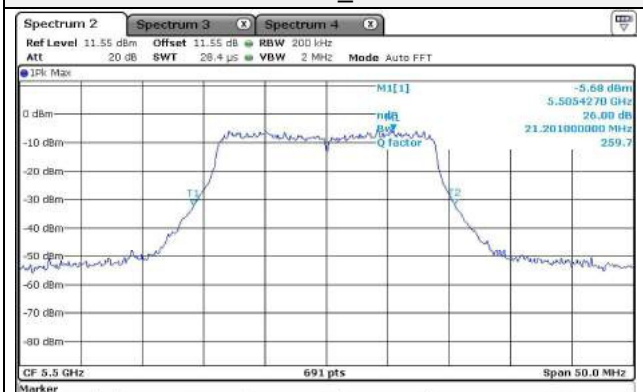
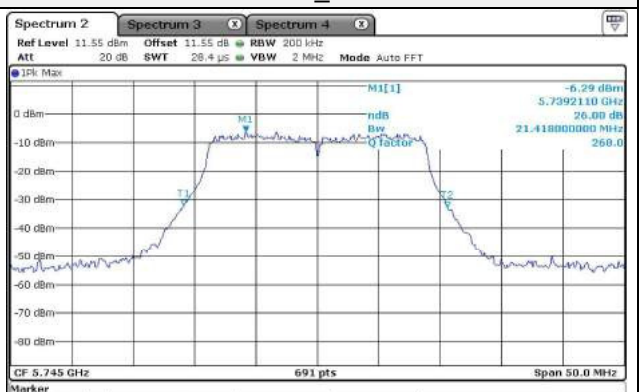
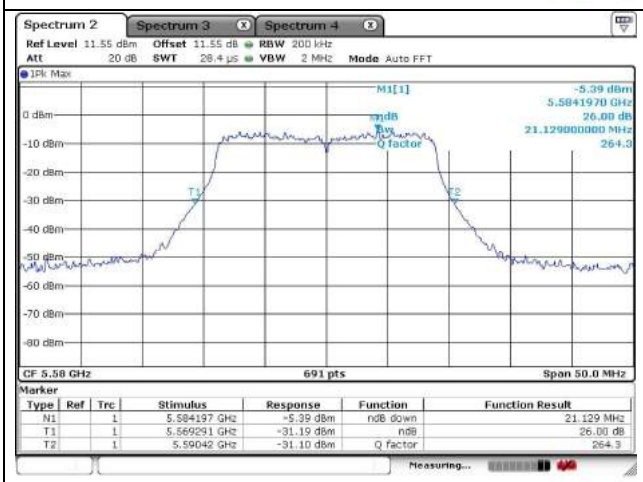
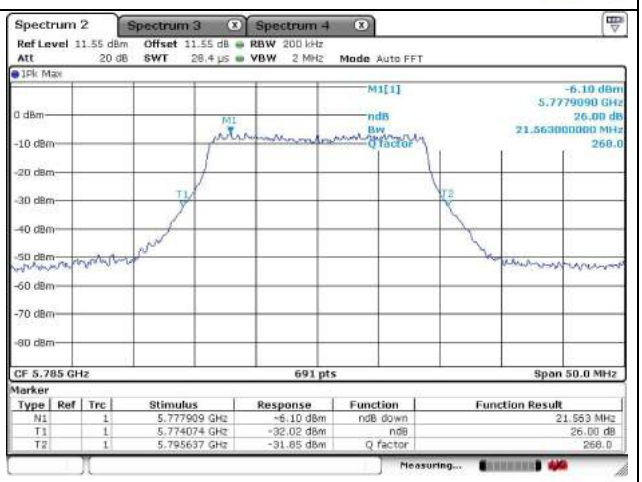
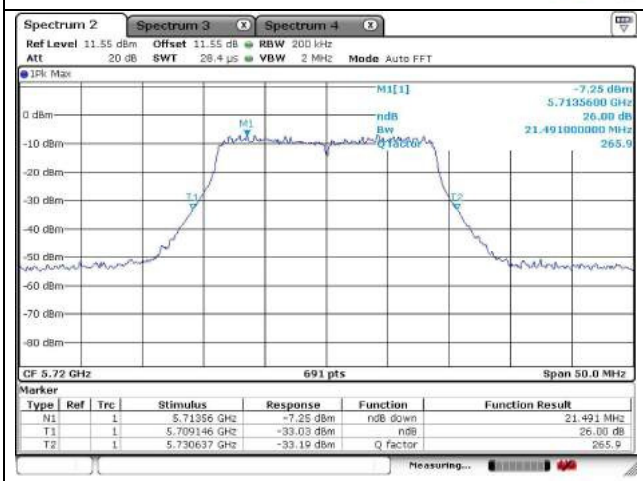
UNII-2C_HT20	UNII-3_ HT20

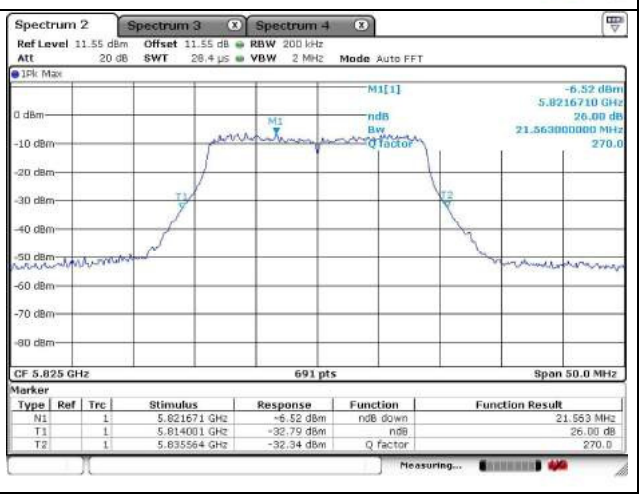












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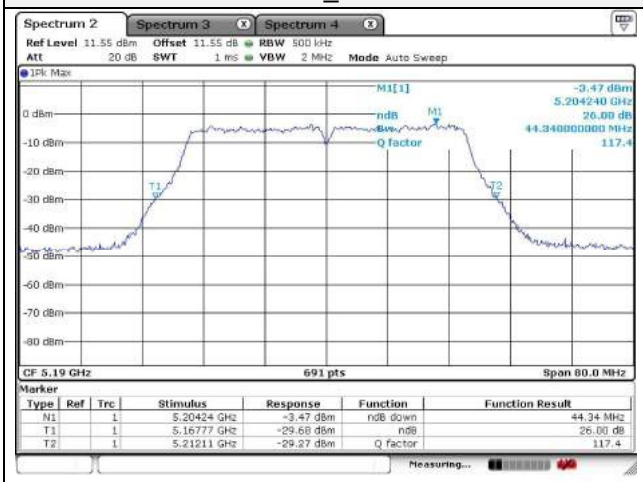
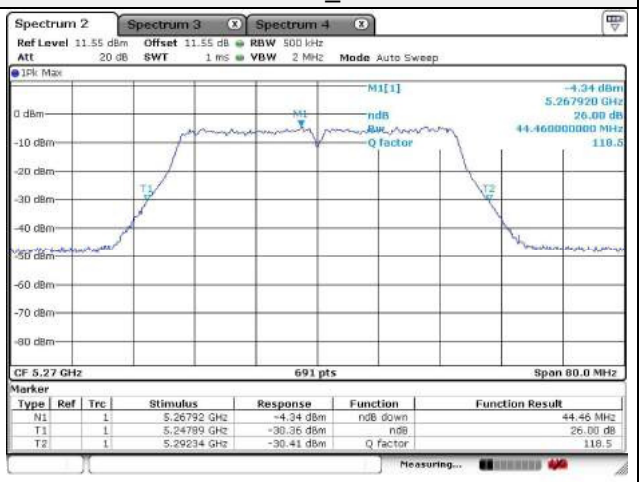
UNII-1_ HT40	UNII-2A_ HT40
	
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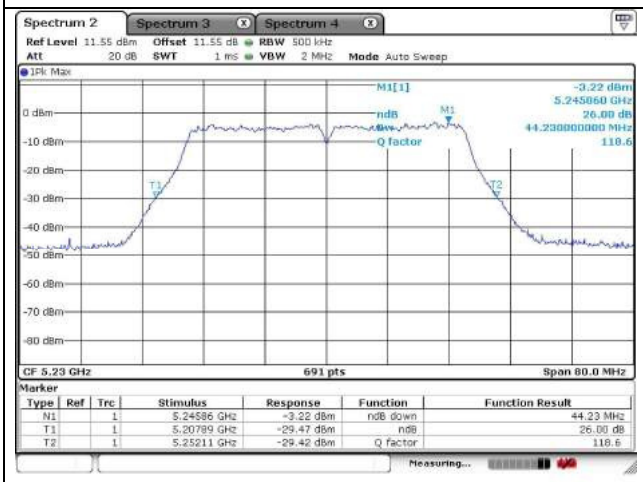	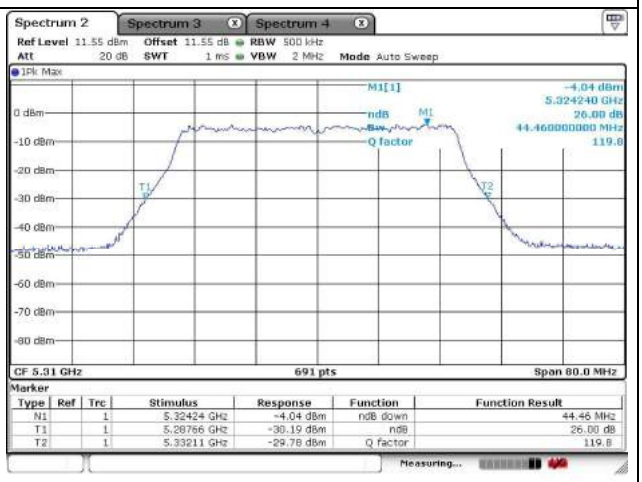

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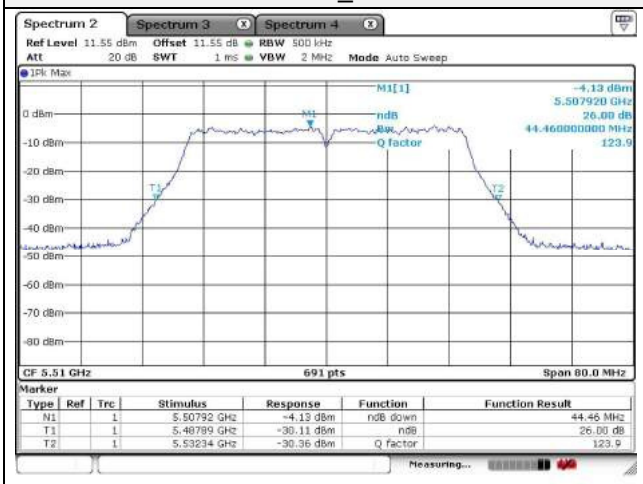
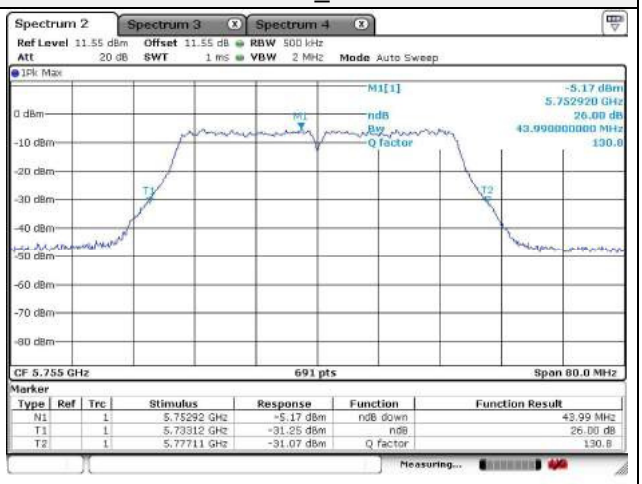
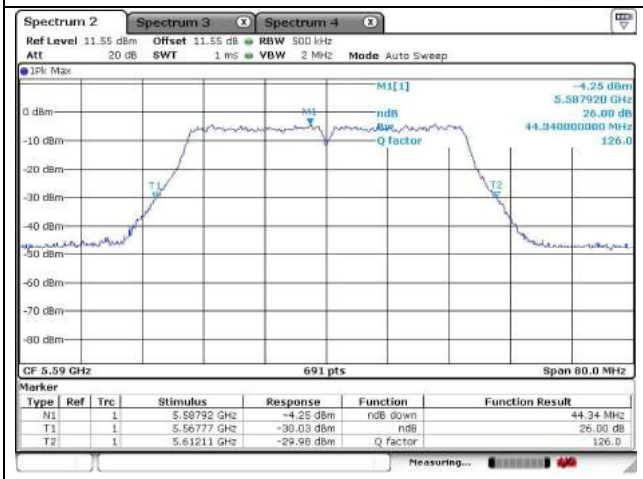
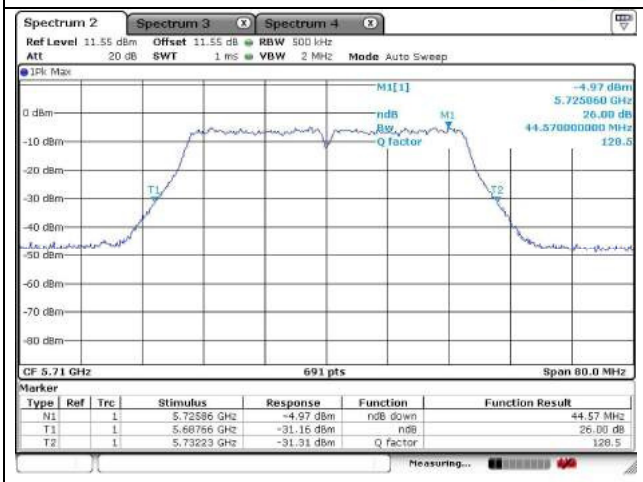
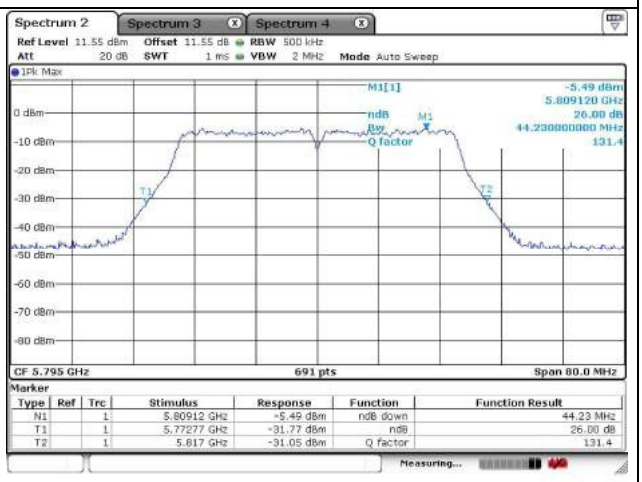
UNII-2C_HT40	UNII-3_ HT40
	
	N/A
	

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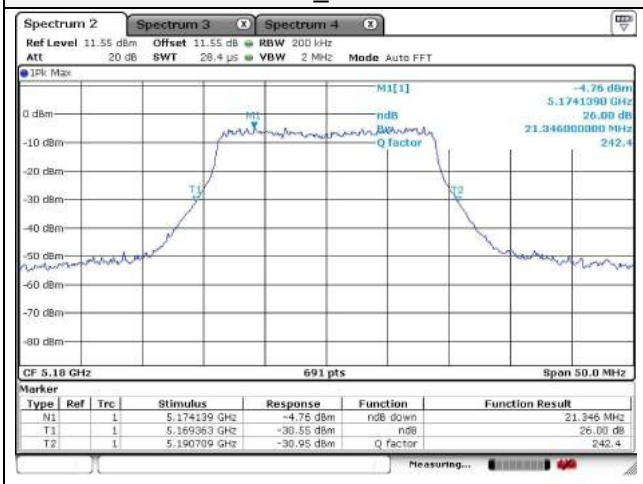
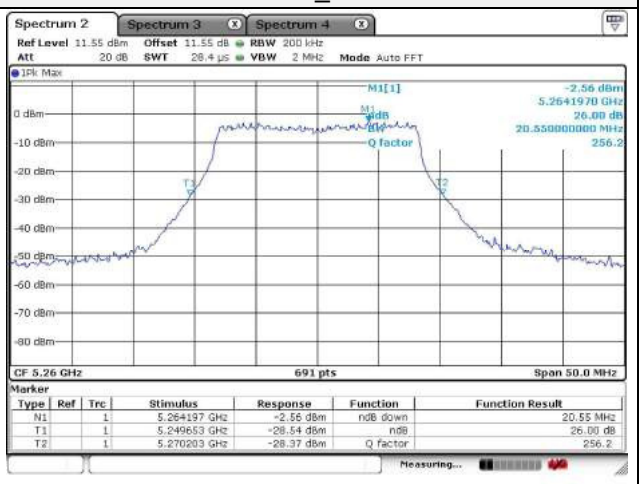
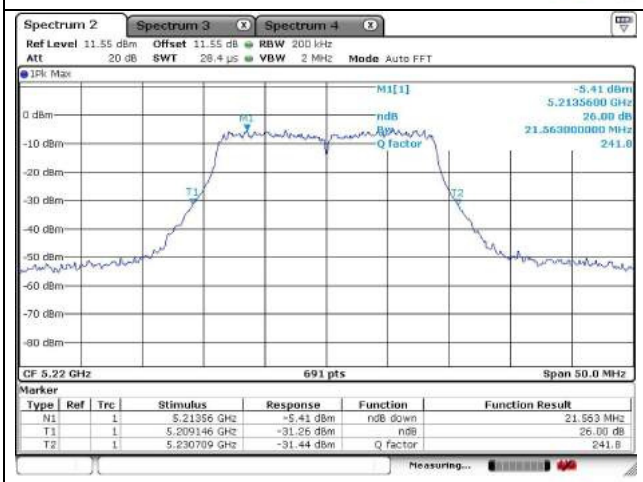
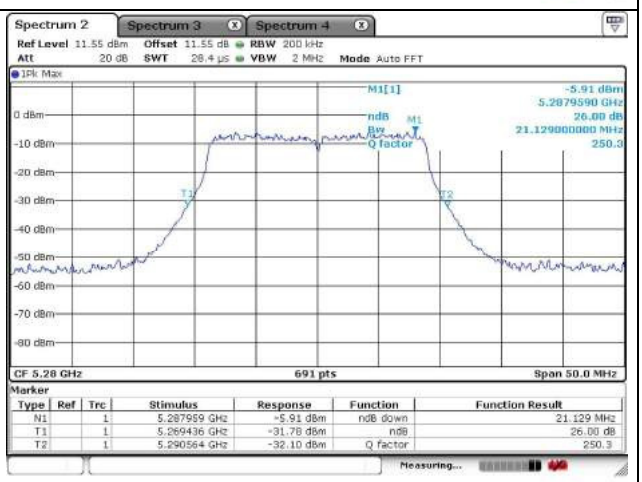
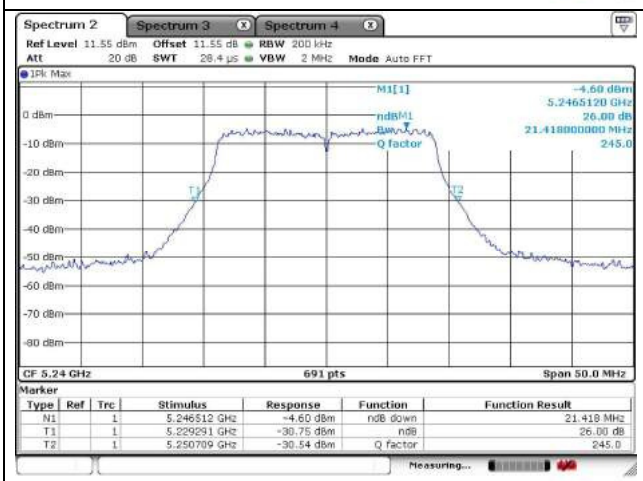
UNII-1_ VHT20	UNII-2A_ VHT20

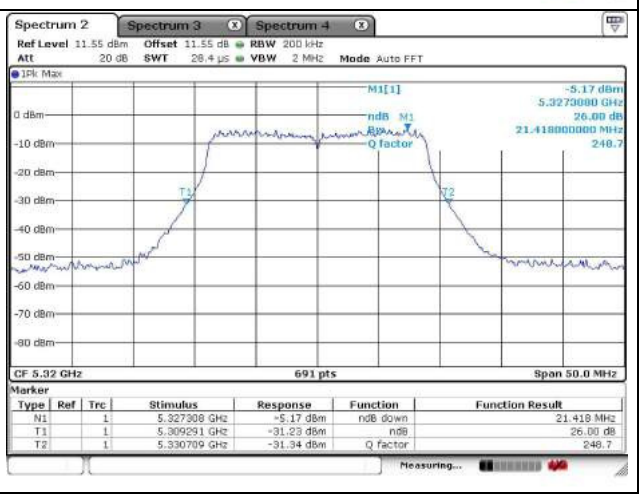












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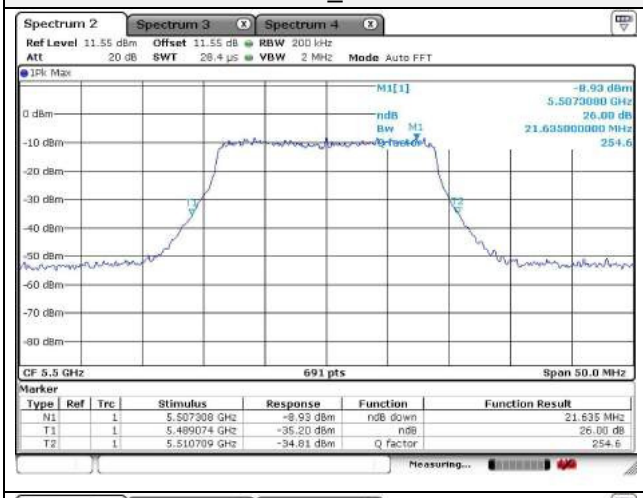
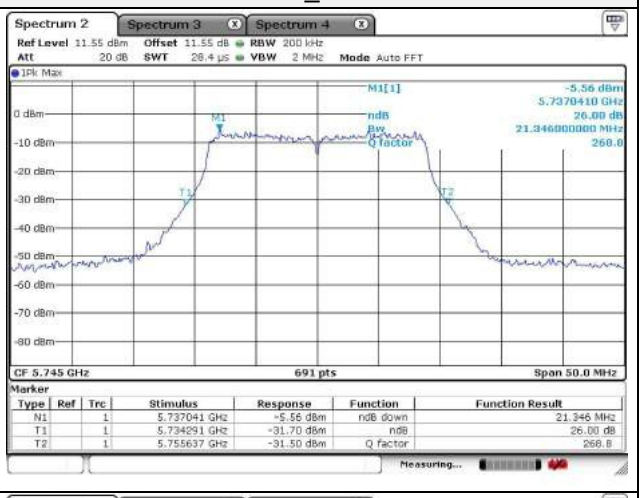
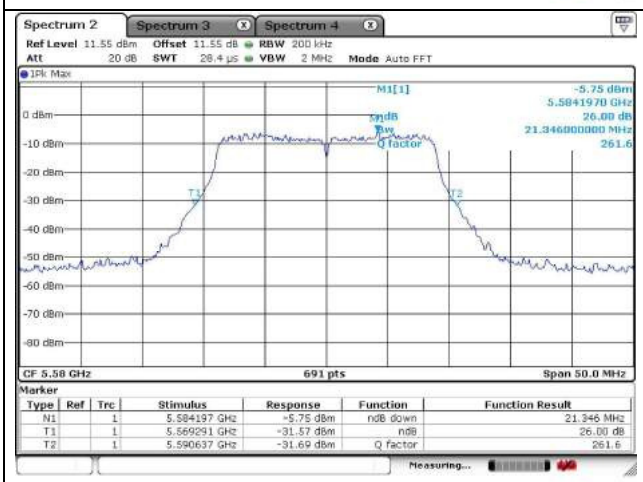
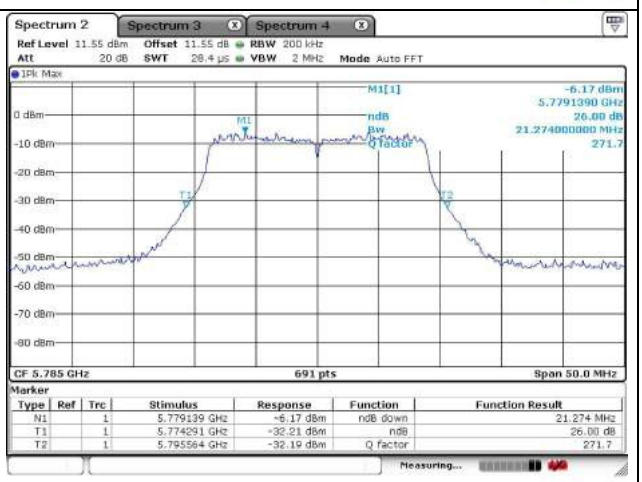
UNII-2C_VHT20

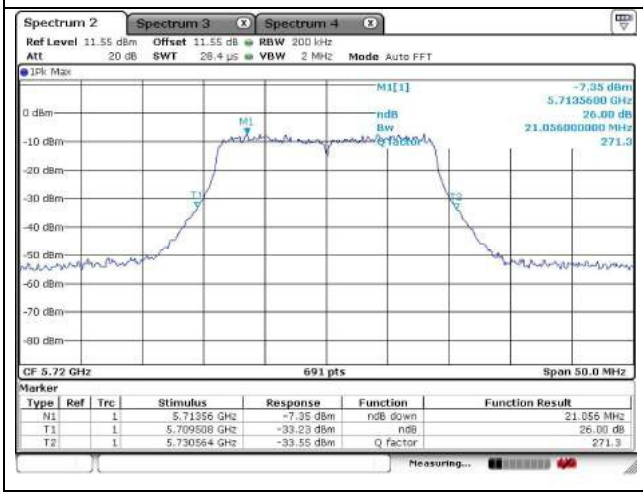


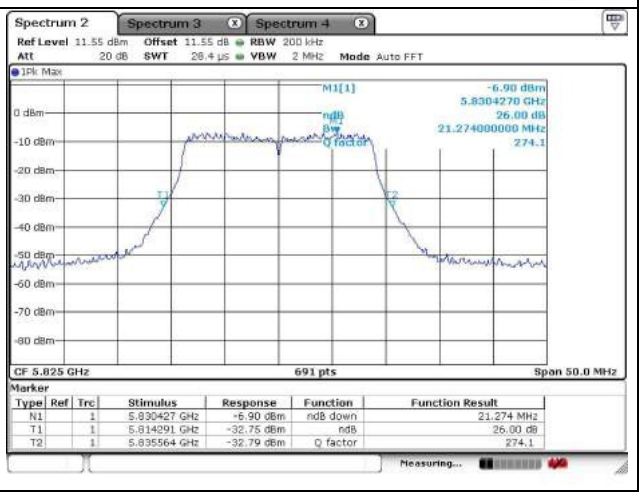
UNII-3_ VHT20











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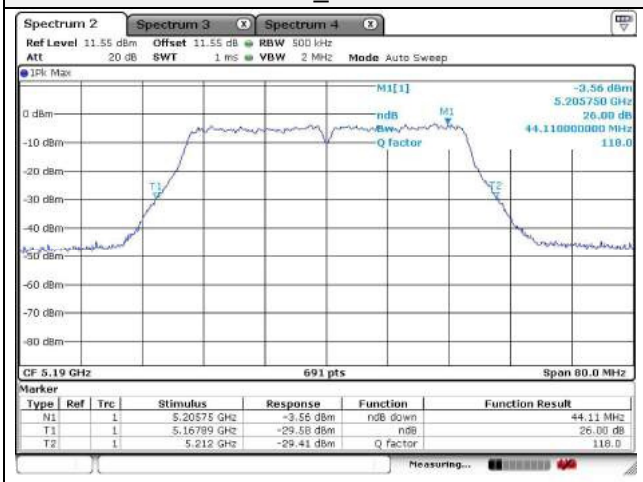
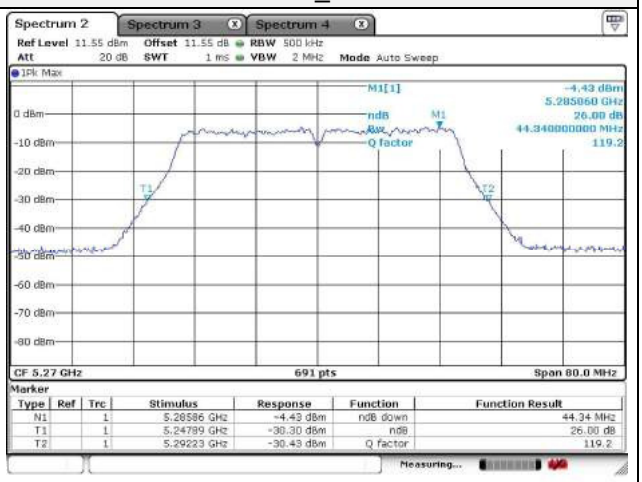
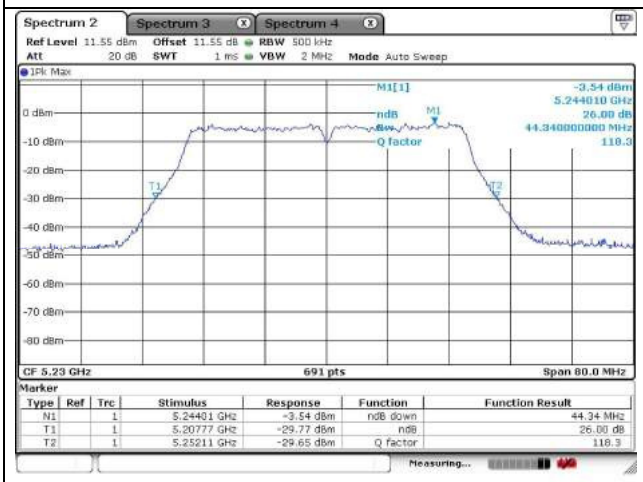
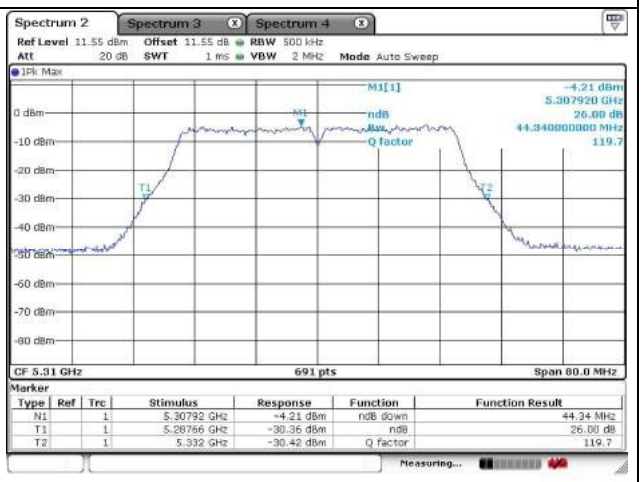
UNII-1_ VHT40	UNII-2A_ VHT40
	
N/A	N/A
	

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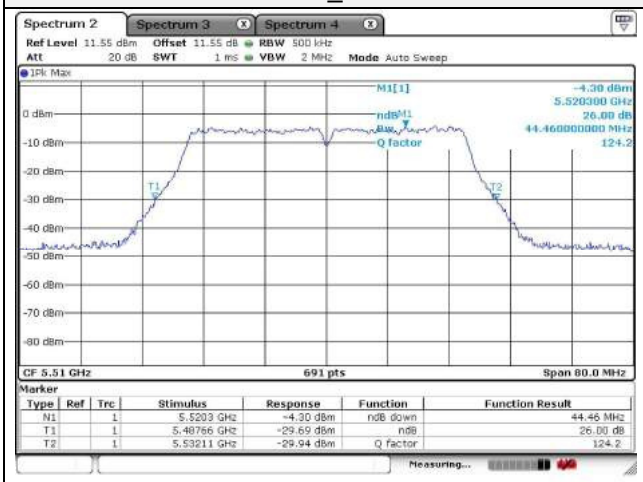
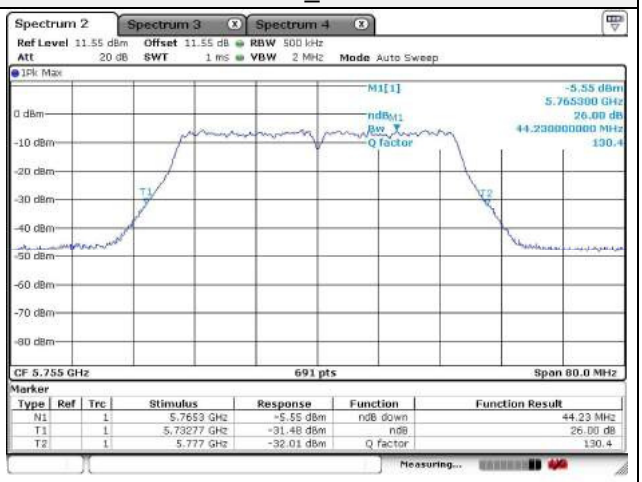
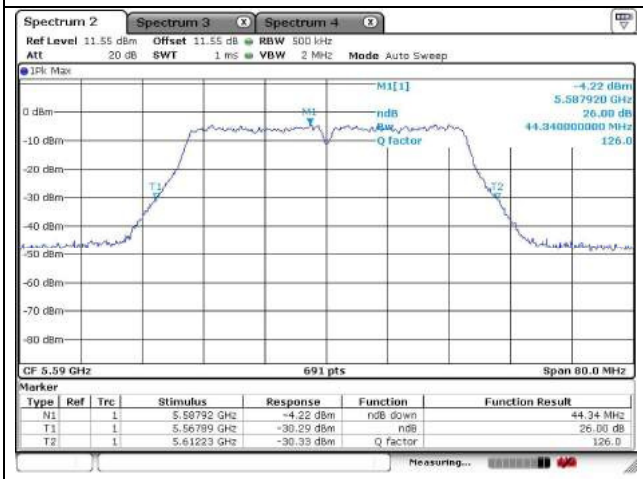
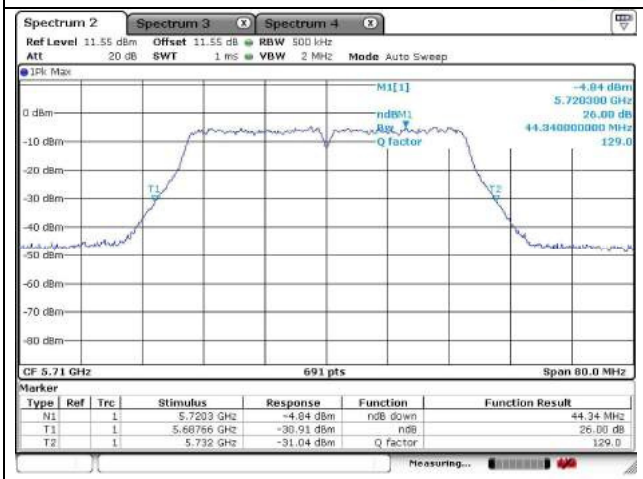
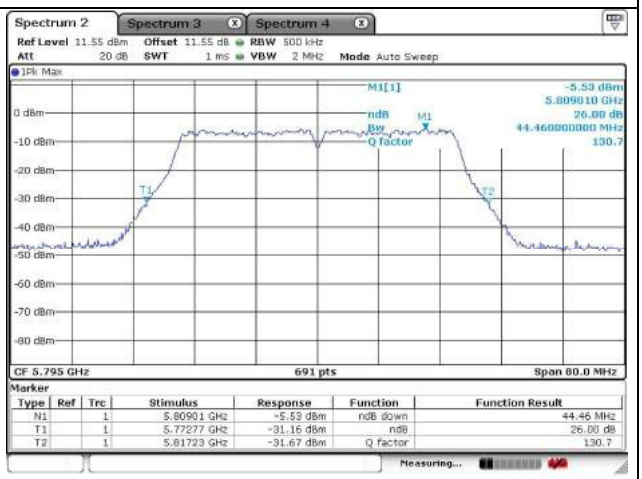
UNII-2C_VHT40	UNII-3_ VHT40
	
	N/A
	

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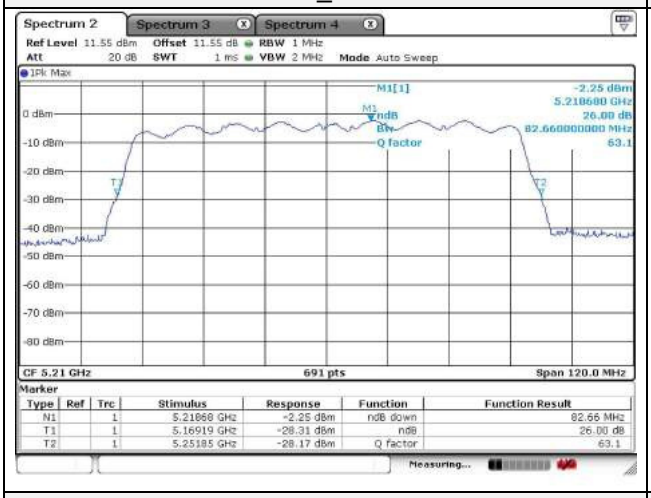
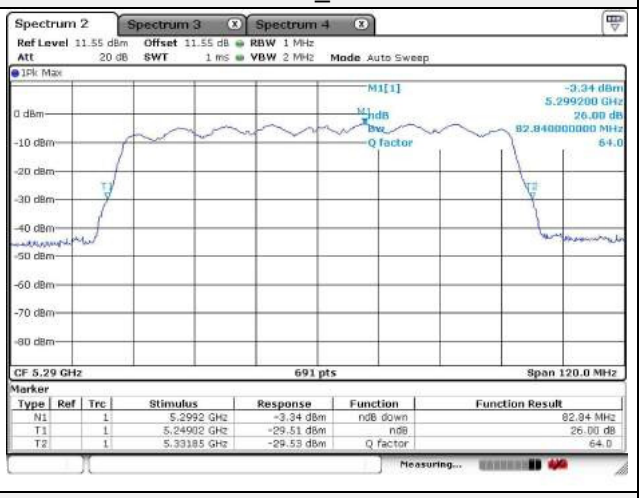
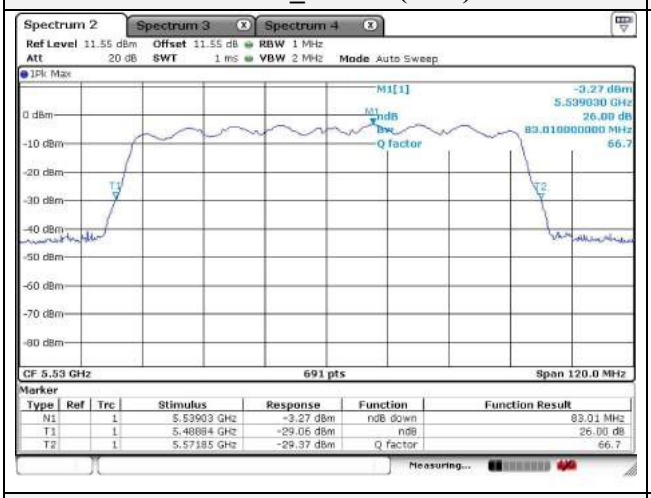
UNII-1_VHT80



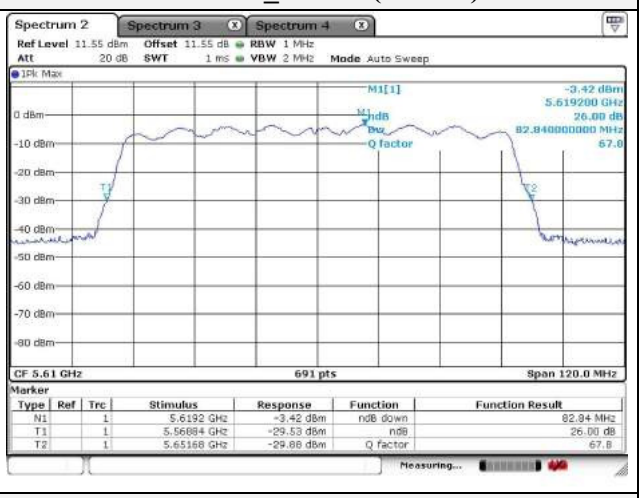
UNII-2A_ VHT80



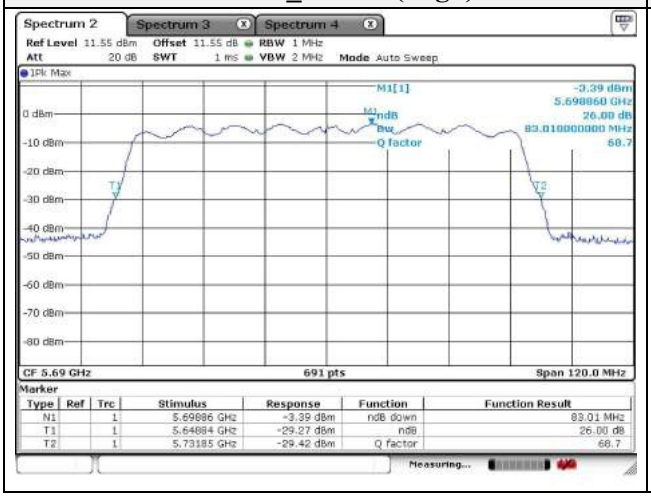
UNII-2C_VHT80(Low)



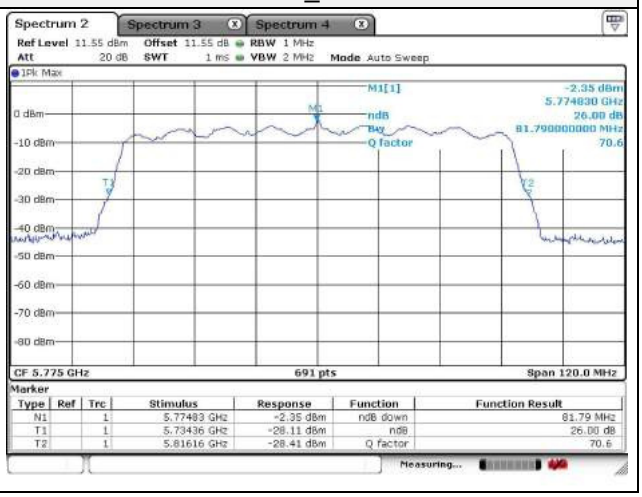
UNII-2C_VHT80(Middle)



UNII-2C_VHT80(High)



UNII-3_ VHT80



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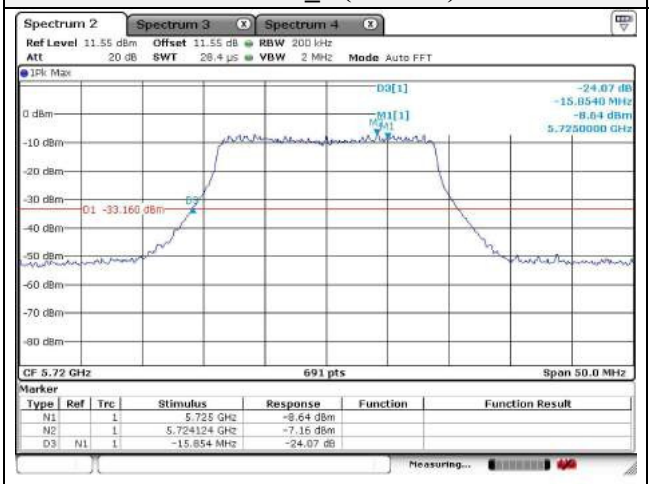
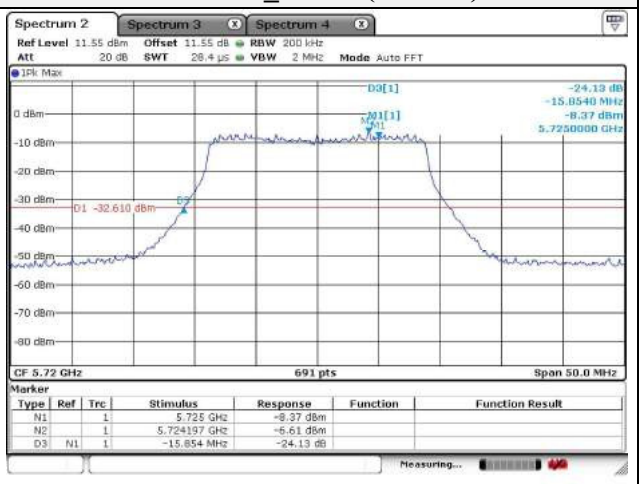
Band-crossing channels

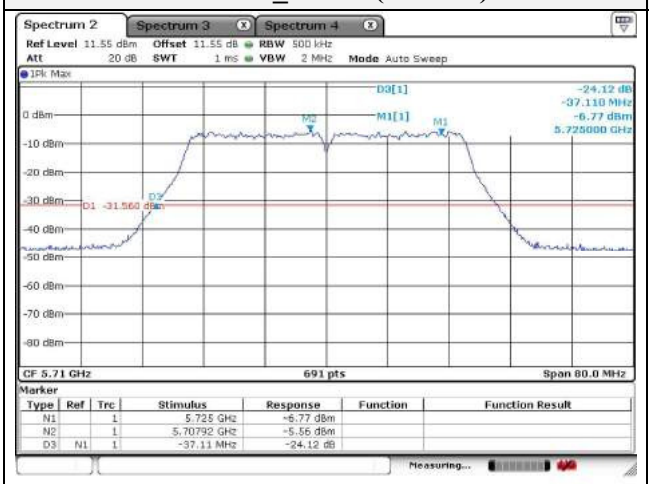
UNII-2C_a (Ch. 144)



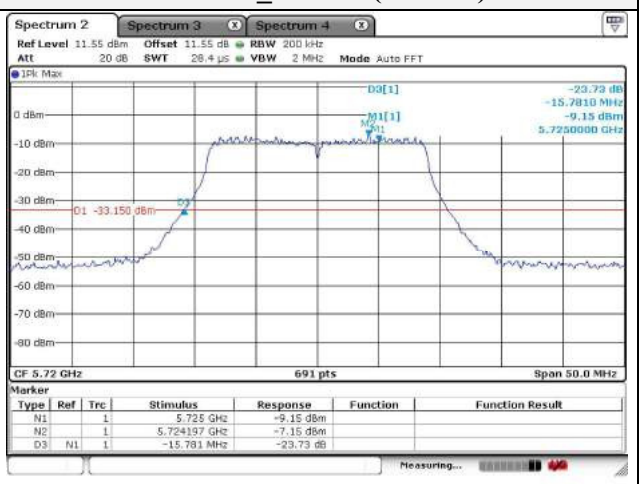
UNII-2C_ HT20 (Ch. 144)



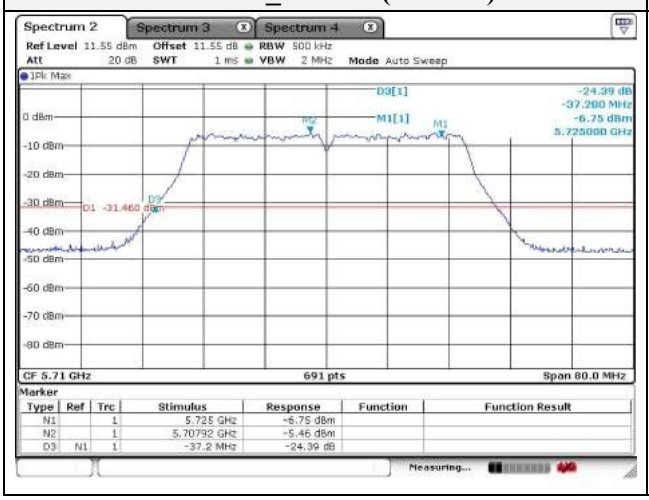
UNII-2C_ HT40 (Ch. 142)



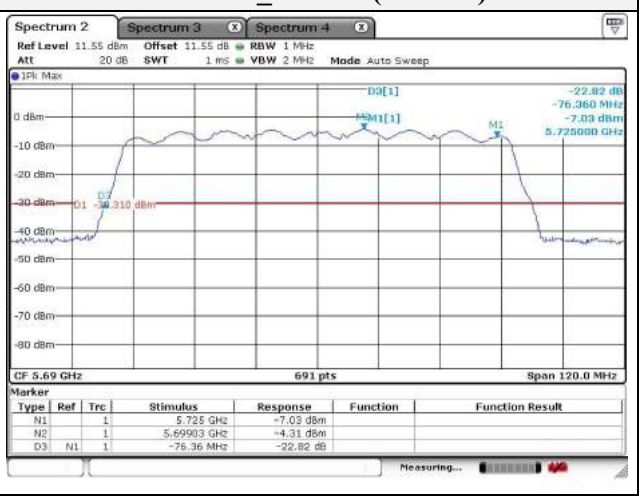
UNII-2C_VHT20 (Ch. 144)



UNII-2C_VHT40 (Ch. 142)



UNII-2C_VHT80 (Ch. 138)



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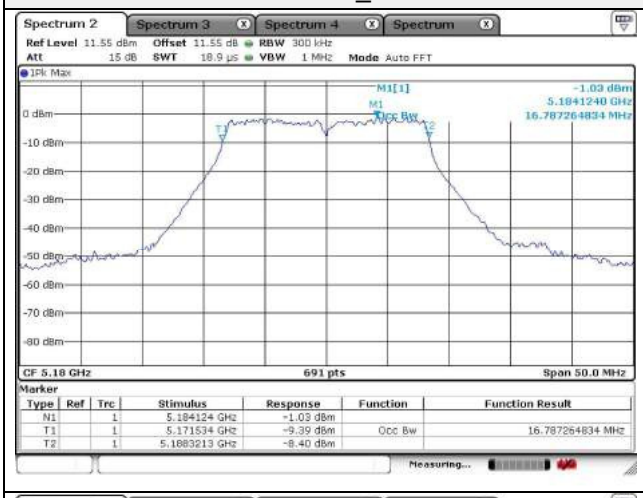
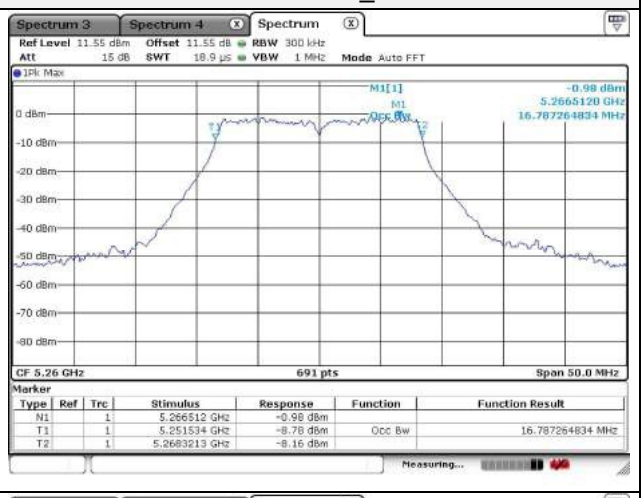
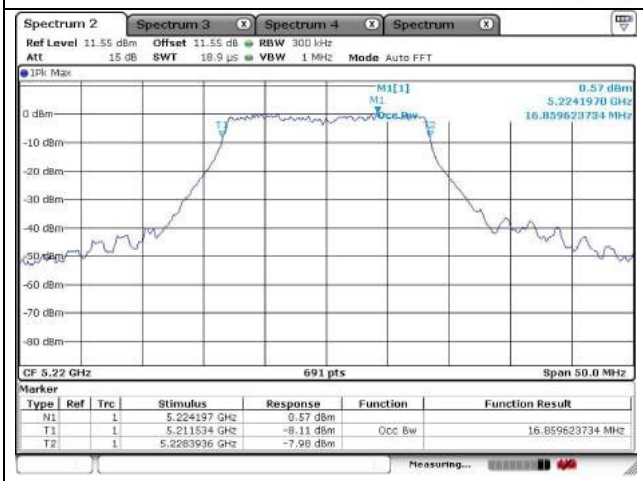
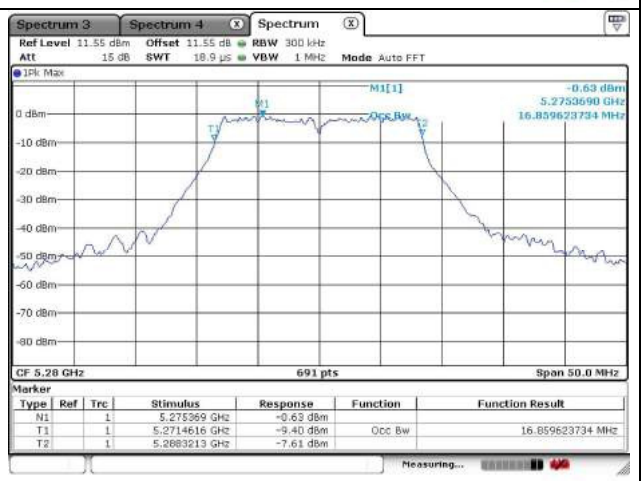
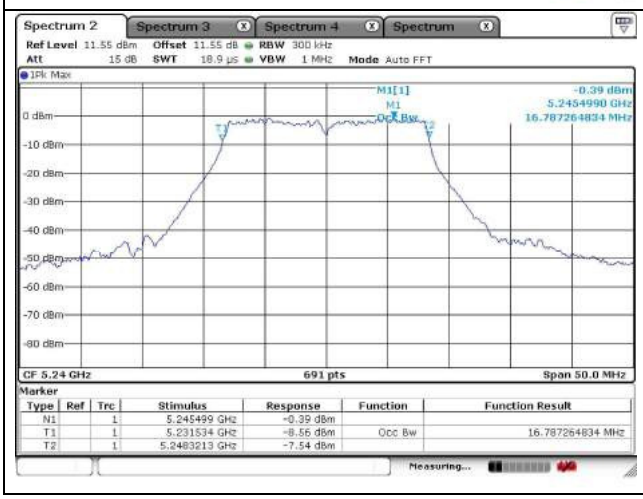
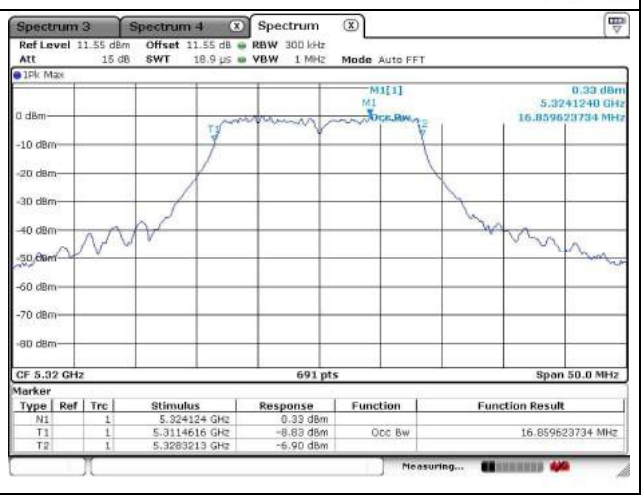
99% bandwidth

UNII-1_a	UNII-2A_a
	
	
	

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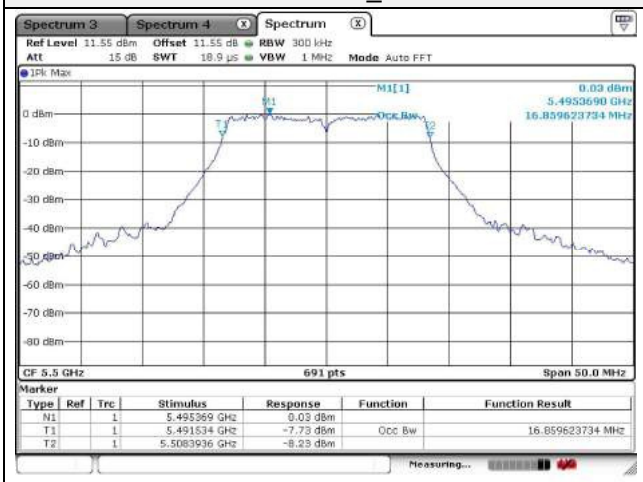
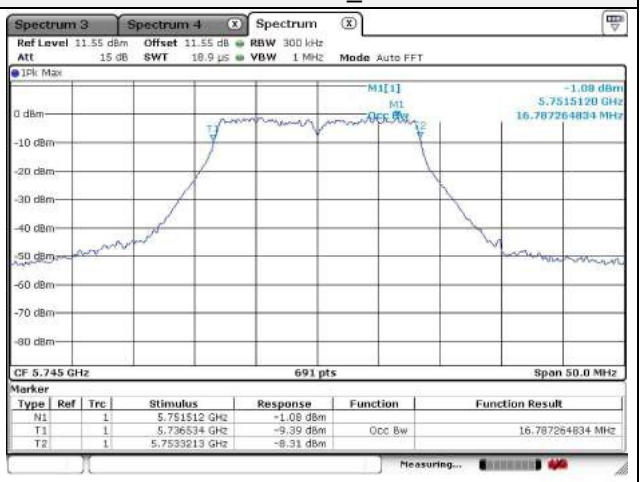
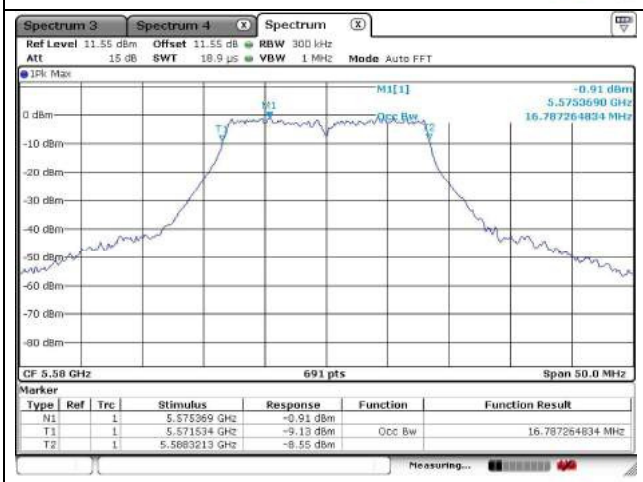
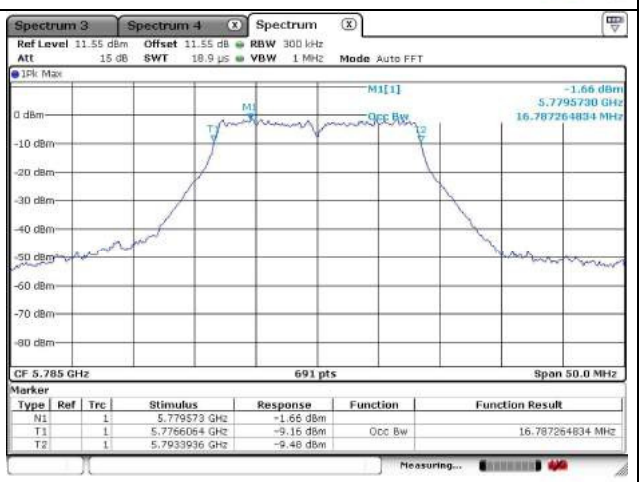
UNII-2C_a

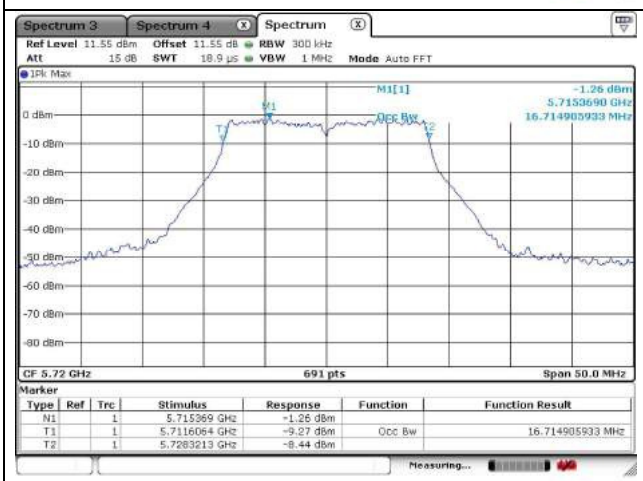


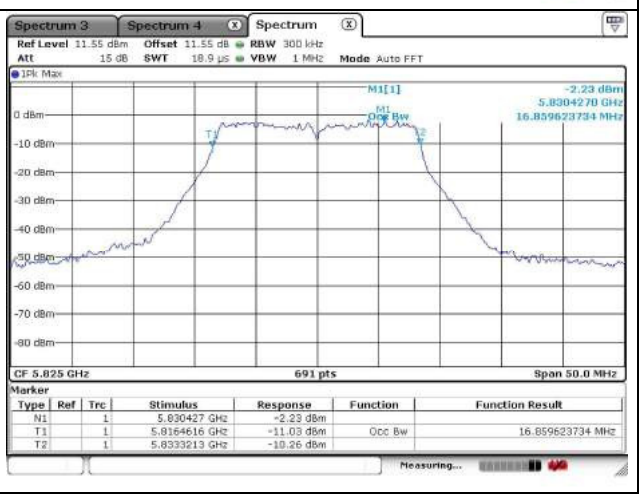
UNII-3_a











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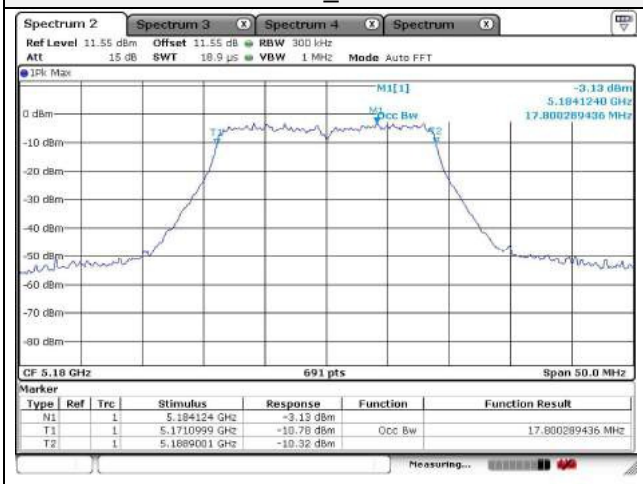
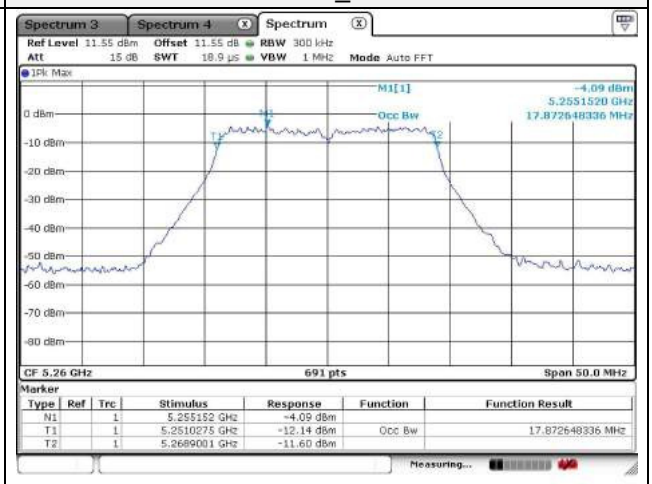
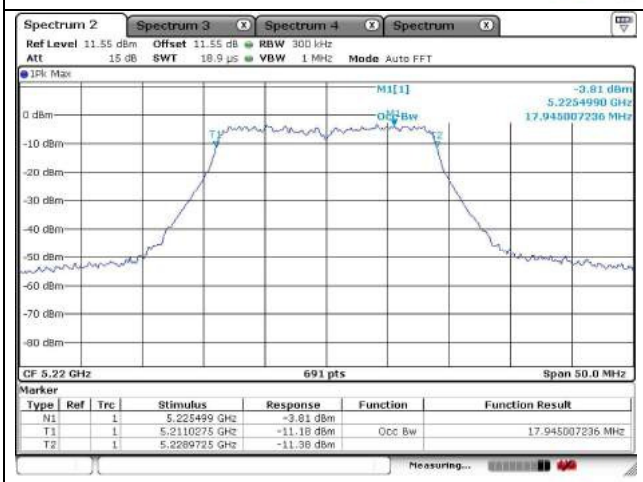
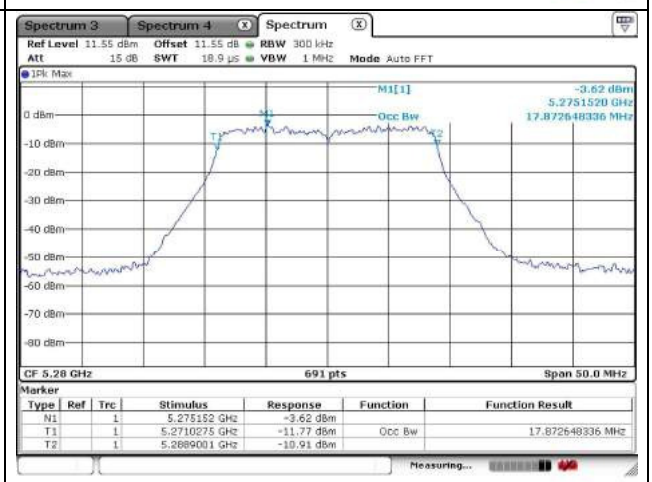
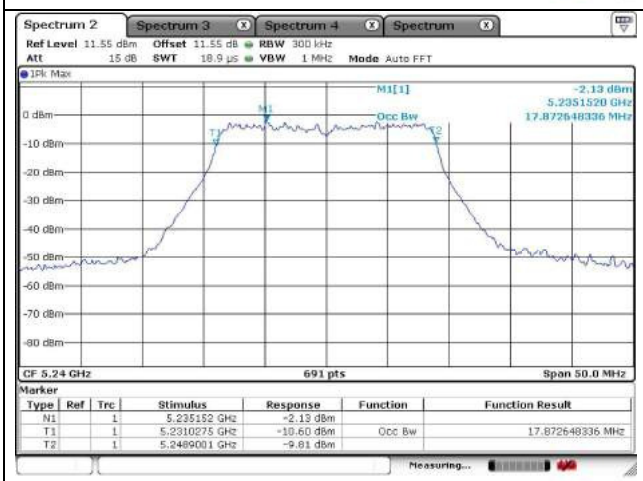
UNII-1_ HT20	UNII-2A_ HT20

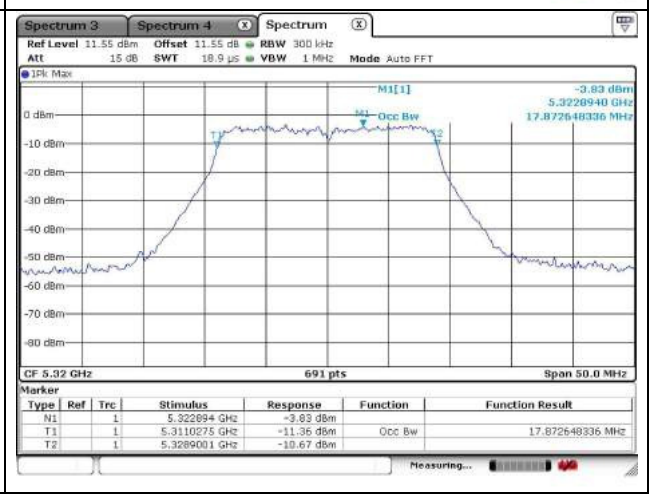












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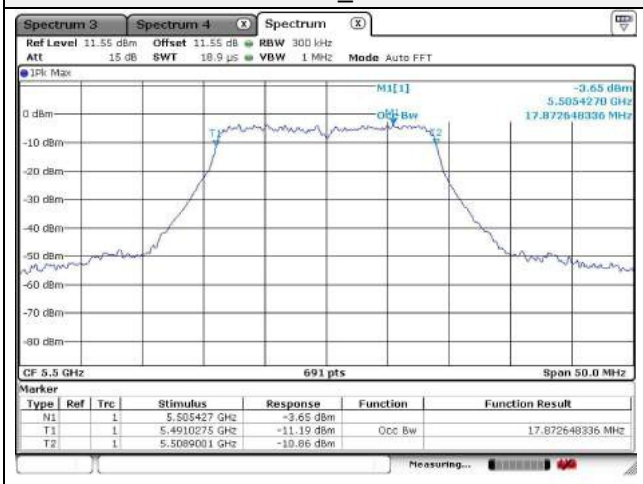
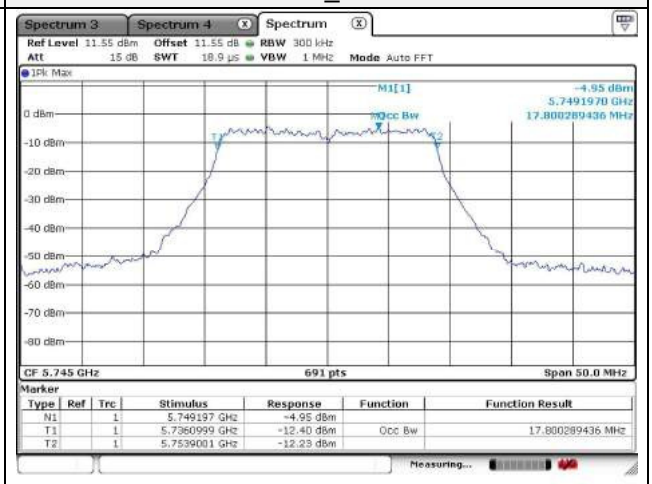
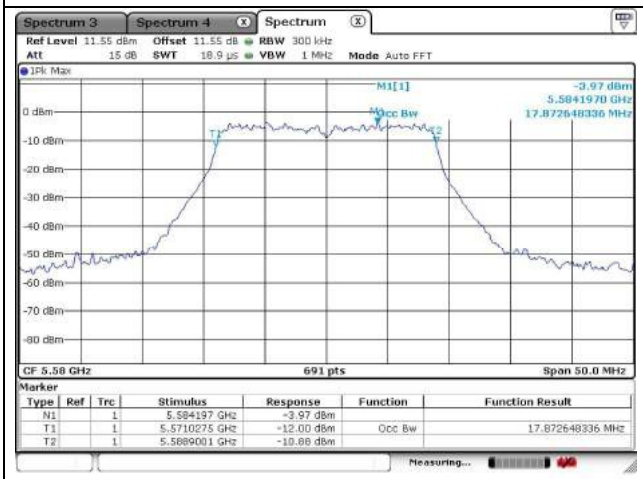
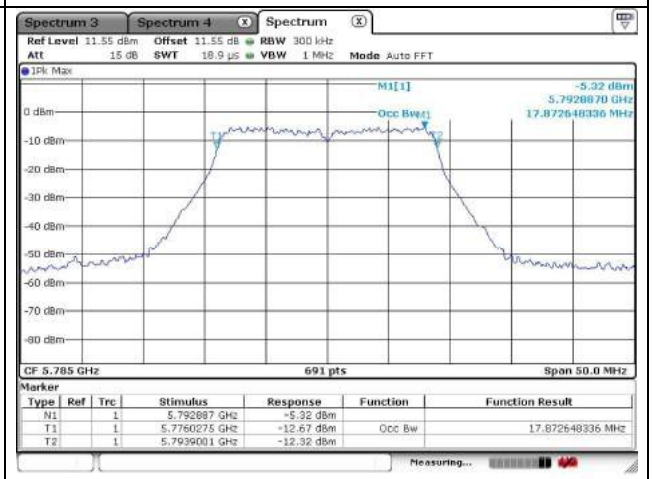
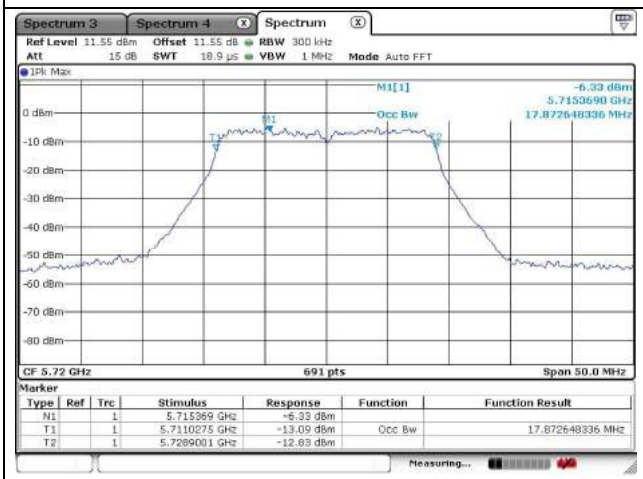
UNII-2C_HT20	UNII-3_ HT20

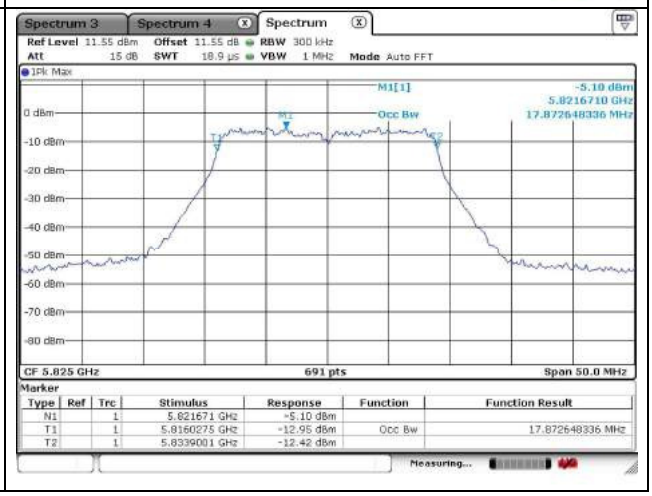












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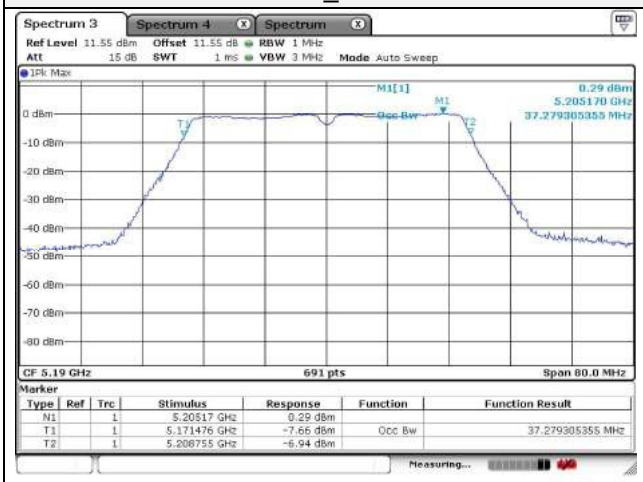
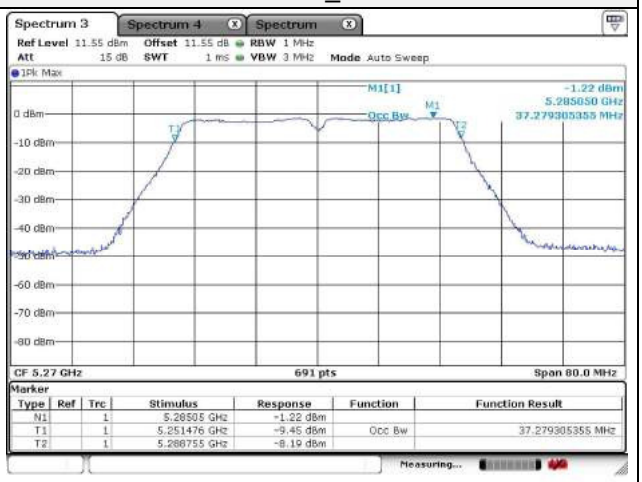
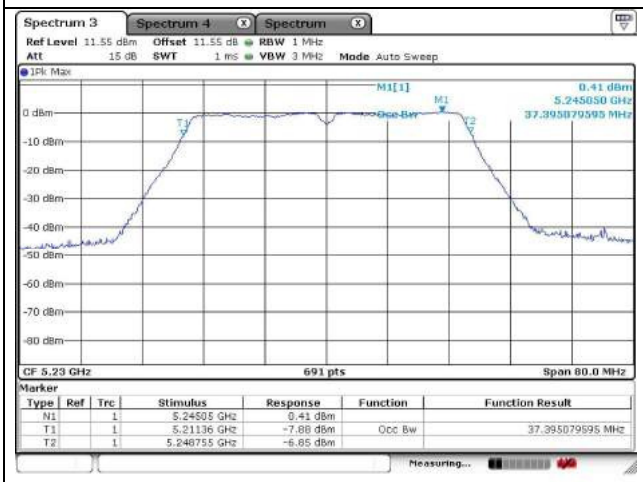
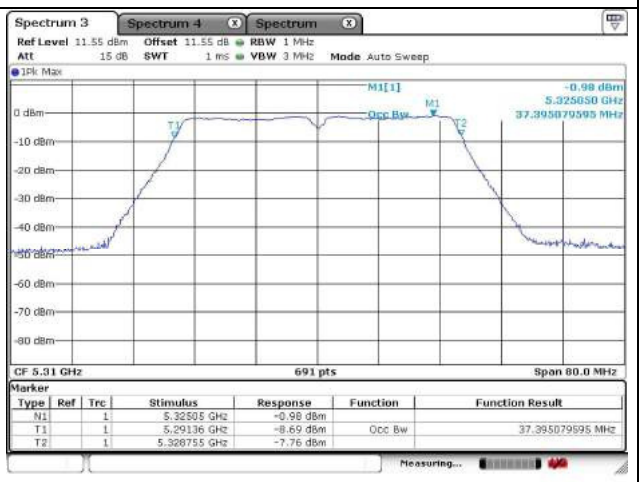
UNII-1_ HT40	UNII-2A_ HT40
	
N/A	N/A
	

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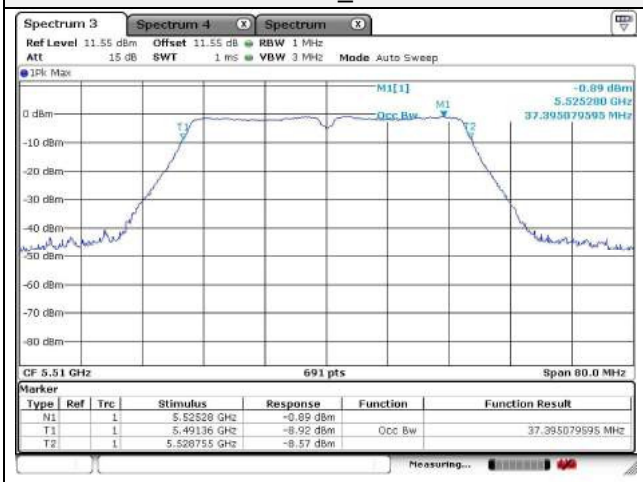
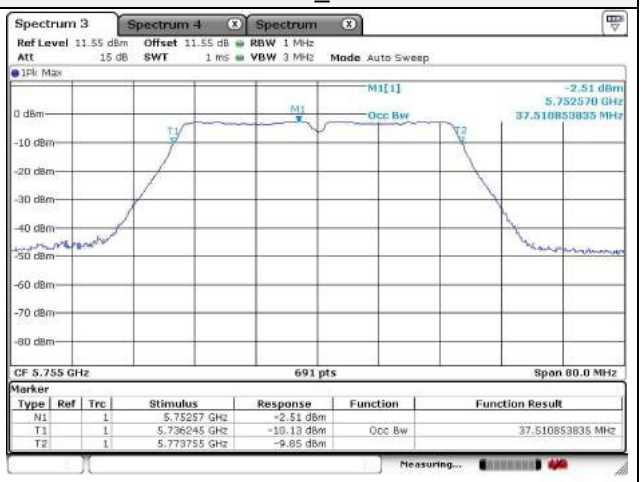
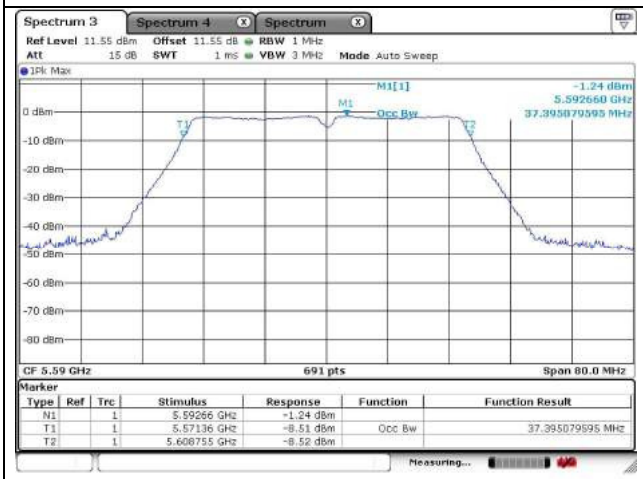
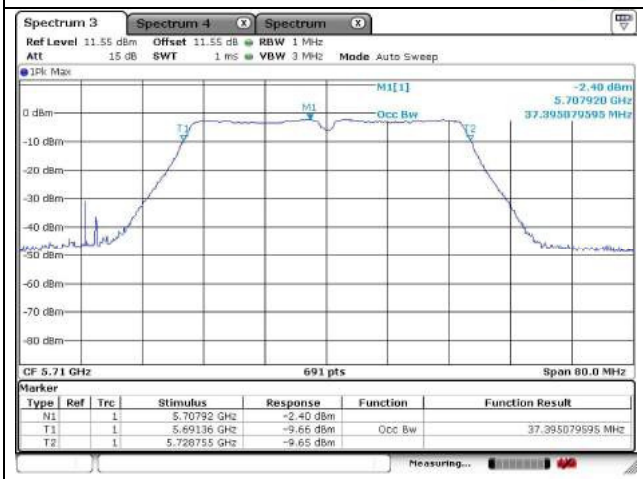
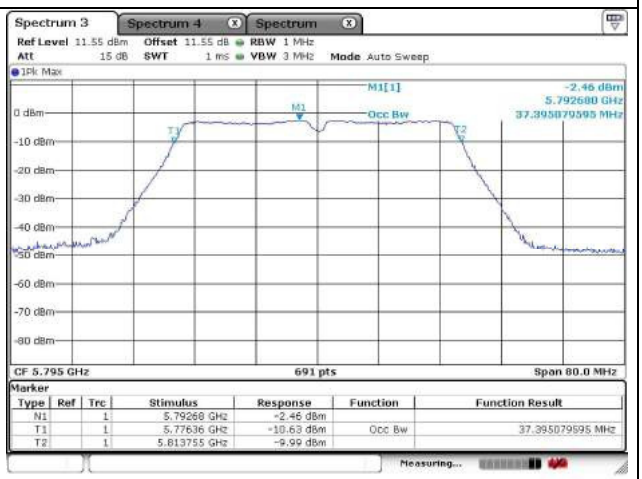
UNII-2C_HT40	UNII-3_ HT40
	
	N/A
	

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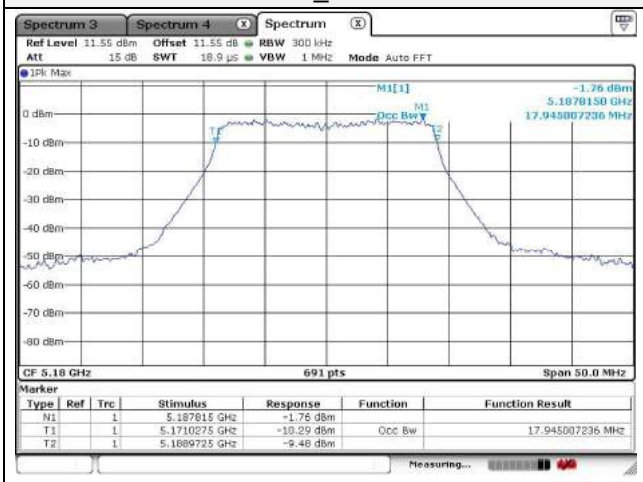
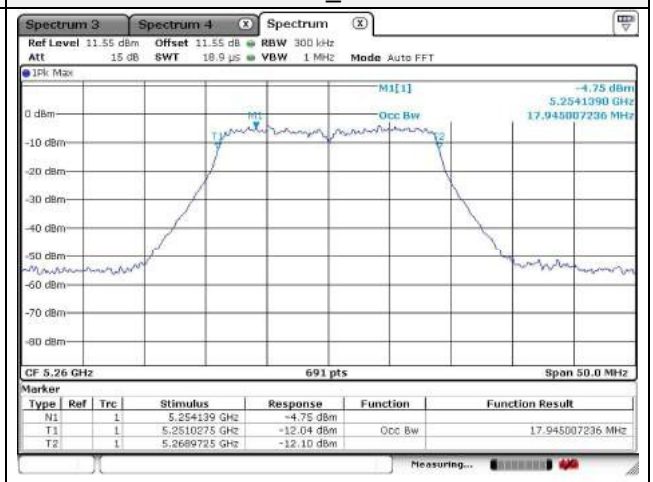
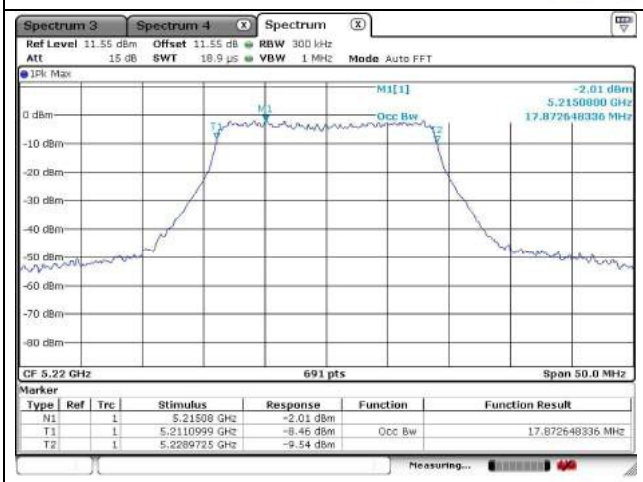
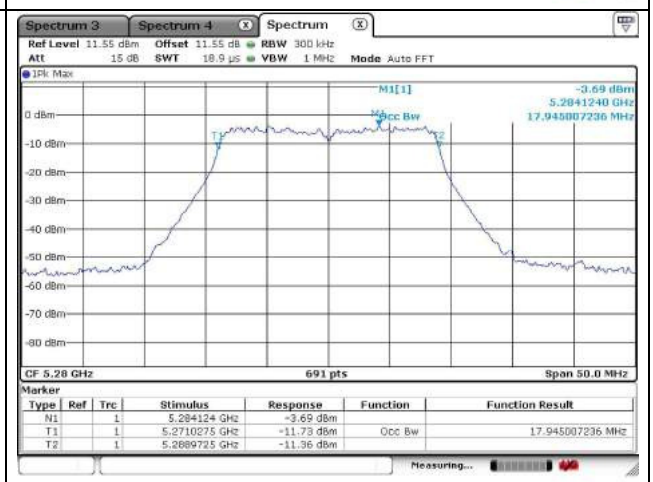
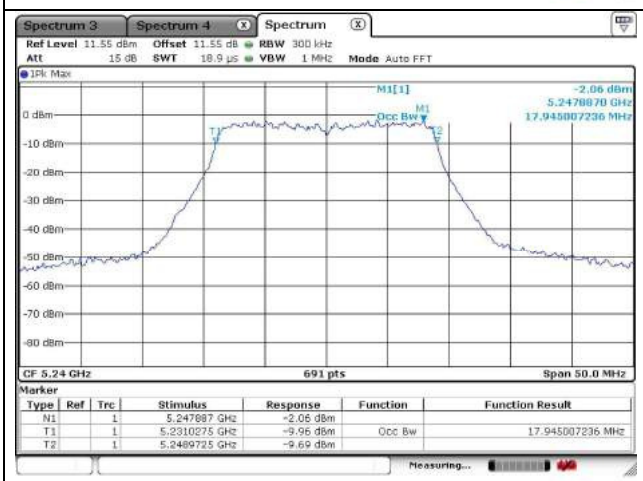
UNII-1_ VHT20	UNII-2A_ VHT20

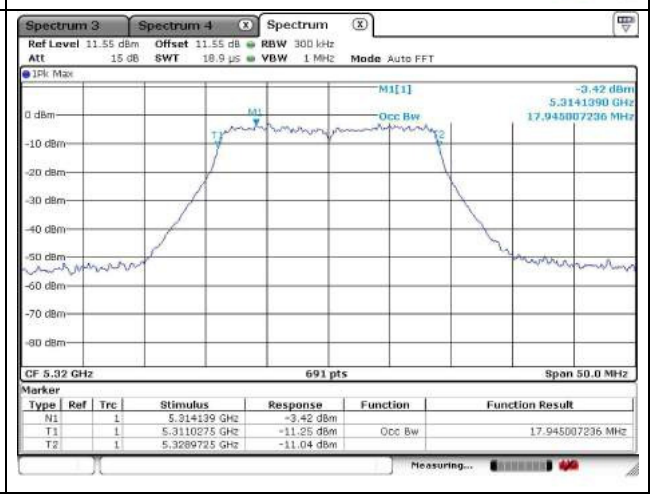












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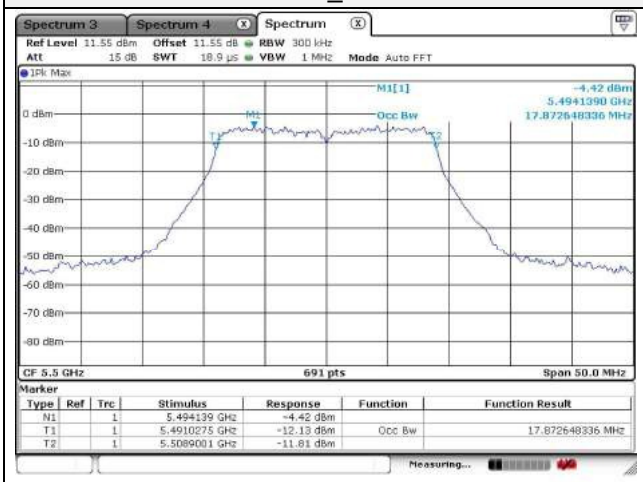
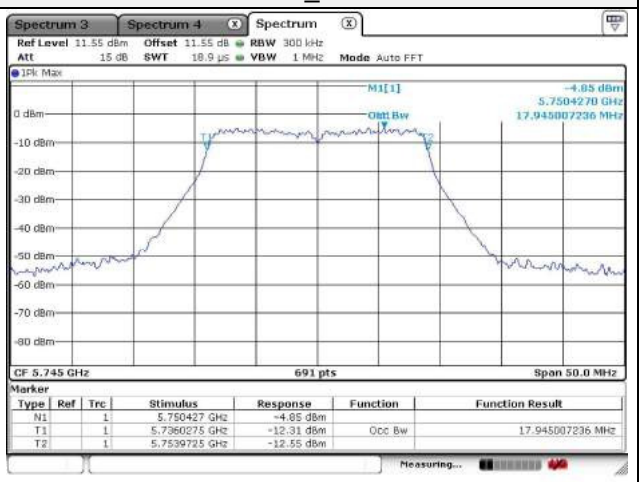
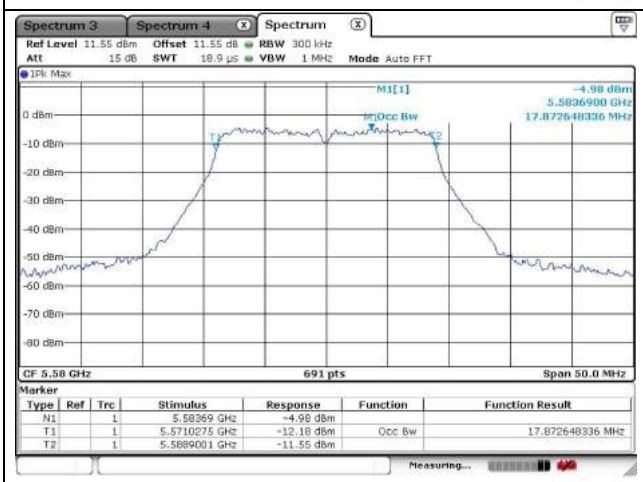
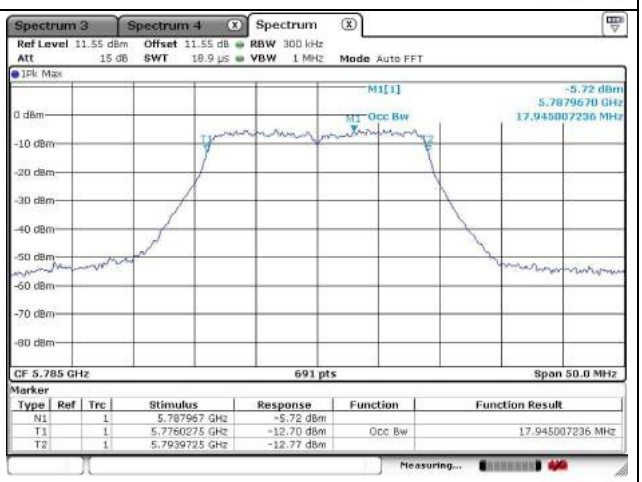
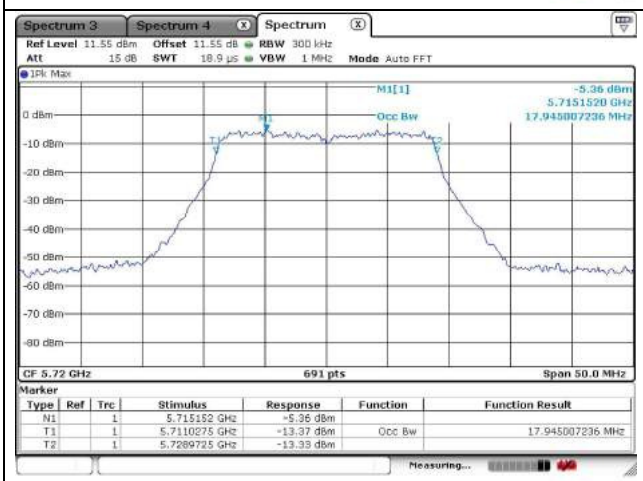
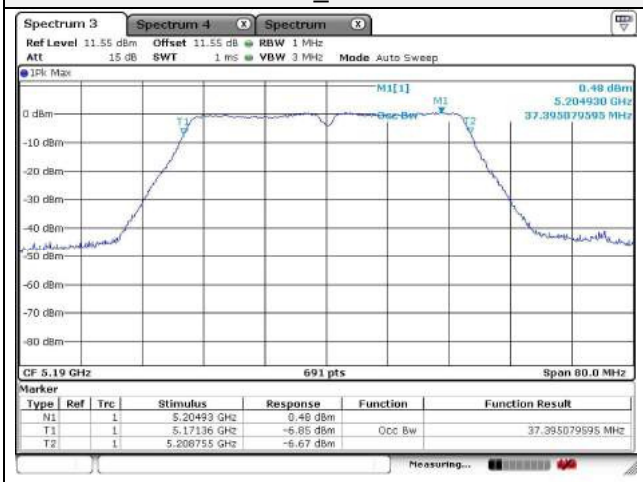
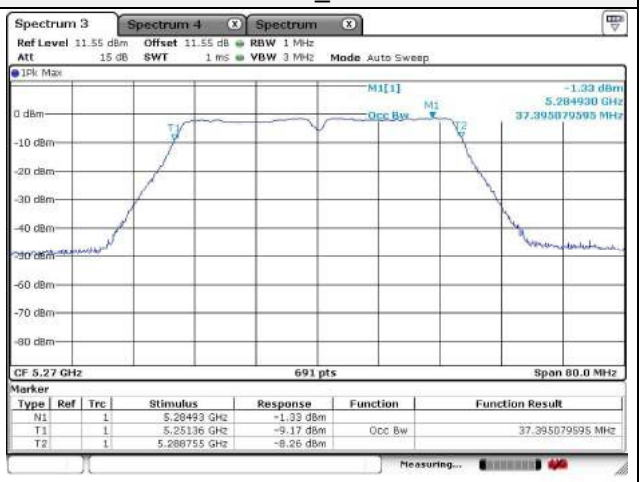
UNII-2C_VHT20	UNII-3_ VHT20
	
	
	

UNII-1_ VHT40	UNII-2A_ VHT40
	
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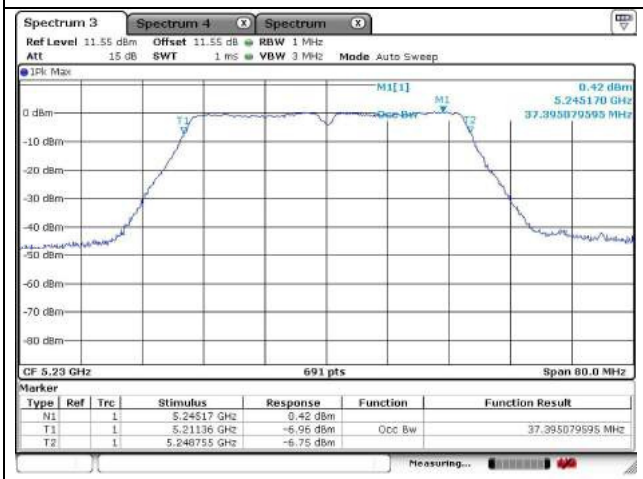	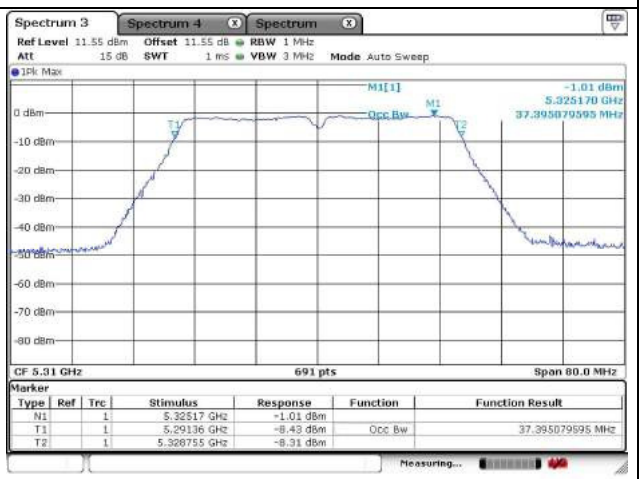

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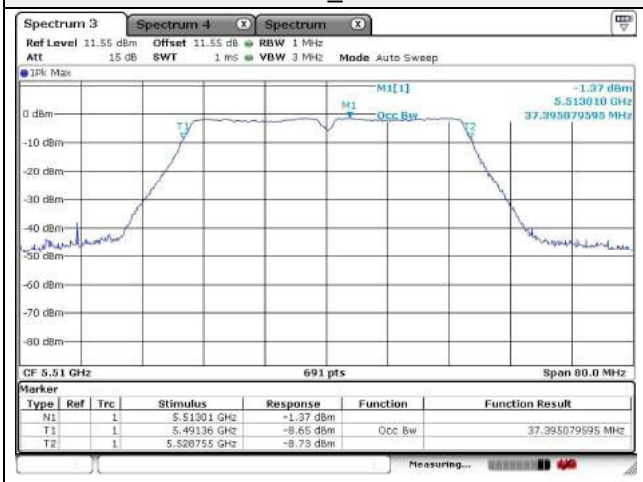
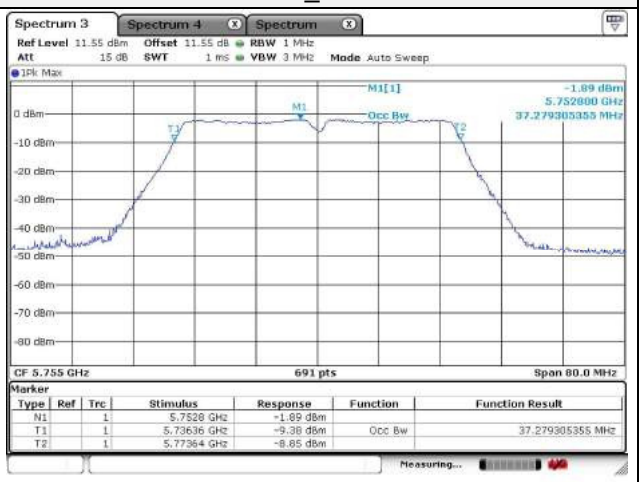
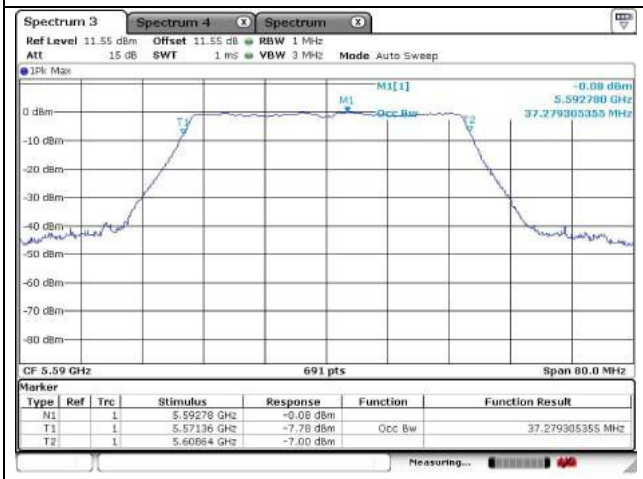
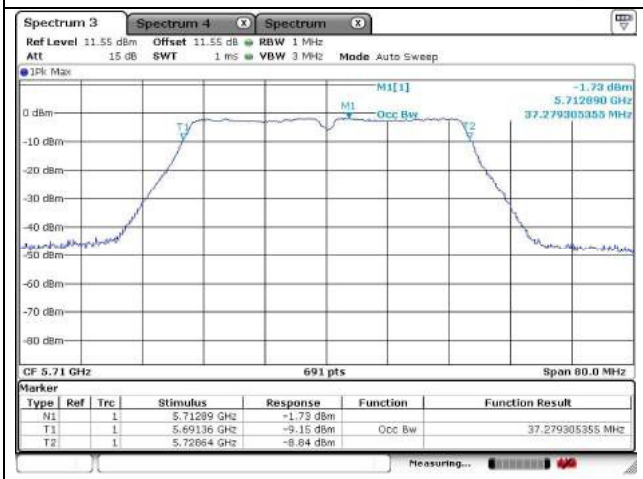
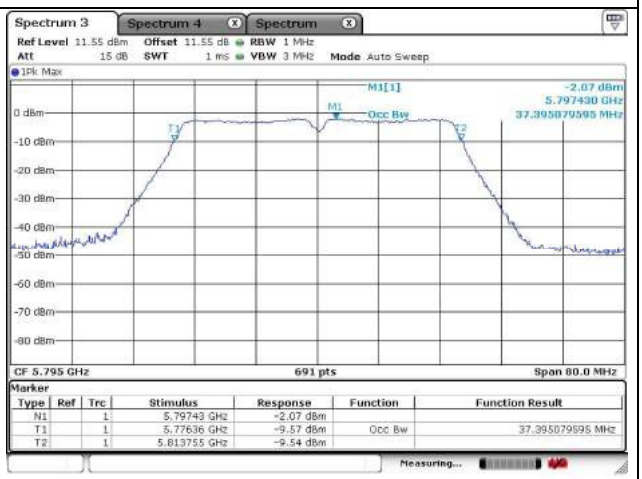
UNII-2C_VHT40	UNII-3_ VHT40
	
	N/A
	

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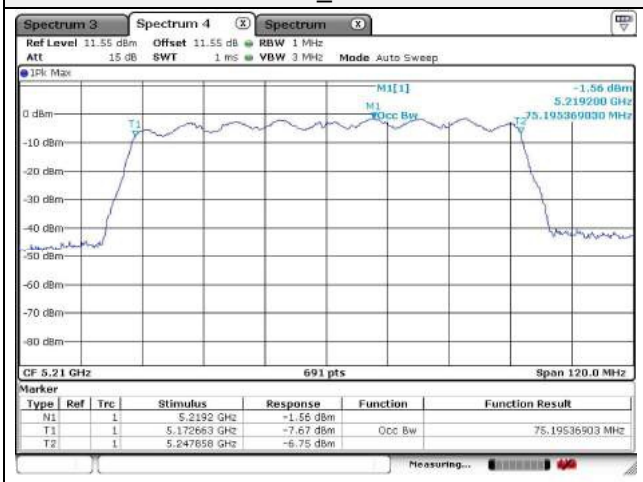
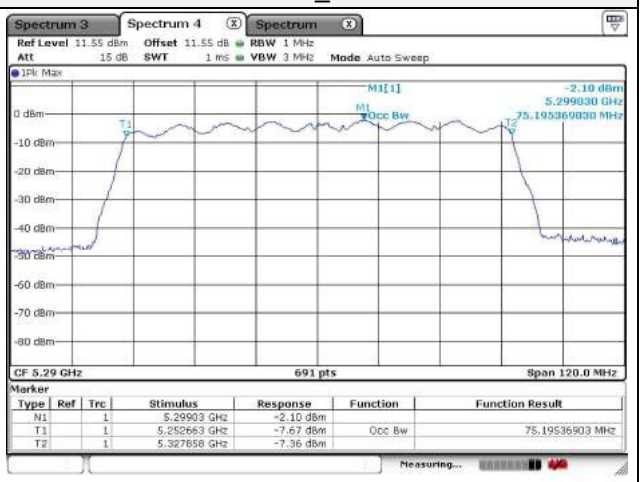
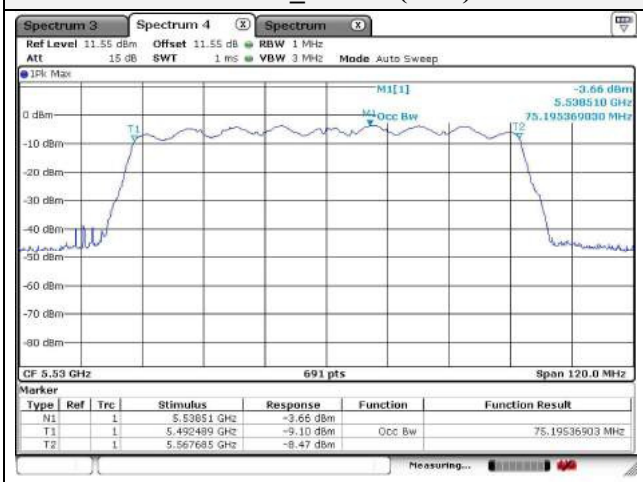
UNII-1_VHT80



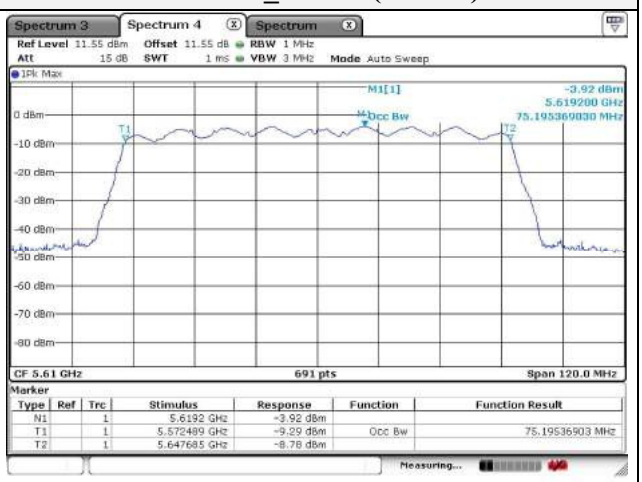
UNII-2A_ VHT80



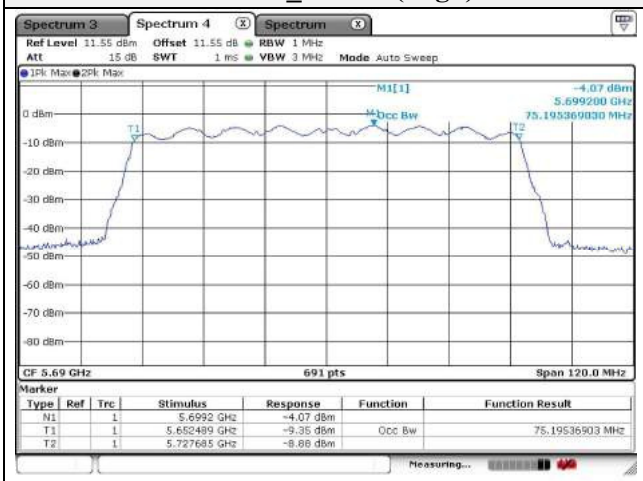
UNII-2C_VHT80(Low)



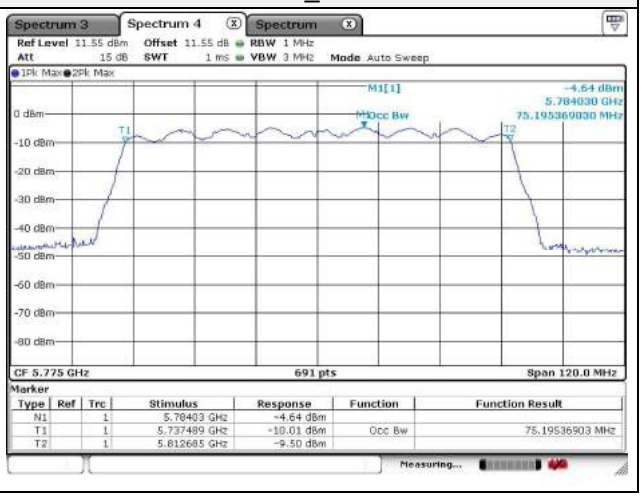
UNII-2C_VHT80(Middle)



UNII-2C_VHT80(High)



UNII-3_ VHT80



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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 ㏈ 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 ㏈ bandwidth of U-NII devices shall be at least 500 ㎑.

According to RSS-247 6.1 (1), equipment operating in the band 5725-5850 MHz, the minimum 6 dB bandwidth shall be at least 500 kHz.

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Test results

Band	Frequency([redacted])	Mode	6 [redacted] bandwidth([redacted])
UNII-3	5 745	a	16.498
	5 785		16.498
	5 825		16.498
	5 745	HT20	17.656
	5 785		17.728
	5 825		17.800
	5 755	HT40	36.580
	5 795		36.580
	5 745	VHT20	17.800
	5 785		17.800
	5 825		17.800
	5 755	VHT40	36.580
	5 795		36.580
	5 775	VHT80	75.720
UNII-3 (Band-crossing channels)	5 720	a	3.249
	5 720	HT20	3.900
	5 710	HT40	3.290
	5 720	VHT20	3.900
	5 710	VHT40	3.290
	5 690	VHT80	2.940

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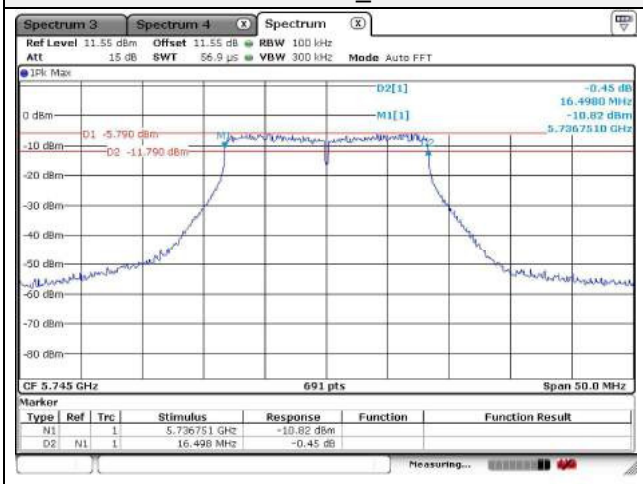
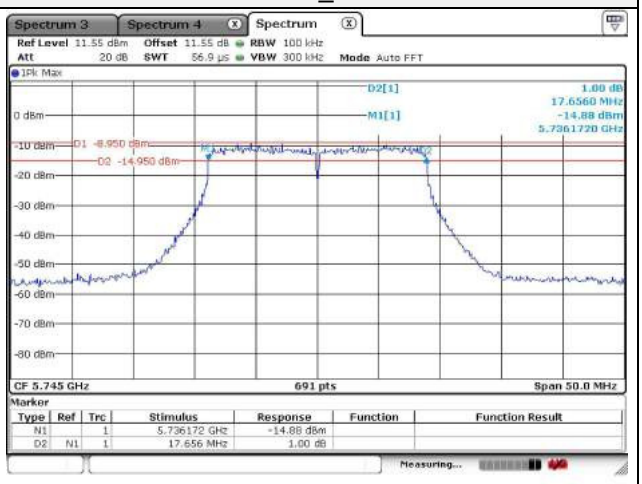
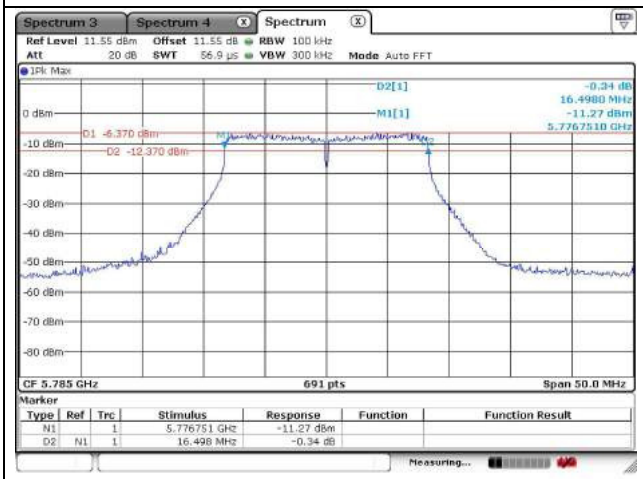
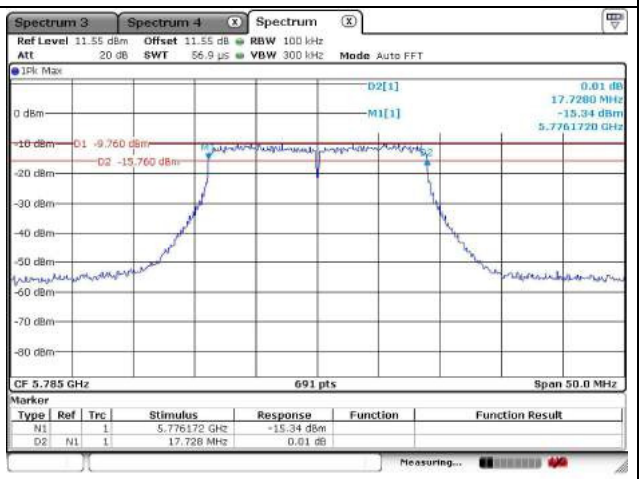
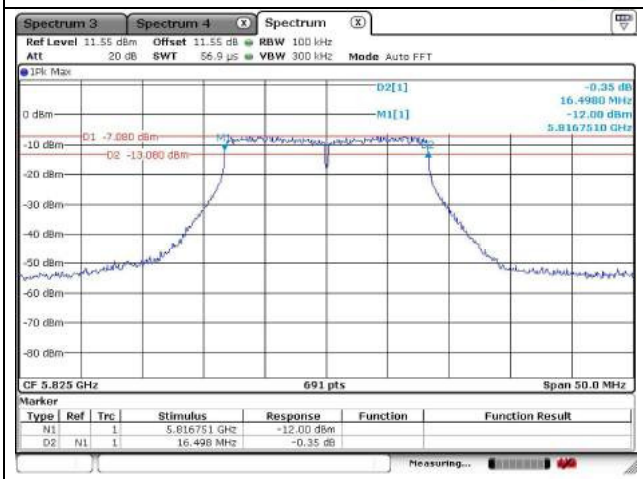
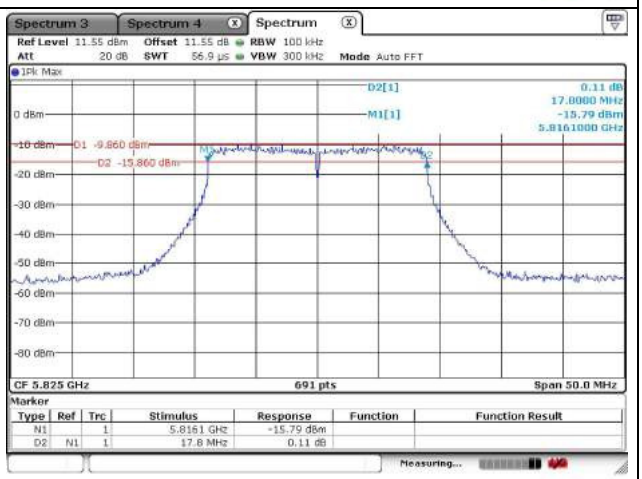
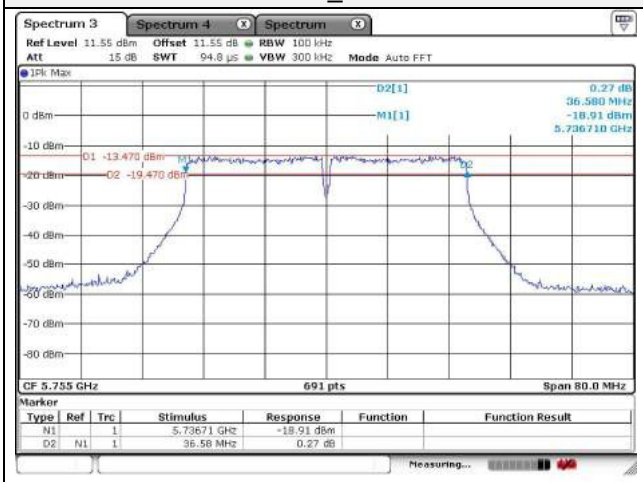
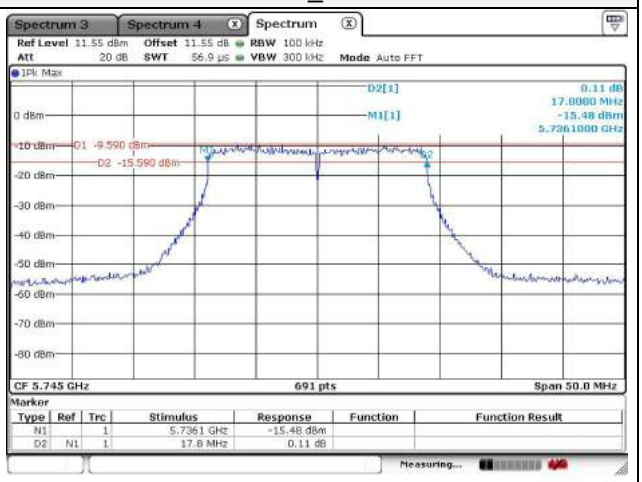
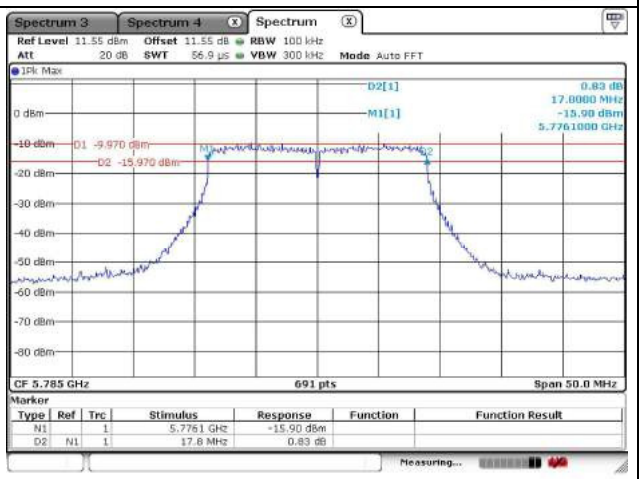
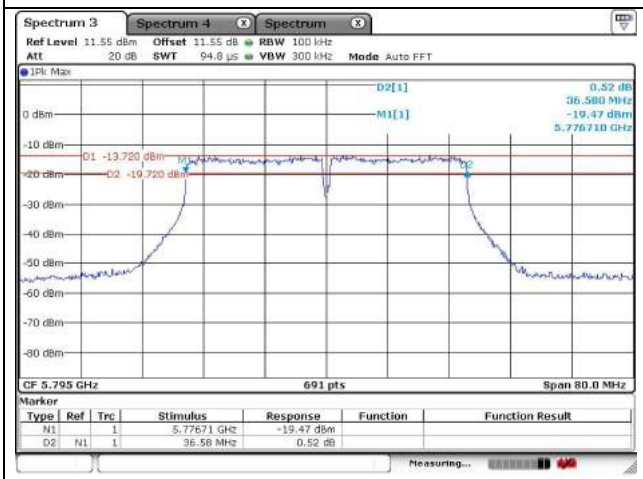
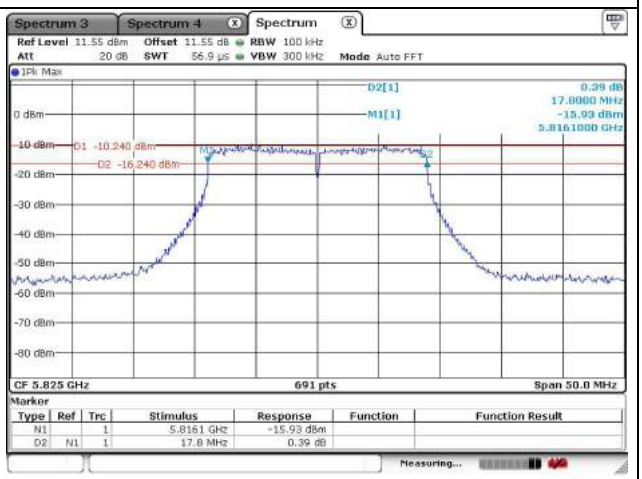
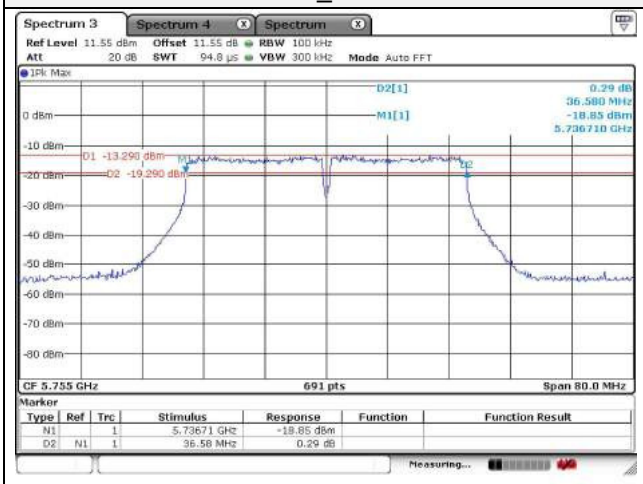
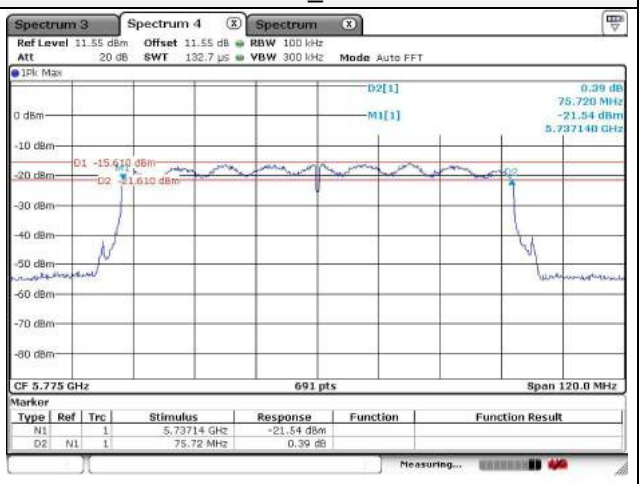
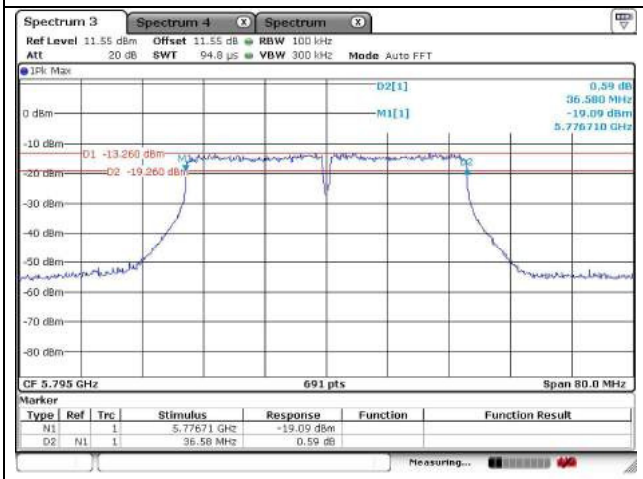
UNII-3_a	UNII-3_HT20
	
	
	

UNII-3_HT40	UNII-3_VHT20
	
N/A	
	

UNII-3_VHT40	UNII-3_VHT80
	
	N/A

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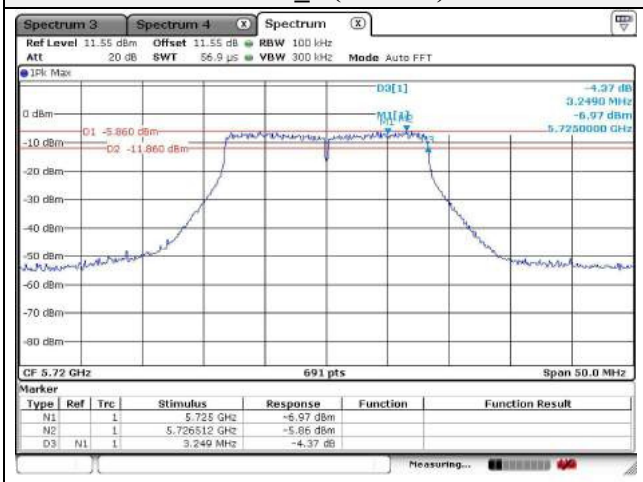
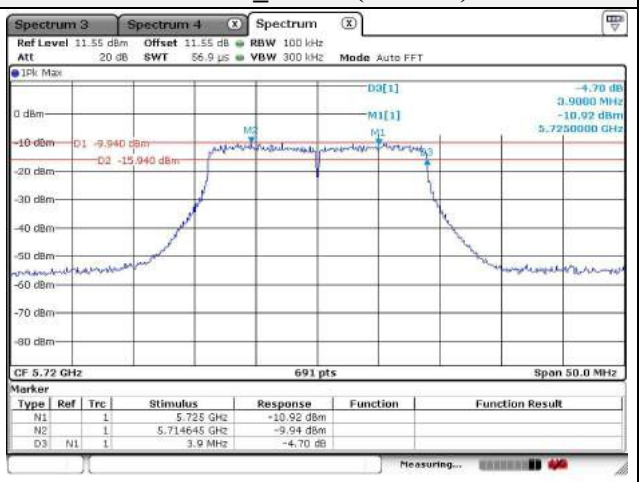
Band-crossing channels

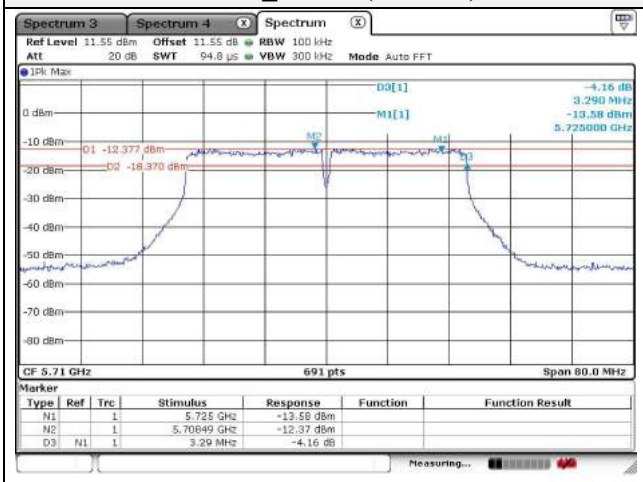
UNII-3_a (Ch. 144)



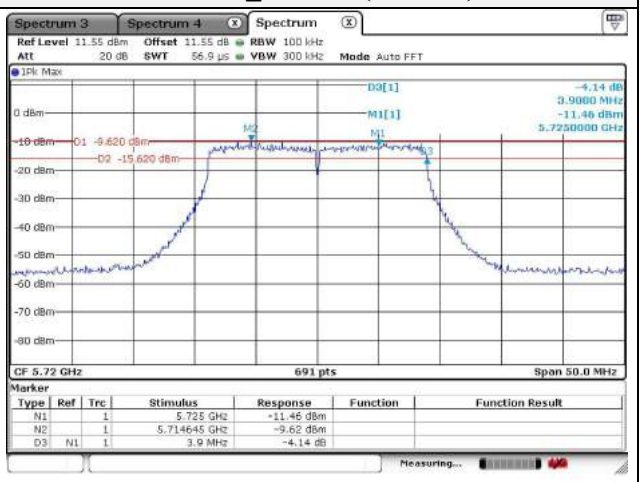
UNII-3_ HT20 (Ch. 144)



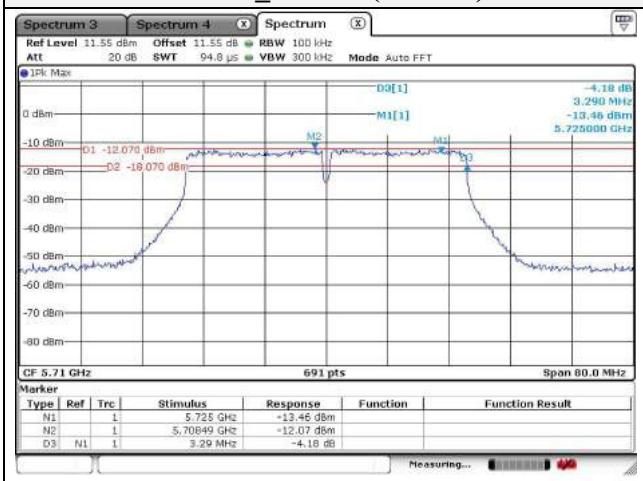
UNII-3_ HT40 (Ch. 142)



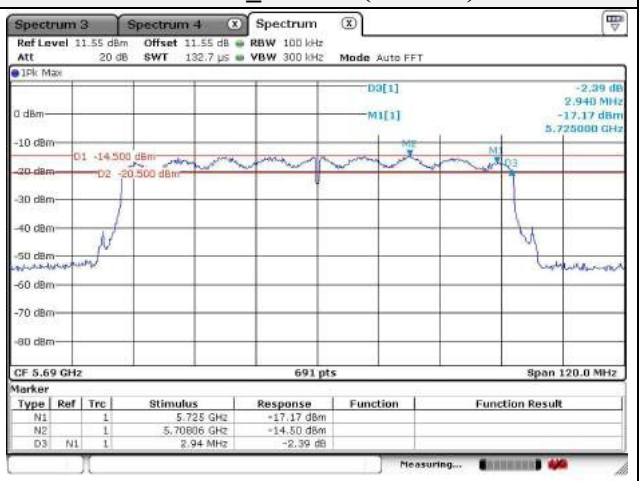
UNII-3_VHT20 (Ch. 144)



UNII-3_VHT40 (Ch. 142)



UNII-3_VHT80 (Ch. 138)



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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

FCC

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)

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IC

Band	Limit
5150~5250 [redacted]	EIRP shall not exceed 200 mW or 10+10logB*, dBm
5250~5350 [redacted]	Conducted output power shall not exceed 250 mW or 11 dBm + 10logB* EIRP shall not exceed 1.0 W or 17+10logB*, dBm
5470~5600 [redacted] **and** 5650~5725 [redacted]	Conducted output power shall not exceed 250 mW or 11 dBm + 10logB* EIRP shall not exceed 1.0 W or 17+10logB*, dBm
5725~5850 [redacted]	Conducted output power shall not exceed 1 W

Note.

1. FCC Limit B is the 26 dB emission bandwidth.
2. IC Limit B is the 99% emission bandwidth in megahertz.
3. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceed 6 dBi.

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Test results

Band	Frequency (MHz)	Mode	Detector mode	DCF Note1	Output power (dBm)	Limit (dBm)	
						FCC	IC
UNII-1	5 180	a	AV	-	11.12	24.00	22.25
	5 220		AV		11.37		22.27
	5 240		AV		11.84		22.25
UNII-2A	5 260		AV	-	11.35	24.00	23.25
	5 280		AV		11.83		23.27
	5 320		AV		12.42		23.27
UNII-2C	5 500		AV	-	11.44	23.11	22.38
	5 580		AV		10.85		22.36
	5 720		AV		10.70		22.34
UNII-3	5 745		AV	-	11.33	29.11	29.11
	5 785		AV		11.14		
	5 825		AV		10.74		

Band	Frequency (MHz)	Mode	Detector mode	DCF Note1	Output power (dBm)	Limit (dBm)	
						FCC	IC
UNII-1	5 180	HT20	AV	-	8.87	24.00	22.50
	5 220		AV		8.96		22.54
	5 240		AV		9.65		22.52
UNII-2A	5 260		AV	-	8.15	24.00	23.52
	5 280		AV		8.68		23.52
	5 320		AV		8.89		23.52
UNII-2C	5 500		AV	-	8.35	23.11	22.63
	5 580		AV		8.48		22.63
	5 720		AV		7.25		22.63
UNII-3	5 745		AV	-	7.97	29.11	29.11
	5 785		AV		7.80		
	5 825		AV		7.46		

Note.

1. Refer to the page 78 in this report.

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Band	Frequency (MHz)	Mode	Detector mode	DCF Note1	Output power (dBm)	Limit(dBm)	
						FCC	IC
UNII-1	5 190	HT40	AV	-	8.77	24.00	23.00
	5 230		AV		9.05		
UNII-2A	5 270		AV	-	8.04	24.00	24.00
	5 310		AV		8.55		
UNII-2C	5 510		AV	-	8.11	23.11	23.11
	5 590		AV		8.35		
	5 710		AV		7.75		
UNII-3	5 755		AV	-	7.80	29.11	29.11
	5 795		AV		7.49		

Band	Frequency (MHz)	Mode	Detector mode	DCF Note1	Output power (dBm)	Limit(dBm)	
						FCC	IC
UNII-1	5 180	VHT20	AV	-	8.81	24.00	22.54
	5 220		AV		8.95		22.52
	5 240		AV		9.36		22.54
UNII-2A	5 260		AV	-	8.05	24.00	23.54
	5 280		AV		8.57		23.54
	5 320		AV		8.90		23.54
UNII-2C	5 500		AV	-	8.25	23.11	22.63
	5 580		AV		8.44		22.63
	5 720		AV		7.20		22.65
UNII-3	5 745		AV	-	7.92	29.11	29.11
	5 785		AV		7.77		
	5 825		AV		7.40		

Note.

1. Refer to the page 78 in this report.

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Band	Frequency (MHz)	Mode	Detector mode	DCF Note1	Output power (dBm)	Limit(dBm)	
						FCC	IC
UNII-1	5 190	VHT40	AV	-	8.54	24.00	23.00
	5 230		AV		8.87		
UNII-2A	5 270		AV	-	8.03	24.00	24.00
	5 310		AV		8.49		
UNII-2C	5 510		AV	-	8.09	23.11	23.11
	5 590		AV		8.30		
	5 710		AV		7.73		
UNII-3	5 755		AV	-	7.74	29.11	29.11
	5 795		AV		7.40		

Band	Frequency (MHz)	Mode	Detector mode	DCF Note1	Output power (dBm)	Limit(dBm)	
						FCC	IC
UNII-1	5 210	VHT80	AV	-	8.63	24.00	24.00
UNII-2A	5 290		AV	-	7.81	24.00	24.00
UNII-2C	5 530		AV	-	7.85	23.11	23.11
	5 610		AV		7.83		
	5 590		AV		7.95		
UNII-3	5 775		AV	-	7.23	29.11	29.11

Note.

1. Refer to the page 78 on this report.

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Band-crossing channels

Band	Frequency (MHz)	Mode	Detector mode	DCF Note1	Output power (dBm)	Limit(dBm)	
						FCC	IC
UNII-2C	5 720	a	AV	-	5.85	22.11	23.11
	5 720	HT20	AV		2.59	22.11	23.11
	5 710	HT40	AV		3.95	23.11	23.11
	5 720	VHT20	AV		3.30	22.09	23.11
	5 710	VHT40	AV		4.83	23.11	23.11
	5 690	VHT80	AV		4.97	23.11	23.11
UNII-3	5 720	a	AV	-	0.22	29.11	29.11
	5 720	HT20	AV		-2.66		
	5 710	HT40	AV		-6.07		
	5 720	VHT20	AV		-2.03		
	5 710	VHT40	AV		-5.31		
	5 690	VHT80	AV		-10.08		

Note.

1. Refer to the page 78 on this report.

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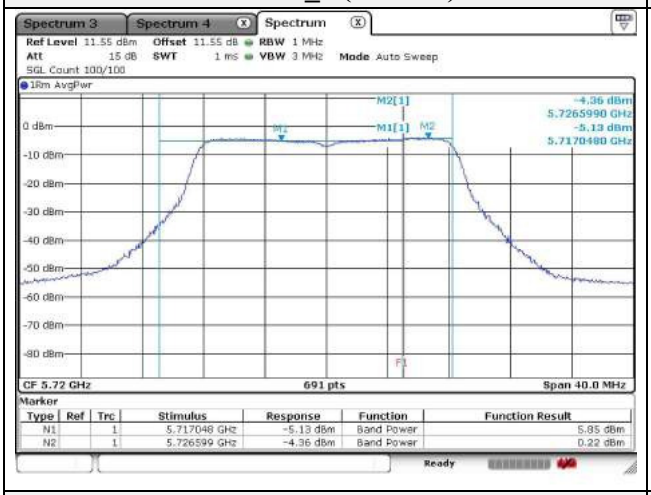
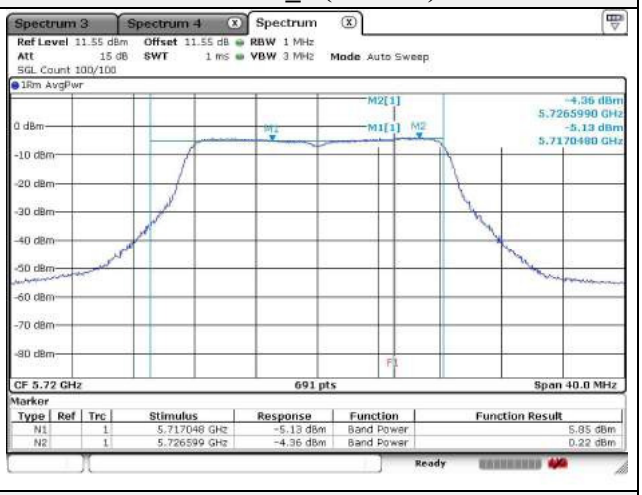
Band-crossing channels

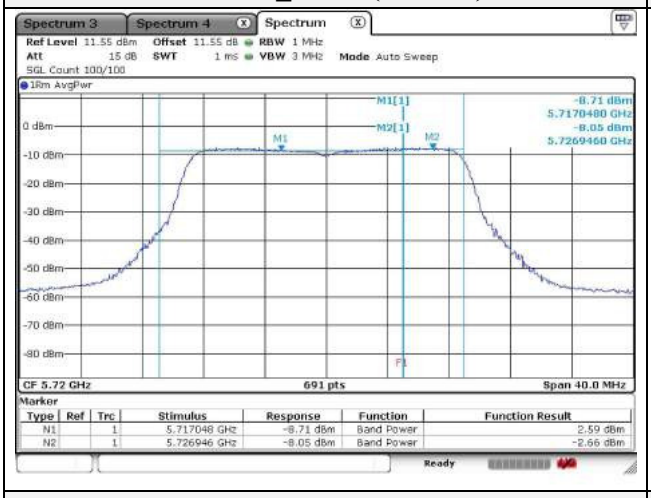
UNII-2C_a (Ch. 144)



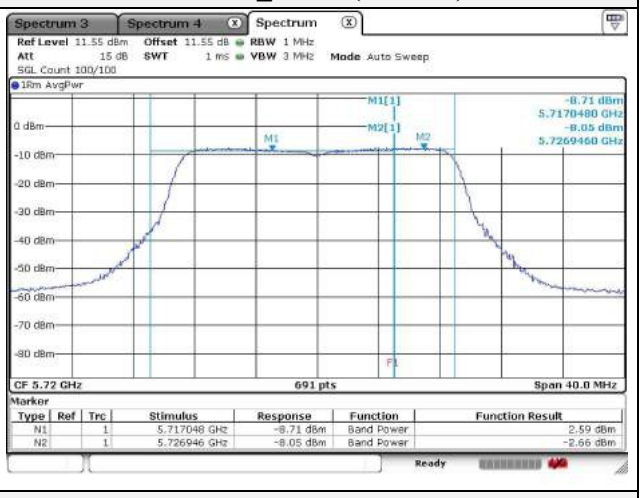
UNII-3_a (Ch. 144)



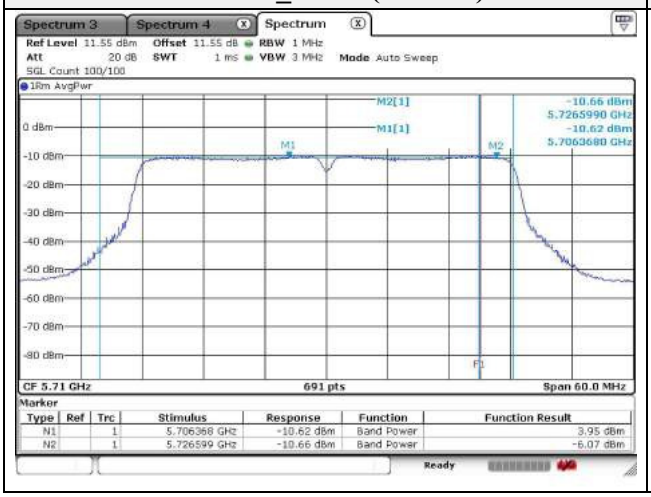
UNII-2C_HT20 (Ch. 144)



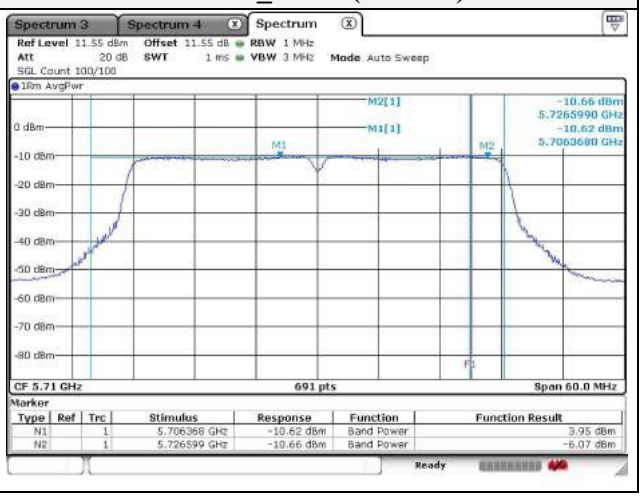
UNII-3_HT20 (Ch. 144)



UNII-2C_HT40 (Ch. 142)



UNII-3_HT40 (Ch. 142)



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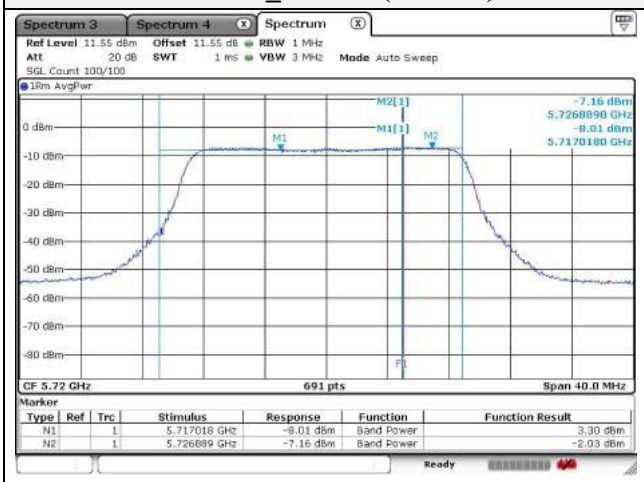
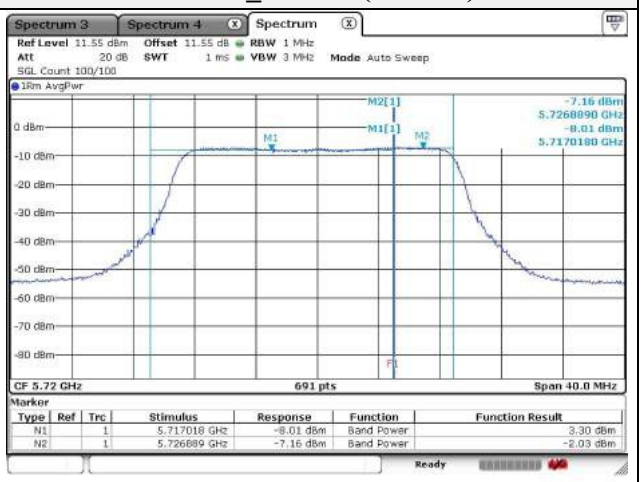
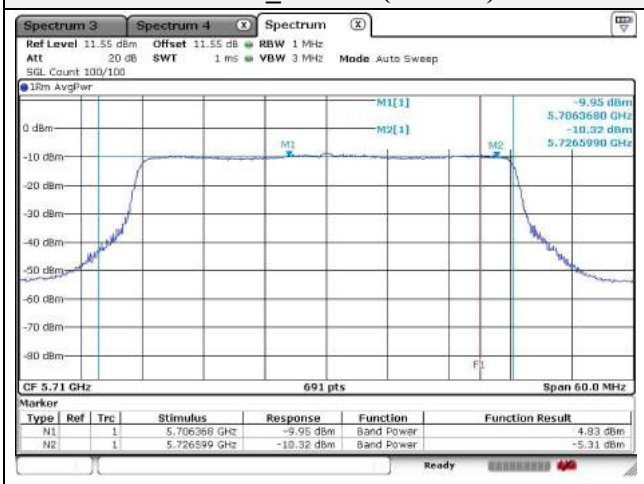
UNII-2C_VHT20 (Ch. 144)



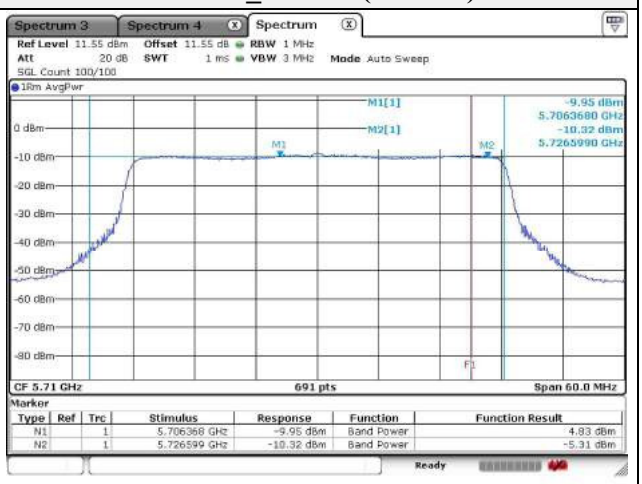
UNII-3_VHT20 (Ch. 144)



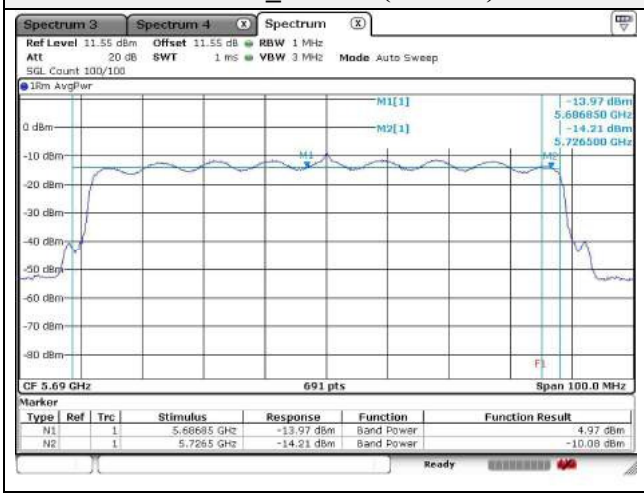
UNII-2C_VHT40 (Ch. 142)



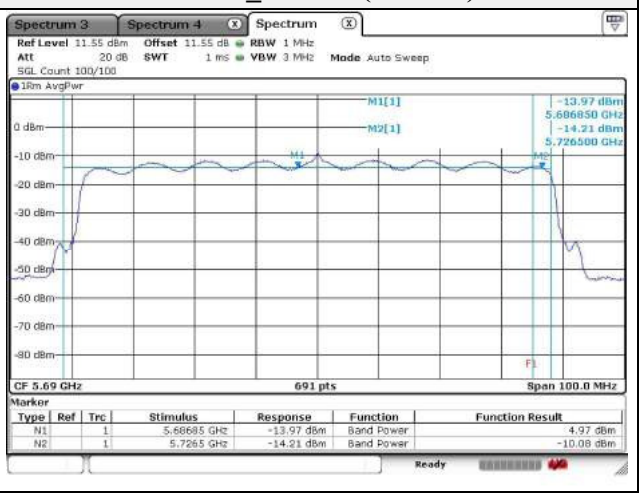
UNII-3_VHT40 (Ch. 142)



UNII-2C_VHT80 (Ch. 138)



UNII-3_VHT80 (Ch. 138)



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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
FCC

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

IC

Band	Limit
5150~5250 [redacted]	EIRP spectral density 10 dBm/MHz
5250~5350 [redacted]	11 dBm/MHz
5470~5600 [redacted] **and** 5650~5725 [redacted]	11 dBm/MHz
5725~5850 [redacted]	30 dBm/500 kHz

Note.

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

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Test results

Band	Frequency (MHz)	Mode	PSD (dBm)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm)	
							FCC	IC
UNII-1	5 180	a	-2.40	-	-	-2.40	11.00	10.00
	5 220		-1.96	-		-1.96		
	5 240		-1.88	-		-1.88		
UNII-2A	5 260		-2.36	-	-	-2.36	11.00	11.00
	5 280		-1.75	-		-1.75		
	5 320		-1.20	-		-1.20		
UNII-2C	5 500		-1.57	-	-	-1.57	10.11	10.11
	5 580		-2.82	-		-2.82		
	5 720		-3.71	-		-3.71		
UNII-3	5 745		-4.60	-	-	-4.60	29.11	29.11
	5 785		-4.97	-		-4.97		
	5 825		-5.70	-		-5.70		

Band	Frequency (MHz)	Mode	PSD (dBm)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm)	
							FCC	FCC
UNII-1	5 180	HT20	-5.00	-	-	-5.00	11.00	10.00
	5 220		-4.95	-		-4.95		
	5 240		-4.48	-		-4.48		
UNII-2A	5 260		-5.89	-	-	-5.89	11.00	11.00
	5 280		-5.13	-		-5.13		
	5 320		-4.59	-		-4.59		
UNII-2C	5 500		-5.48	-	-	-5.48	10.11	10.11
	5 580		-5.50	-		-5.50		
	5 720		-7.00	-		-7.00		
UNII-3	5 745		-8.79	-	-	-8.79	29.11	29.11
	5 785		-8.95	-		-8.95		
	5 825		-9.39	-		-9.39		

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Band	Frequency (MHz)	Mode	PSD (dBm)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm)	
							FCC	FCC
UNII-1	5 190	HT40	-7.70	-	-	-7.70	11.00	10.00
	5 230		-7.19	-		-7.19		
UNII-2A	5 270		-8.76	-	-	-8.76	11.00	11.00
	5 310		-7.78	-		-7.78		
UNII-2C	5 510		-8.79	-	-	-8.79	10.11	10.11
	5 590		-8.69	-		-8.69		
	5 710		-9.58	-		-9.58		
UNII-3	5 755		-12.29	-	-	-12.29	29.11	29.11
	5 795		-12.56	-		-12.56		

Band	Frequency (MHz)	Mode	PSD (dBm)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm)	
							FCC	FCC
UNII-1	5 180	VHT20	-4.36	-	-	-4.36	11.00	10.00
	5 220		-4.89	-		-4.89		
	5 240		-3.50	-		-3.50		
UNII-2A	5 260		-5.97	-	-	-5.97	11.00	11.00
	5 280		-5.33	-		-5.33		
	5 320		-4.35	-		-4.35		
UNII-2C	5 500		-5.56	-	-	-5.56	10.11	10.11
	5 580		-5.33	-		-5.33		
	5 720		-7.22	-		-7.22		
UNII-3	5 745		-8.84	-	-	-8.84	29.11	29.11
	5 785		-8.80	-		-8.80		
	5 825		-9.31	-		-9.31		

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Band	Frequency (MHz)	Mode	PSD (dBm)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm)	
							FCC	FCC
UNII-1	5 190	VHT40	-7.73	-	-	-7.73	11.00	10.00
	5 230		-7.77	-		-7.77		
UNII-2A	5 270		-8.94	-	-	-8.94	11.00	11.00
	5 310		-8.47	-		-8.47		
UNII-2C	5 510		-8.60	-	-	-8.60	10.11	10.11
	5 590		-8.79	-		-8.79		
	5 710		-9.88	-		-9.88		
UNII-3	5 755		-12.55	-	-	-12.55	29.11	29.11
	5 795		-12.64	-		-12.64		

Band	Frequency (MHz)	Mode	PSD (dBm)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm)	
							FCC	FCC
UNII-1	5 210	VHT80	-9.70	-	-	-9.70	11.00	10.00
UNII-2A	5 290		-9.96	-	-	-9.96	11.00	11.00
UNII-2C	5 530		-10.75	-	-	-10.75	10.11	10.11
	5 610		-11.07	-		-11.07		
	5 690		-11.16	-		-11.16		
UNII-3	5 775		-14.94	-	-	-14.94	29.11	29.11

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Band-crossing channels

Band	Frequency (MHz)	Mode	PSD (dBm)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm)	
							FCC	FCC
UNII-2C	5 720	a	-3.71	-	-	-3.71	10.11	10.11
	5 720	HT20	-7.00	-		-7.00		
	5 710	HT40	-9.58	-		-9.58		
	5 720	VHT20	-7.22	-		-7.22		
	5 710	VHT40	-9.88	-		-9.88		
	5 690	VHT80	-11.16	-		-11.16		
UNII-3	5 720	a	-6.10	-	-	-6.10	29.11	29.11
	5 720	HT20	-10.09	-		-10.09		
	5 710	HT40	-13.00	-		-13.00		
	5 720	VHT20	-9.47	-		-9.47		
	5 710	VHT40	-12.86	-		-12.86		
	5 690	VHT80	-16.51	-		-16.51		

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 78 on this report.
3. Sum(dBm) = PSD(dBm) + RBWF + Duty correction factor (dB)

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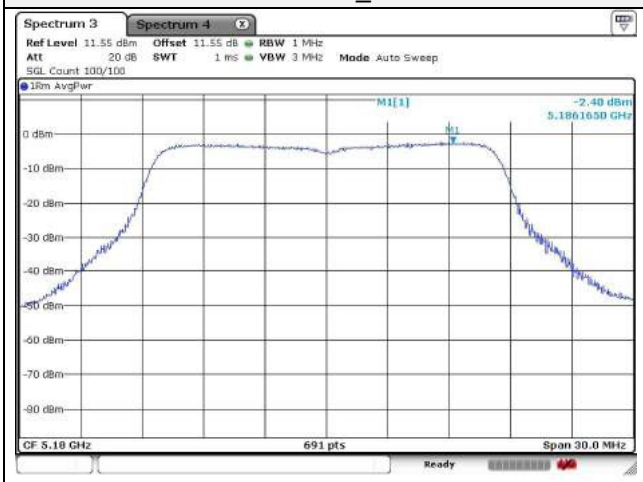
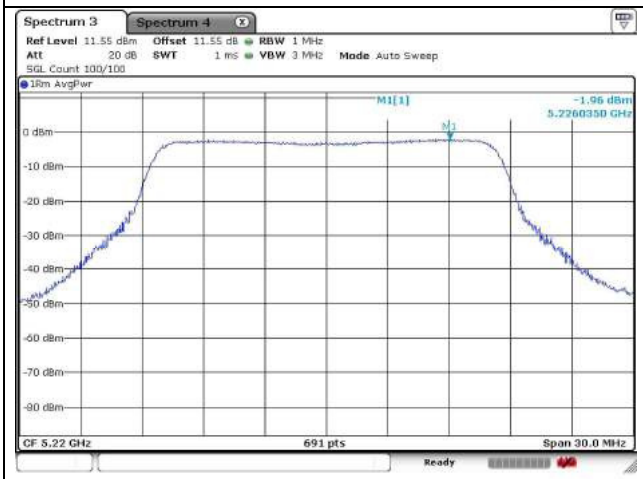
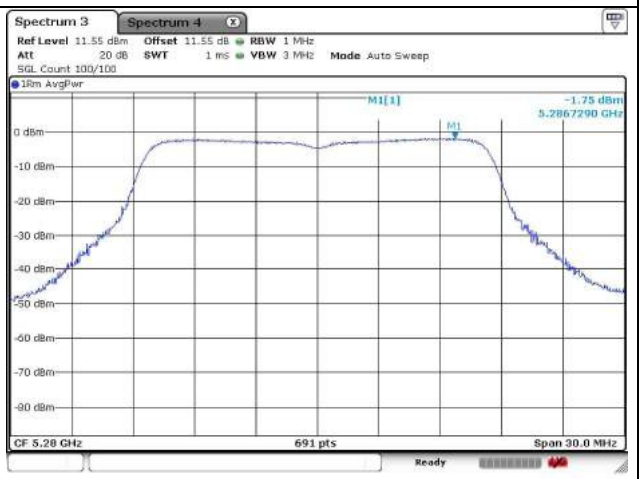
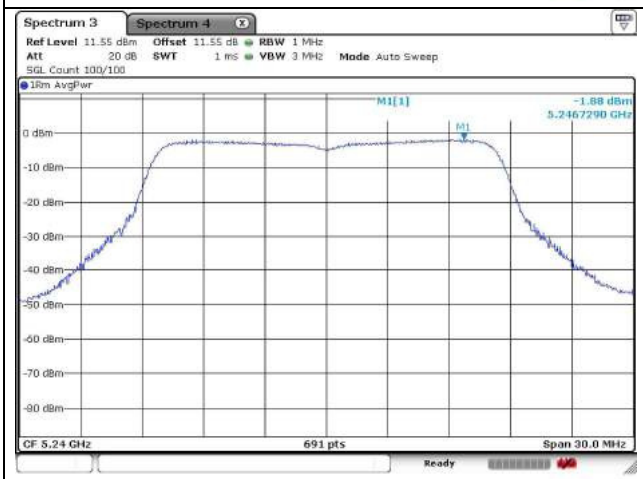
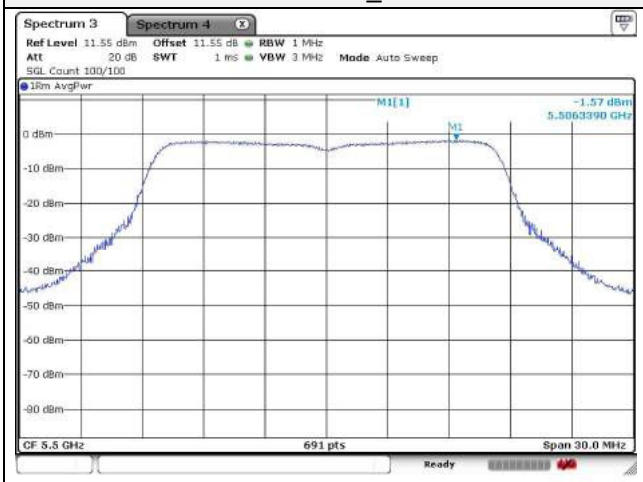
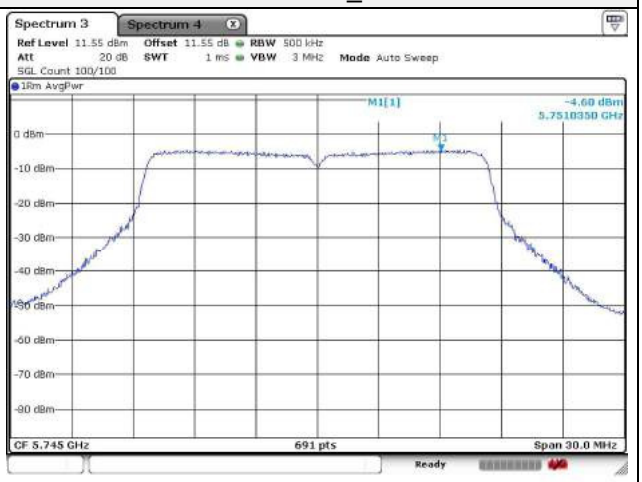
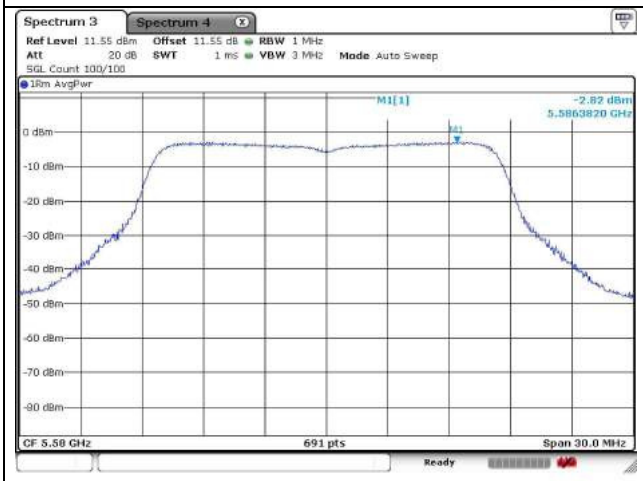
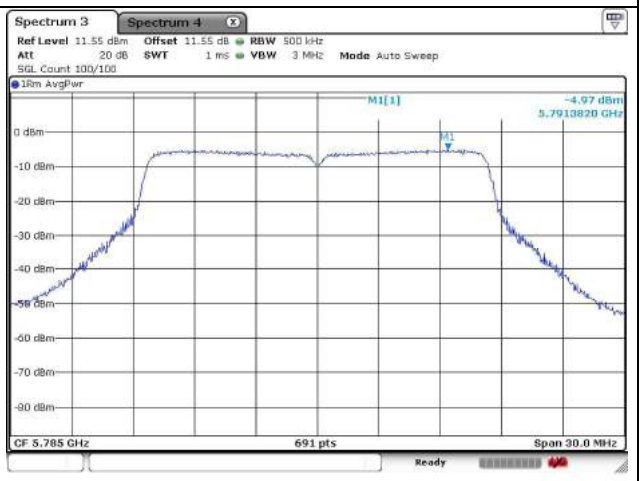
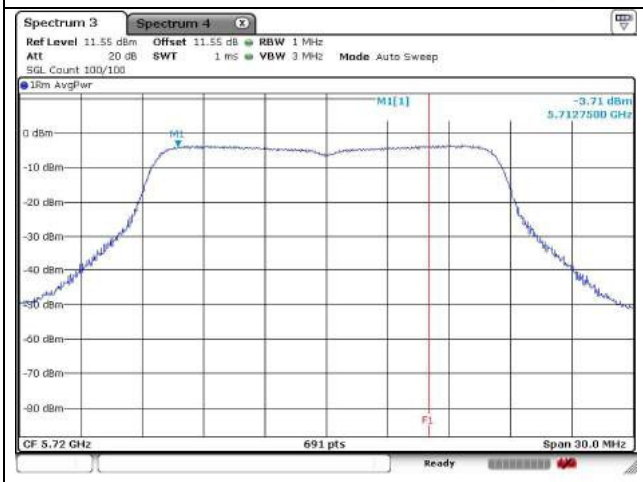
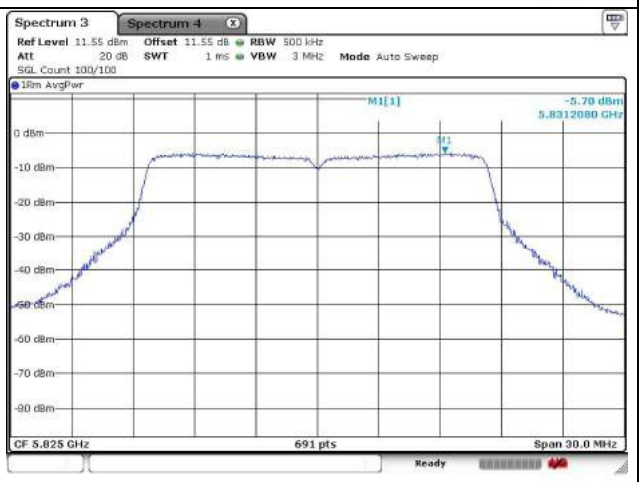
UNII-1_a	UNII-2A_a
	
	
	

UNII-2C_a	UNII-3_a
	
	
	

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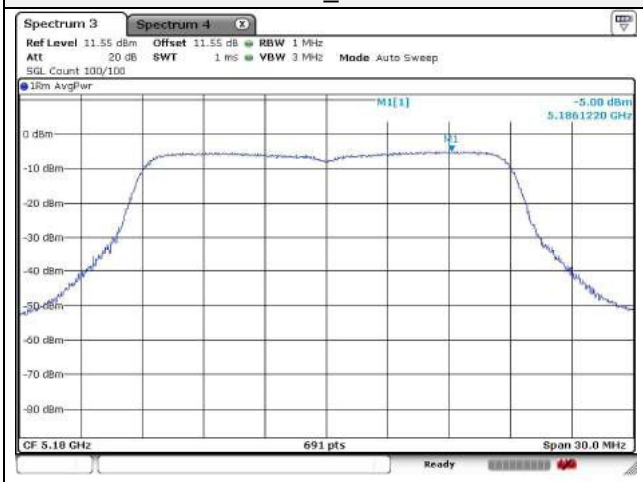
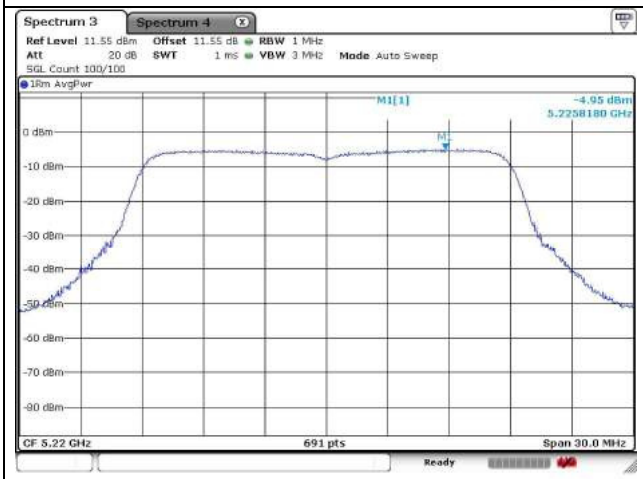
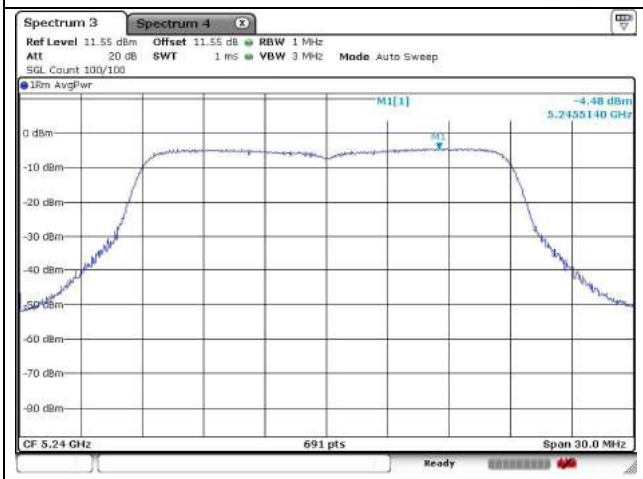
UNII-1_ HT20	UNII-2A_ HT20
	
	
	

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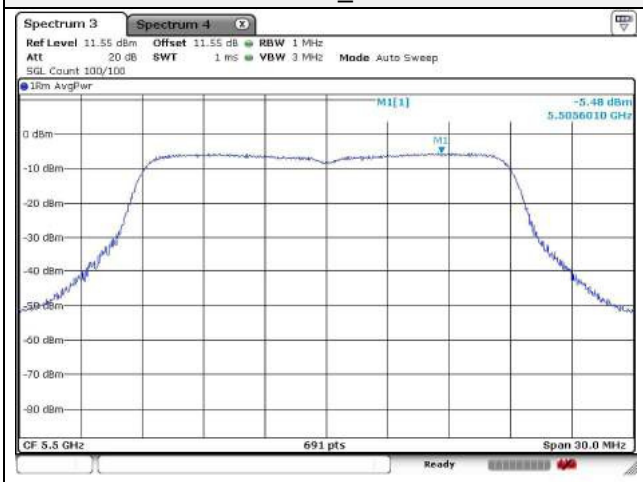
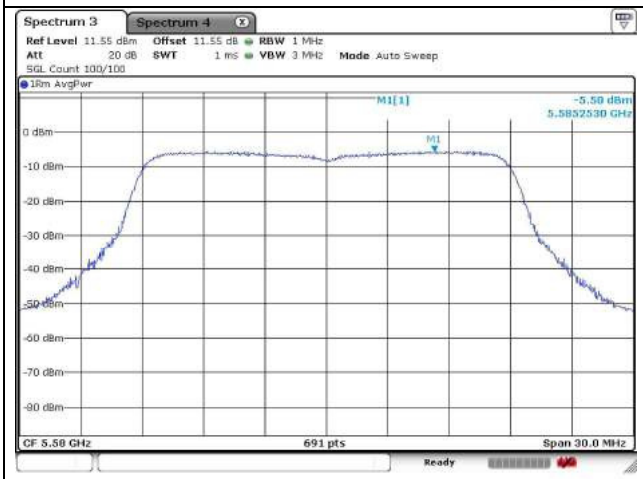
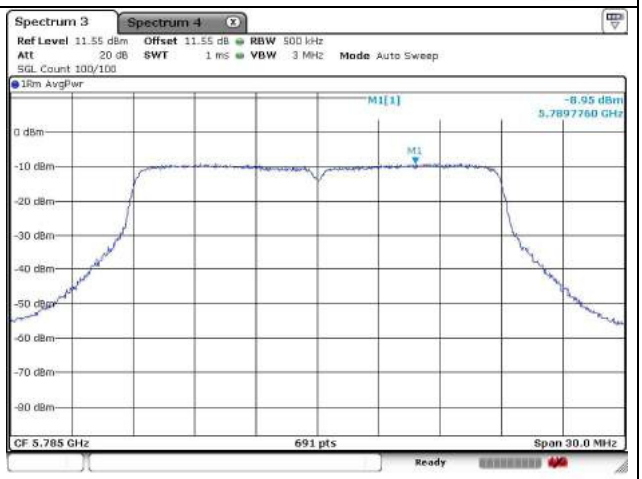
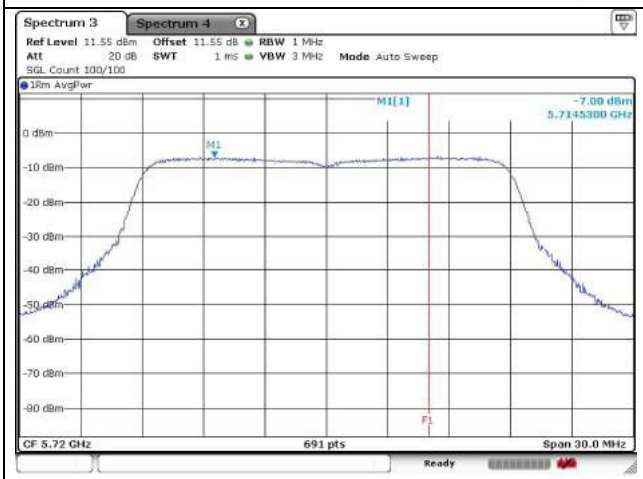
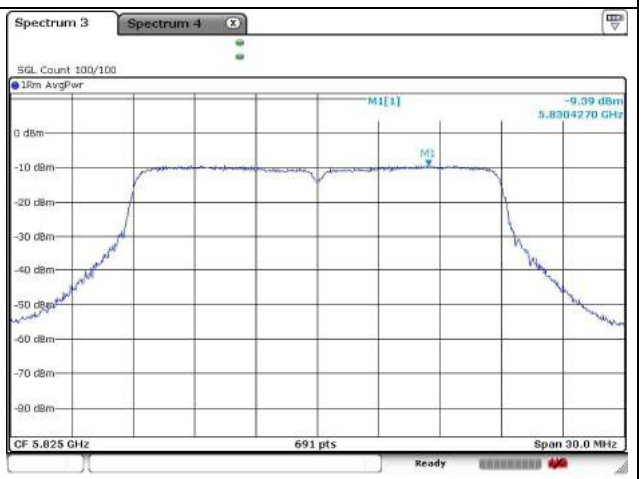
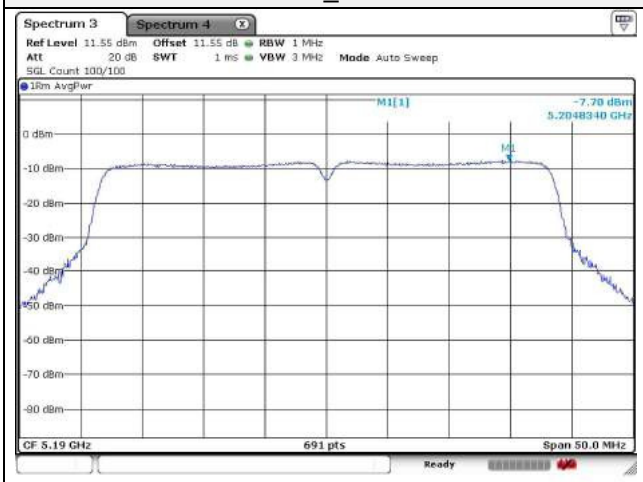
UNII-2C_HT20	UNII-3_ HT20
	
	
	

UNII-1_ HT40	UNII-2A_ HT40
	
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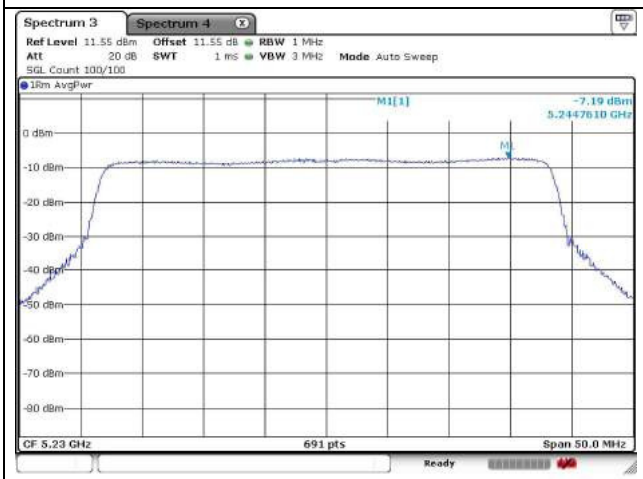	

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UNII-2C_HT40	UNII-3_ HT40
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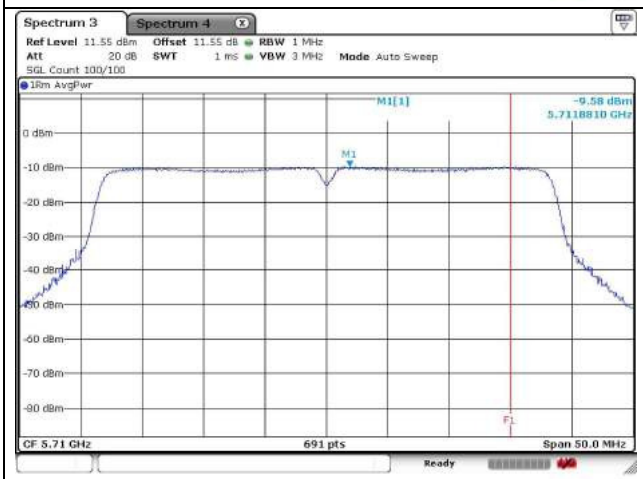	

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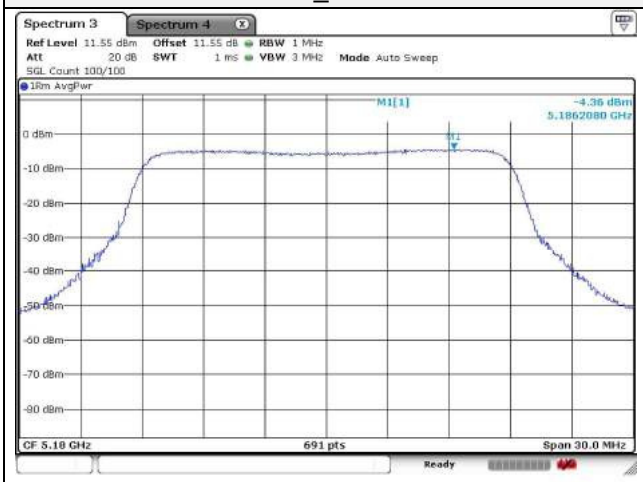
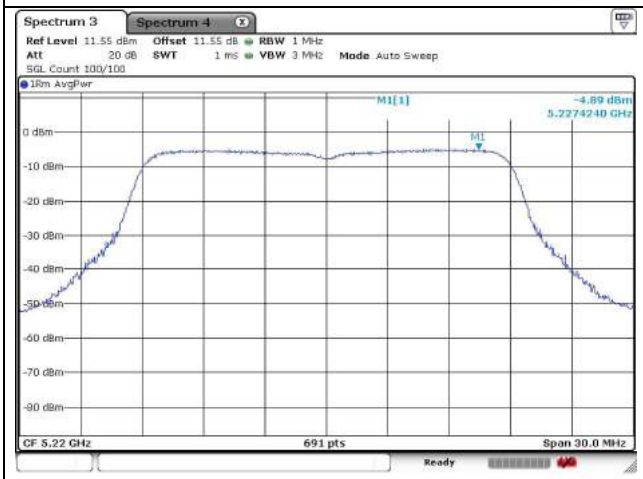
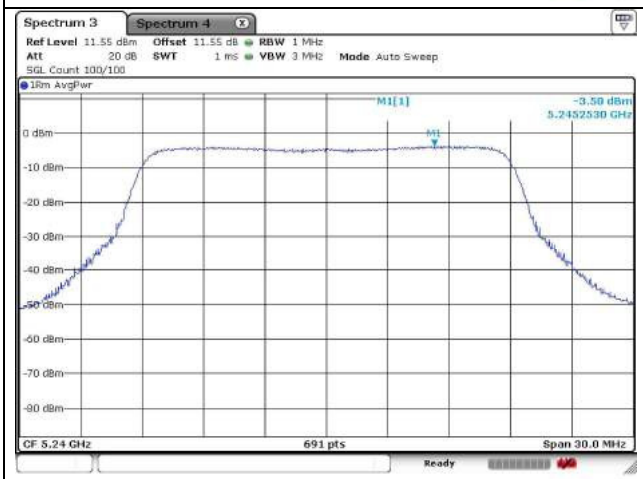
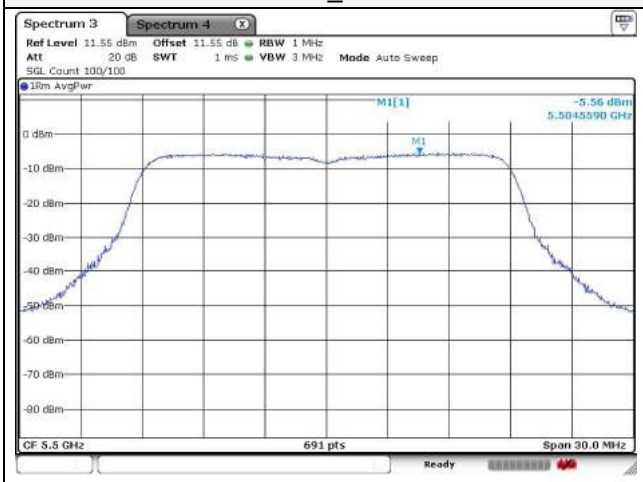
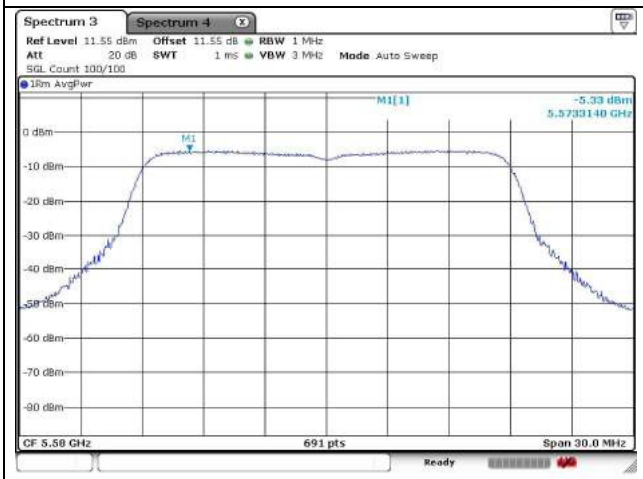
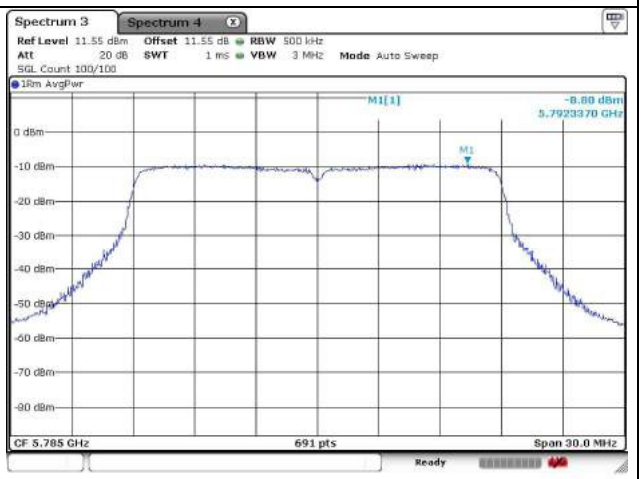
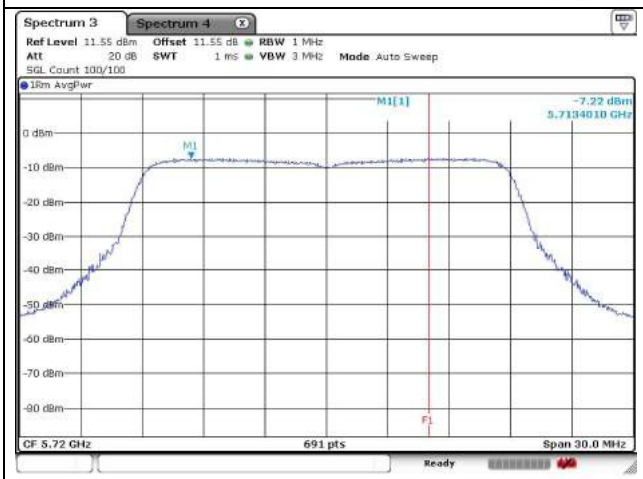
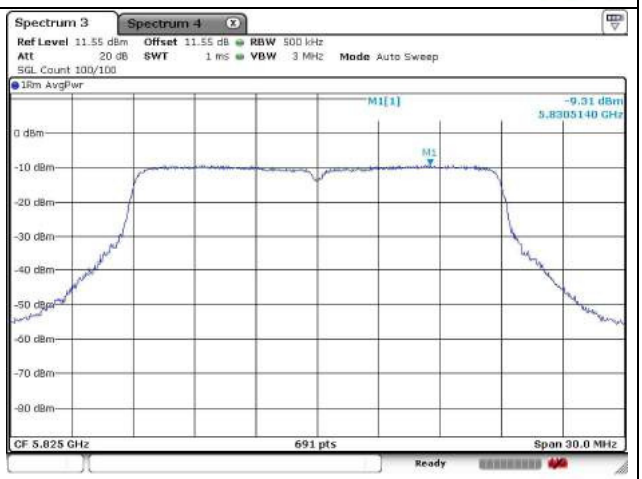
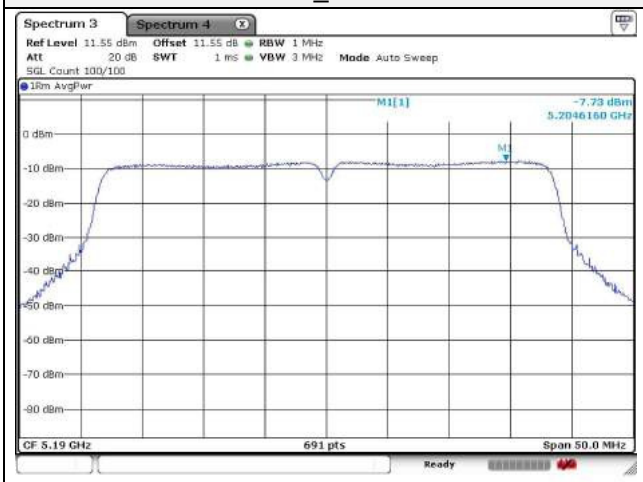
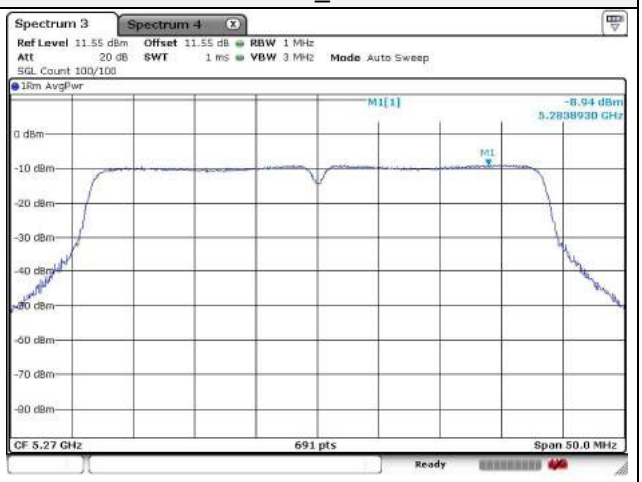
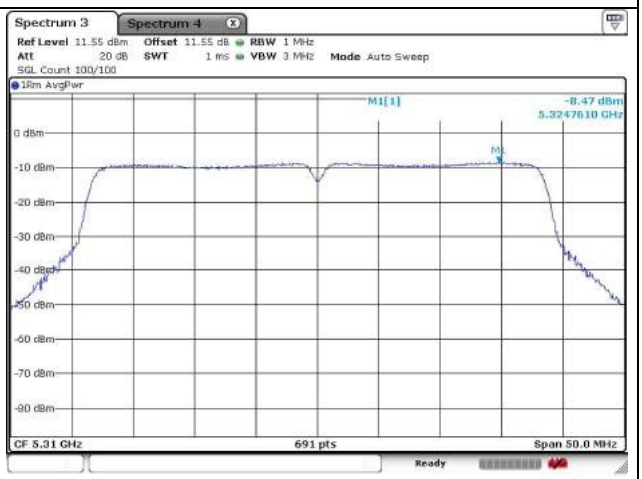
UNII-1_ VHT20	UNII-2A_ VHT20
	
	
	

UNII-2C_VHT20	UNII-3_ VHT20
	
	
	

UNII-1_ VHT40	UNII-2A_ VHT40
	
N/A	N/A
	

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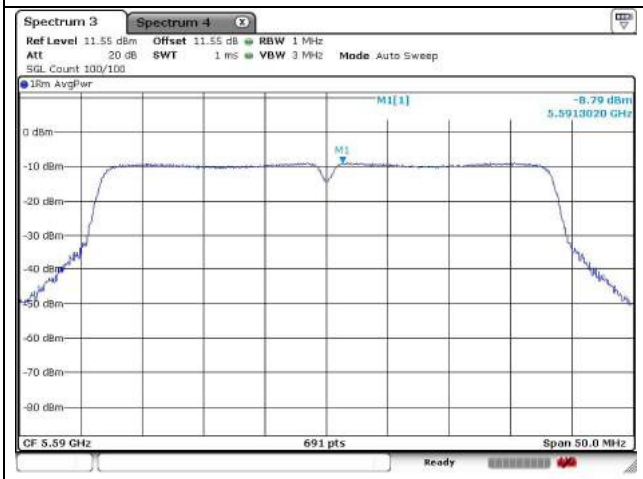
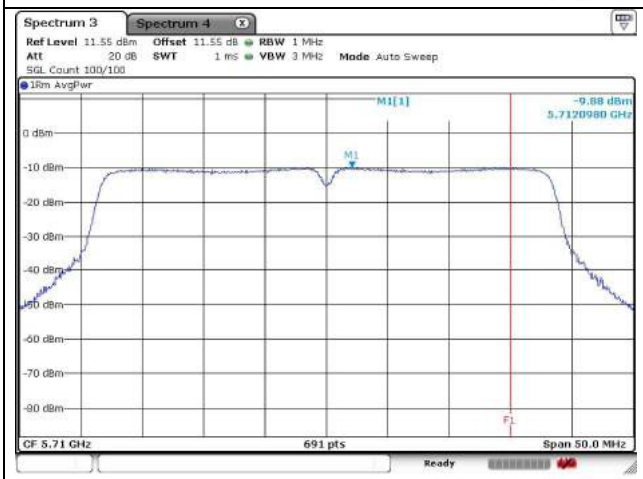
UNII-2C_VHT40	UNII-3_ VHT40
	N/A
	

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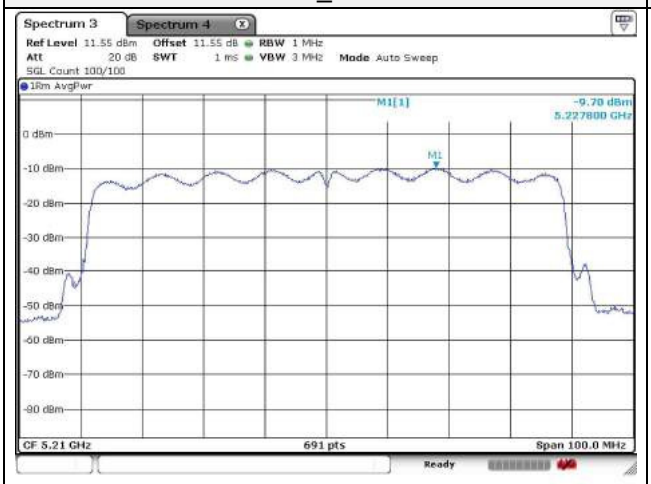
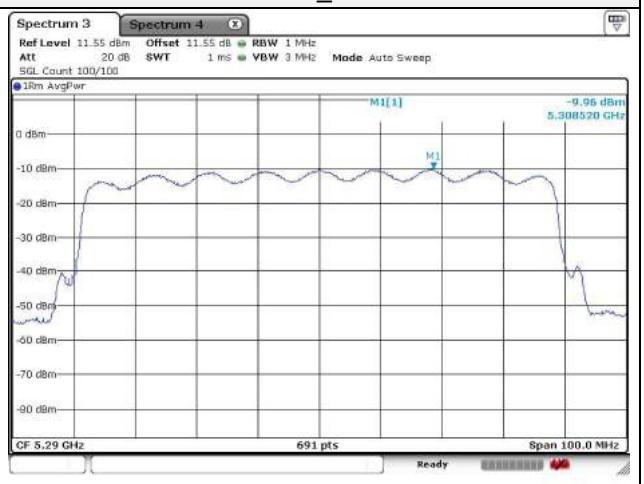
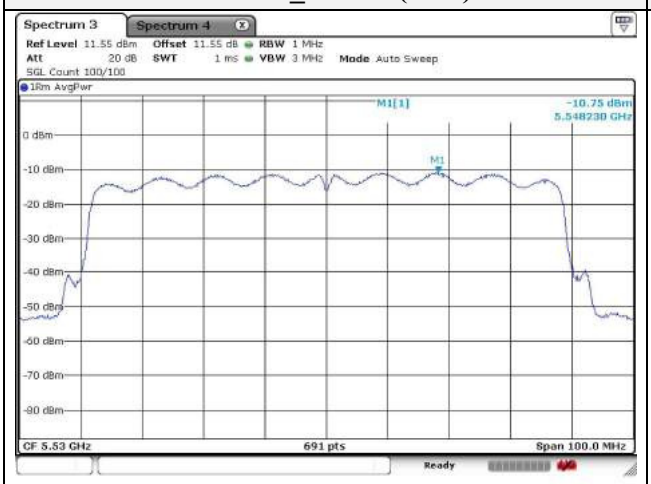
UNII-1_VHT80



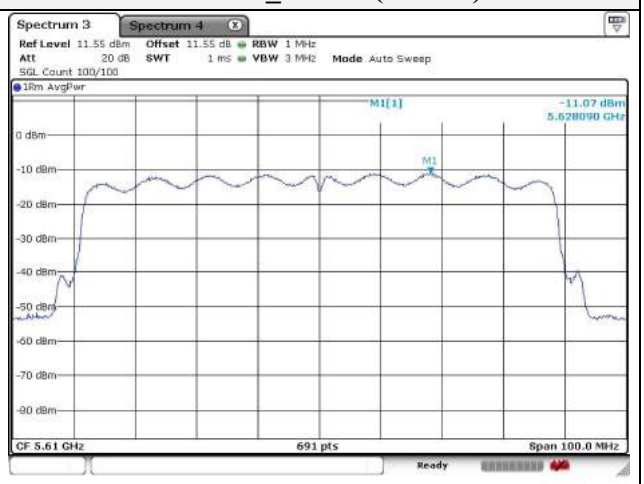
UNII-2A_ VHT80



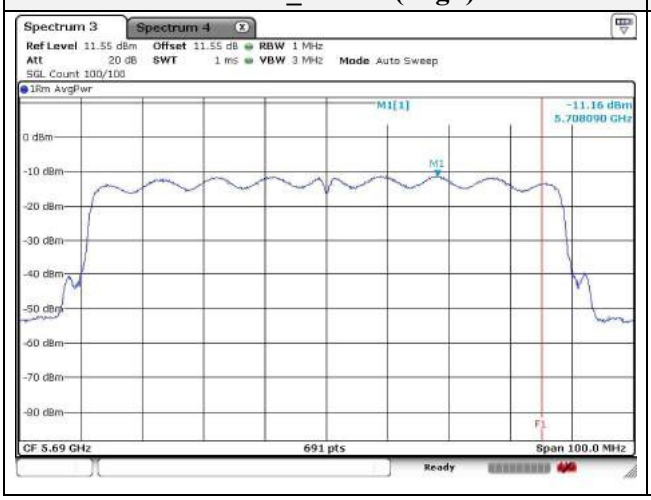
UNII-2C_VHT80(Low)



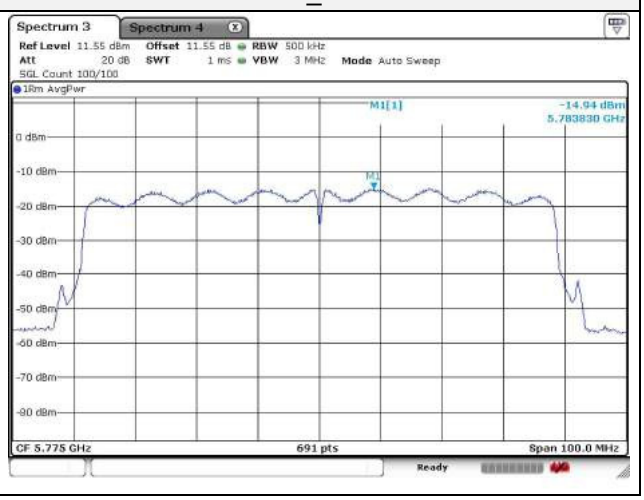
UNII-2C_VHT80(Middle)



UNII-2C_VHT80(High)



UNII-3_ VHT80



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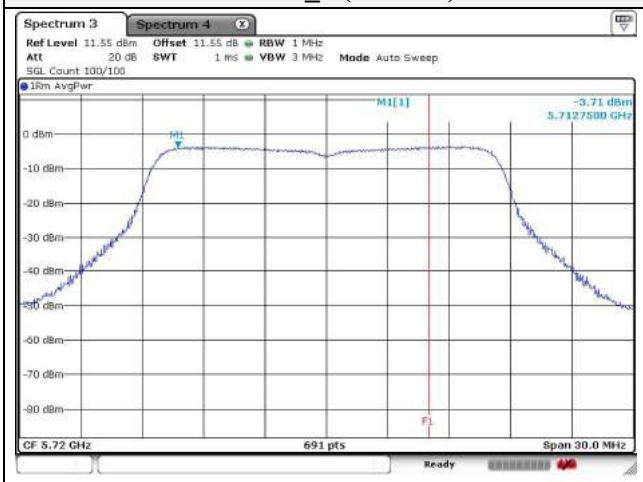
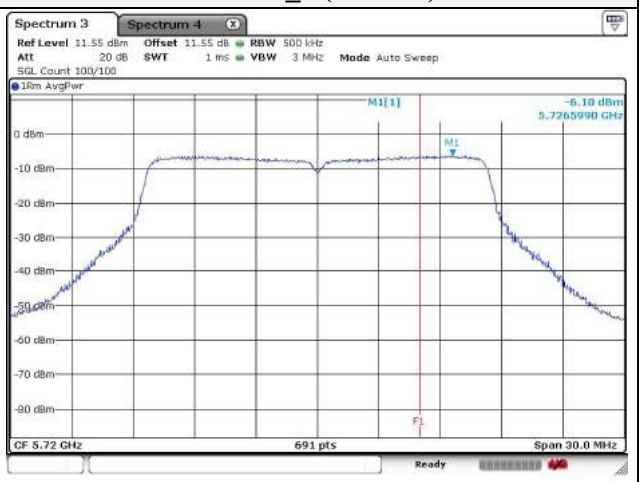
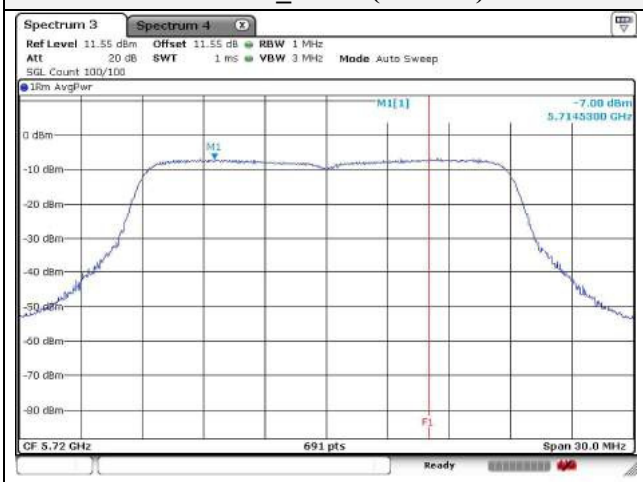
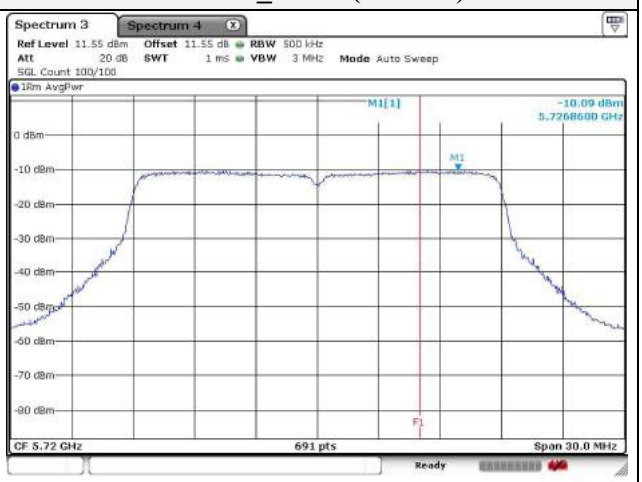
Band-crossing channels

UNII-2C_a (Ch. 144)	UNII-3_a (Ch. 144)
	
UNII-2C_HT20 (Ch. 144)	**UNII-3_HT20 (Ch. 144)**
	
UNII-2C_HT40 (Ch. 142)	**UNII-3_HT40 (Ch. 142)**

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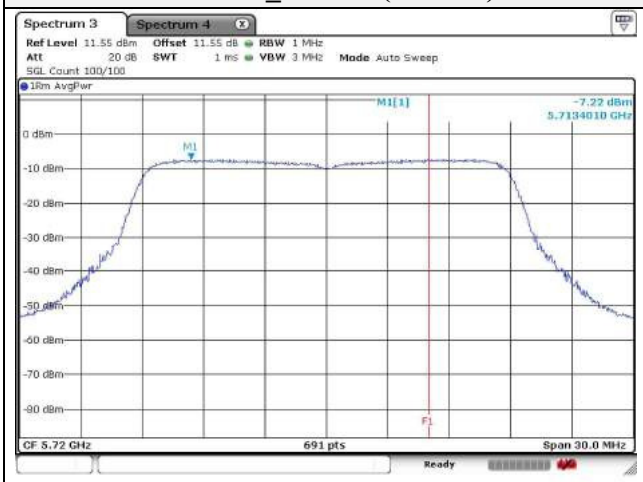
UNII-2C_VHT20 (Ch. 144)

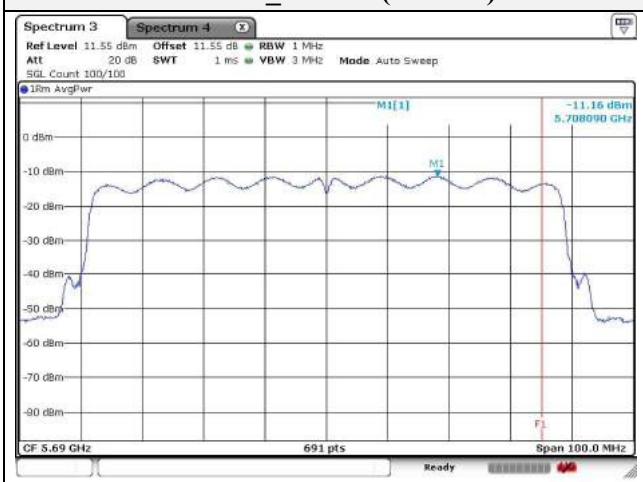


UNII-3_VHT20 (Ch. 144)

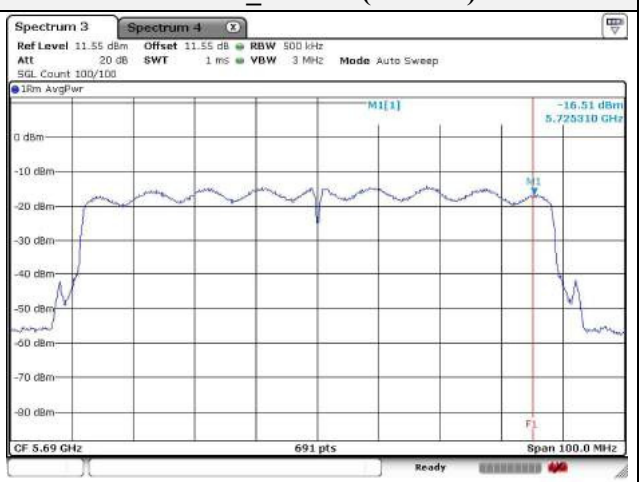
UNII-2C_VHT40 (Ch. 142)

UNII-3_VHT40 (Ch. 142)

UNII-2C_VHT80 (Ch. 138)



UNII-3_VHT80 (Ch. 138)



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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: 5 180 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	AC 24.0	-20	Startup	5 180.022 086	22 086	0.000 426
			2 minutes	5 180.022 105	22 105	0.000 427
			5 minutes	5 180.022 137	22 137	0.000 427
			10 minutes	5 180.022 190	22 190	0.000 428
100 %		-10	Startup	5 180.017 762	17 762	0.000 343
			2 minutes	5 180.017 813	17 813	0.000 344
			5 minutes	5 180.017 876	17 876	0.000 345
			10 minutes	5 180.017 965	17 965	0.000 347
100 %		0	Startup	5 180.004 775	4 775	0.000 092
			2 minutes	5 180.004 791	4 791	0.000 092
			5 minutes	5 180.005 062	5 062	0.000 098
			10 minutes	5 180.005 099	5 099	0.000 098
100 %		10	Startup	5 180.001 518	1 518	0.000 029
			2 minutes	5 180.001 631	1 631	0.000 031
			5 minutes	5 180.001 680	1 680	0.000 032
			10 minutes	5 180.001 722	1 722	0.000 033
100 %		20	Startup	5 180.002 894	2 894	0.000 056
			2 minutes	5 180.003 429	3 429	0.000 066
			5 minutes	5 180.003 488	3 488	0.000 067
			10 minutes	5 180.003 525	3 525	0.000 068
100 %		23	Startup	5 180.014 117	14 117	0.000 273
			2 minutes	5 180.014 303	14 303	0.000 276
			5 minutes	5 180.014 375	14 375	0.000 278
			10 minutes	5 180.014 419	14 419	0.000 278
100 %		30	Startup	5 180.026 148	26 148	0.000 505
			2 minutes	5 180.026 230	26 230	0.000 506
			5 minutes	5 180.026 254	26 254	0.000 507
			10 minutes	5 180.026 401	26 401	0.000 510
100 %		40	Startup	5 180.049 889	49 889	0.000 963
			2 minutes	5 180.050 150	50 150	0.000 968
			5 minutes	5 180.050 208	50 208	0.000 969
			10 minutes	5 180.050 296	50 296	0.000 971
100 %		50	Startup	5 180.064 799	64 799	0.001 251
			2 minutes	5 180.065 020	65 020	0.001 255
			5 minutes	5 180.065 137	65 137	0.001 257
			10 minutes	5 180.065 220	65 220	0.001 259
85 %	AC 20.4	23	Startup	5 180.014 260	14 260	0.000 275
			2 minutes	5 180.014 331	14 331	0.000 277
			5 minutes	5 180.014 384	14 384	0.000 278
			10 minutes	5 180.014 471	14 471	0.000 279
115 %	AC 27.6	23	Startup	5 180.014 690	14 690	0.000 284
			2 minutes	5 180.014 710	14 710	0.000 284
			5 minutes	5 180.014 739	14 739	0.000 285
			10 minutes	5 180.014 805	14 805	0.000 286

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Mode: UNII-2A

Operating frequency: 5 260 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎐)	Frequency deviation (㎐)	Deviation (%)
100 %	AC 24.0	-20	Startup	5 260.018 973	18 973	0.000 361
			2 minutes	5 260.019 047	19 047	0.000 362
			5 minutes	5 260.019 114	19 114	0.000 363
			10 minutes	5 260.019 236	19 236	0.000 366
100 %		-10	Startup	5 260.015 345	15 345	0.000 292
			2 minutes	5 260.015 389	15 389	0.000 293
			5 minutes	5 260.015 440	15 440	0.000 294
			10 minutes	5 260.015 514	15 514	0.000 295
100 %		0	Startup	5 260.006 801	6 801	0.000 129
			2 minutes	5 260.006 826	6 826	0.000 130
			5 minutes	5 260.006 896	6 896	0.000 131
			10 minutes	5 260.006 969	6 969	0.000 132
100 %		10	Startup	5 260.005 181	5 181	0.000 098
			2 minutes	5 260.005 243	5 243	0.000 100
			5 minutes	5 260.005 290	5 290	0.000 101
			10 minutes	5 260.005 376	5 376	0.000 102
100 %		20	Startup	5 260.002 894	2 894	0.000 055
			2 minutes	5 260.003 429	3 429	0.000 065
			5 minutes	5 260.003 488	3 488	0.000 066
			10 minutes	5 260.003 525	3 525	0.000 067
100 %		23	Startup	5 260.007 902	7 902	0.000 150
			2 minutes	5 260.007 938	7 938	0.000 151
			5 minutes	5 260.007 985	7 985	0.000 152
			10 minutes	5 260.008 307	8 307	0.000 158
100 %		30	Startup	5 260.022 508	22 508	0.000 428
			2 minutes	5 260.022 570	22 570	0.000 429
			5 minutes	5 260.022 633	22 633	0.000 430
			10 minutes	5 260.022 809	22 809	0.000 434
100 %		40	Startup	5 260.039 156	39 156	0.000 744
			2 minutes	5 260.040 031	40 031	0.000 761
			5 minutes	5 260.040 131	40 131	0.000 763
			10 minutes	5 260.040 189	40 189	0.000 764
100 %		50	Startup	5 260.052 190	52 190	0.000 992
			2 minutes	5 260.052 531	52 531	0.000 999
			5 minutes	5 260.052 826	52 826	0.001 004
			10 minutes	5 260.053 015	53 015	0.001 008
85 %	AC 20.4	23	Startup	5 260.007 476	7 476	0.000 142
			2 minutes	5 260.007 503	7 503	0.000 143
			5 minutes	5 260.007 537	7 537	0.000 143
			10 minutes	5 260.007 590	7 590	0.000 144
115 %	AC 27.6	23	Startup	5 260.006 547	6 547	0.000 124
			2 minutes	5 260.006 591	6 591	0.000 125
			5 minutes	5 260.006 640	6 640	0.000 126
			10 minutes	5 260.006 712	6 712	0.000 128

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Mode: UNII-2C

Operating frequency: 5500 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎑)	Deviation (%)
100 %	AC 24.0	-20	Startup	5 500.027 841	27 841	0.000 506
			2 minutes	5 500.027 965	27 965	0.000 508
			5 minutes	5 500.028 312	28 312	0.000 515
			10 minutes	5 500.028 556	28 556	0.000 519
100 %		-10	Startup	5 500.021 746	21 746	0.000 395
			2 minutes	5 500.021 804	21 804	0.000 396
			5 minutes	5 500.021 885	21 885	0.000 398
			10 minutes	5 500.021 940	21 940	0.000 399
100 %		0	Startup	5 500.013 104	13 104	0.000 238
			2 minutes	5 500.013 215	13 215	0.000 240
			5 minutes	5 500.013 341	13 341	0.000 243
			10 minutes	5 500.013 529	13 529	0.000 246
100 %		10	Startup	5 500.008 134	8 134	0.000 148
			2 minutes	5 500.008 214	8 214	0.000 149
			5 minutes	5 500.008 256	8 256	0.000 150
			10 minutes	5 500.008 291	8 291	0.000 151
100 %		20	Startup	5 500.009 054	9 054	0.000 165
			2 minutes	5 500.009 090	9 090	0.000 165
			5 minutes	5 500.009 150	9 150	0.000 166
			10 minutes	5 500.009 234	9 234	0.000 168
100 %		23	Startup	5 500.012 532	12 532	0.000 228
			2 minutes	5 500.012 605	12 605	0.000 229
			5 minutes	5 500.012 714	12 714	0.000 231
			10 minutes	5 500.012 784	12 784	0.000 232
100 %		30	Startup	5 500.031 505	31 505	0.000 573
			2 minutes	5 500.031 647	31 647	0.000 575
			5 minutes	5 500.031 770	31 770	0.000 578
			10 minutes	5 500.031 885	31 885	0.000 580
100 %		40	Startup	5 500.048 130	48 130	0.000 875
			2 minutes	5 500.048 269	48 269	0.000 878
			5 minutes	5 500.048 513	48 513	0.000 882
			10 minutes	5 500.049 100	49 100	0.000 893
100 %		50	Startup	5 500.058 990	58 990	0.001 073
			2 minutes	5 500.060 225	60 225	0.001 095
			5 minutes	5 500.061 104	61 104	0.001 111
			10 minutes	5 500.062 357	62 357	0.001 134
85 %	AC 20.4	23	Startup	5 500.013 082	13 082	0.000 238
			2 minutes	5 500.013 115	13 115	0.000 238
			5 minutes	5 500.013 196	13 196	0.000 240
			10 minutes	5 500.013 405	13 405	0.000 244
115 %	AC 27.6	23	Startup	5 500.013 574	13 574	0.000 247
			2 minutes	5 500.013 641	13 641	0.000 248
			5 minutes	5 500.013 696	13 696	0.000 249
			10 minutes	5 500.013 740	13 740	0.000 250

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Mode: UNII-3

Operating frequency: 5 745 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎐)	Frequency deviation (㎐)	Deviation (%)
100 %	AC 24.0	-20	Startup	5 745.040 210	40 210	0.000 700
			2 minutes	5 745.040 335	40 335	0.000 702
			5 minutes	5 745.040 469	40 469	0.000 704
			10 minutes	5 745.040 584	40 584	0.000 706
100 %		-10	Startup	5 745.035 456	35 456	0.000 617
			2 minutes	5 745.035 560	35 560	0.000 619
			5 minutes	5 745.035 711	35 711	0.000 622
			10 minutes	5 745.035 834	35 834	0.000 624
100 %		0	Startup	5 745.013 104	13 104	0.000 228
			2 minutes	5 745.013 215	13 215	0.000 230
			5 minutes	5 745.013 341	13 341	0.000 232
			10 minutes	5 745.013 529	13 529	0.000 235
100 %		10	Startup	5 745.015 074	15 074	0.000 262
			2 minutes	5 745.015 349	15 349	0.000 267
			5 minutes	5 745.015 418	15 418	0.000 268
			10 minutes	5 745.015 867	15 867	0.000 276
100 %		20	Startup	5 745.019 889	19 889	0.000 346
			2 minutes	5 745.020 154	20 154	0.000 351
			5 minutes	5 745.020 274	20 274	0.000 353
			10 minutes	5 745.020 515	20 515	0.000 357
100 %		23	Startup	5 745.037 604	37 604	0.000 655
			2 minutes	5 745.037 860	37 860	0.000 659
			5 minutes	5 745.037 912	37 912	0.000 660
			10 minutes	5 745.038 004	38 004	0.000 662
100 %		30	Startup	5 745.044 768	44 768	0.000 779
			2 minutes	5 745.044 815	44 815	0.000 780
			5 minutes	5 745.044 899	44 899	0.000 782
			10 minutes	5 745.045 124	45 124	0.000 785
100 %		40	Startup	5 745.060 155	60 155	0.001 047
			2 minutes	5 745.060 209	60 209	0.001 048
			5 minutes	5 745.060 488	60 488	0.001 053
			10 minutes	5 745.061 374	61 374	0.001 068
100 %		50	Startup	5 745.073 580	73 580	0.001 281
			2 minutes	5 745.073 796	73 796	0.001 285
			5 minutes	5 745.073 950	73 950	0.001 287
			10 minutes	5 745.074 515	74 515	0.001 297
85 %	AC 20.4	23	Startup	5 745.042 959	42 959	0.000 748
			2 minutes	5 745.043 110	43 110	0.000 750
			5 minutes	5 745.043 189	43 189	0.000 752
			10 minutes	5 745.043 506	43 506	0.000 757
115 %	AC 27.6	23	Startup	5 745.044 790	44 790	0.000 780
			2 minutes	5 745.044 856	44 856	0.000 781
			5 minutes	5 745.045 130	45 130	0.000 786
			10 minutes	5 745.045 598	45 598	0.000 794

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