TEST REPORT

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1. Client

- Name : HYUNDAI MOBIS CO., LTD.
- Address : 203, Teheran-ro, Gangnam-gu, Seoul, 06141, Korea
- Date of Receipt : 2019-09-20

2. Use of Report : Certification

3. Name of Product and Model : WIDE AVN / ATBA0HYAN

4. Manufacturer and Country of Origin : Hyundai Mobis Co., Ltd. / Korea

5. FCC ID : TQ8-ATBA0HYAN

6. Date of Test : 2019-10-01 to 2019-10-31

7. Test Standards : FCC Part 15 Subpart E, 15.407

8. Test Results : Refer to the test result in the test report

Affirmation	Tested by Name : MyeongJun Kwon (Signature)	Technical Manager Name : Heesu Ahn (Signature)

2020-02-09

KCTL Inc.

Report revision history

Date	Revision	Page No
2020-02-09	Initial report	-

CONTENTS

1. General information

Client	:	HYUNDAI MOBIS CO., LTD.
Address	:	203, Teheran-ro, Gangnam-gu, Seoul, 06141, Korea
Manufacturer	:	Hyundai Mobis Co., Ltd
Address	:	95, Sayang 2-Gil, Munbaek-Myeon, Jincheon-Gun, Chungcheongbuk-Do 27862 Korea
Laboratory	:	KCTL Inc.
Address	:	65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
Accreditations	:	FCC Site Designation No: KR0040, FCC Site Registration No: 687132 VCCI Registration No. : R-20080, G-20078, C-20059, T-20056 Industry Canada Registration No. : 8035A KOLAS No.: KT231

2. Device information

Equipment under test	:	WIDE AVN
Model	:	ATBA0HYAN
Derivative model	:	ATBA0HCAN, ATBA3HCAN
Frequency range	:	2 402 ㎒ ~ 2 480 ㎒ (Bluetooth(BDR/EDR) 2 412 ㎒ ~ 2 462 ㎒ (802.11b/g/n_HT20) UNII-1: 5 180 ㎒ ~ 5 240 ㎒ (802.11a/n_HT20/ac_VHT20) UNII-1: 5 190 ㎒ ~ 5 230 ㎒ (802.11n_HT40/ac_VHT40) UNII-1: 5 210 ㎒ (802.11ac_VHT80) UNII-2A: 5 260 ㎒ ~ 5 320 ㎒ (802.11a/n_HT20/ac_VHT20) UNII-2A: 5 270 ㎒ ~ 5 310 ㎒ (802.11n_HT40/ac_VHT40) UNII-2A: 5 290 ㎒ (802.11ac_VHT80) UNII-2C: 5 500 ㎒ ~ 5 720 ㎒ (802.11a/n_HT20/ac_VHT20) UNII-2C: 5 510 ㎒ ~ 5 710 ㎒ (802.11n_HT40/ac_VHT40) UNII-2C: 5 530 ㎒ ~ 5 690 ㎒ (802.11ac_VHT80) UNII-3: 5 745 ㎒ ~ 5 825 ㎒ (802.11a/n_HT20/ac_VHT20) UNII-3: 5 755 ㎒ ~ 5 795 ㎒ (802.11n_HT40/ac_VHT40) UNII-3: 5 775 ㎒ (802.11ac_VHT80)
Modulation technique	:	Bluetooth(BDR/EDR)_ GFSK, π/4DQPSK, 8DPSK WIFI(802.11a/b/g/n20/n40/ac20/ac40/ac80)_DSSS, OFDM
Number of channels	:	Bluetooth(BDR/EDR)_79ch 2.4㎓ WIFI (802.11b/g/n_HT20)_11ch UNII-1: 4 ch (20 ㎒), 2 ch (40 ㎒), 1 ch (80 ㎒) UNII-2A: 4 ch (20 ㎒), 2 ch (40 ㎒), 1 ch (80 ㎒) UNII-2C: 9 ch (20 ㎒), 5 ch (40 ㎒), 2 ch (80 ㎒) UNII-3: 5 ch (20 ㎒), 2 ch (40 ㎒), 1 ch (80 ㎒)
Power source	:	DC 14.4 V

Antenna specification	:	WIFI/Bluetooth(BDR/EDR)_Pattern Antenna
Antenna gain	:	2.4㎓ WIFI (802.11b/g/n_HT20) : -0.70 dBi
		Bluetooth(BDR/EDR) : 0.29 dBi
		UNII-1 :3.51 dBi, UNII-2A : 3.12 dBi
		UNII-2C : 2.28 dBi, UNII-3 : -0.84 dBi
Software version	:	MQ4.USA.0000.V028.001.190821
Hardware version	:	MQ4.USA.STD.AVN_G5_WIDE.004.001
Test device serial No.	:	N/A
Operation temperature	:	-20 ℃ ~ 70 ℃

2.1. Simultaneously transmission condition

Technology	Modulation	Test mode	Frequency (㎒)
WLAN 5 ㎓	OFDM	802.11a / UNII-2A	5 320
Bluetooth	GFSK	BDR	2 480

2.2. Information about derivative model

The difference between basic model and derivative models is:

The derivative models have a different product identification number.

ATBA0HCAN(96560 P4700), ATBA3HCAN(96560 P4900)

2.3. Frequency/channel operations

This device contains the following capabilities:
WIFI(2.4㎓ band 802.11b/g/n(HT20), 5㎓ band 802.11a/n(HT20/HT40)/ac(VHT/20/40/80)), Bluetooth(BDR/EDR)

UNII-1		UNII-2A		UNII-2C		UNII-3	
Ch.	Frequency (㎒)	Ch.	Frequency (㎒)	Ch.	Frequency (㎒)	Ch.	Frequency (㎒)
36	5 180	52	5 260	100	5 500	149	5 745
40	5 200	56	5 280	116	5 580	157	5 785
48	5 240	64	5 320	144	5 720	165	5 825

Table 2.3.1. 802.11a/n/ac HT20/VHT20 mode

UNII-1		UNII-2A		UNII-2C		UNII-3	
Ch.	Frequency (㎒)	Ch.	Frequency (㎒)	Ch.	Frequency (㎒)	Ch.	Frequency (㎒)
38	5 190	54	5 270	102	5 510	151	5 755
46	5 230	62	5 310	110	5 550	159	5 795
				142	5 710		

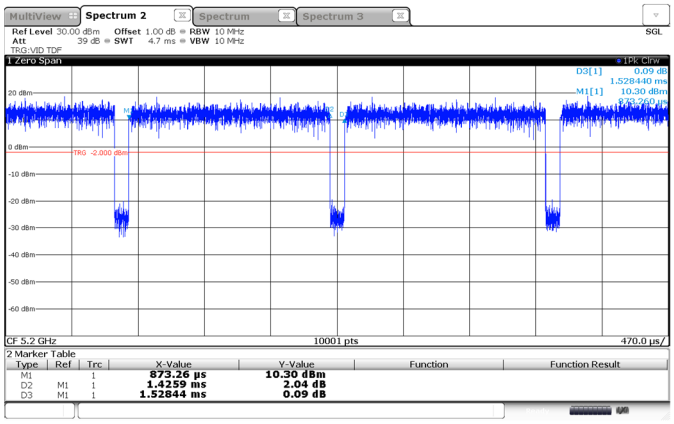
Table 2.3.2. 802.11n/ac_HT40/VHT40 mode

UNII-1		UNII-2A		UNII-2C		UNII-3	
Ch.	Frequency (㎒)	Ch.	Frequency (㎒)	Ch.	Frequency (㎒)	Ch.	Frequency (㎒)
42	5 210	58	5 290	106	5 530	155	5 775
				138	5 690		

Table 2.3.3. 802.11ac_VHT80 mode

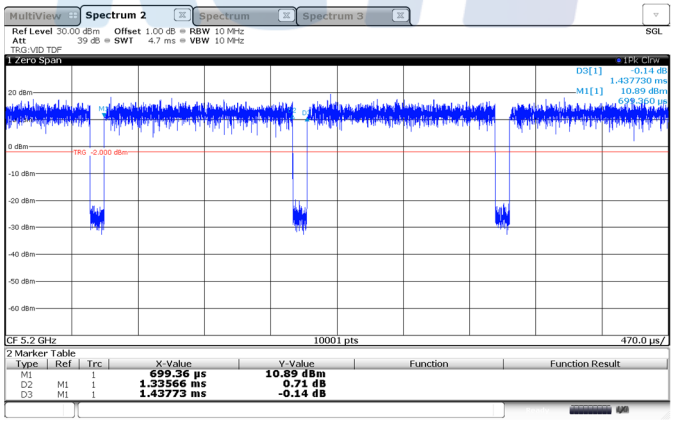
2.4. Duty Cycle Correction Factor

- 802.11a



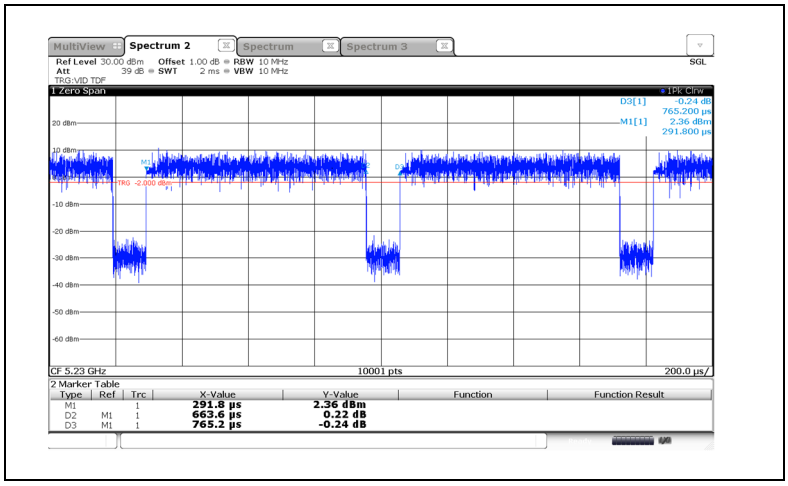
Note1) : Period : 1.528 44 ㎳, On time : 1.425 9 ㎳
Note2) : DCCF = 10log(1/x) = 10log(1/0.93) = 0.30 ㏈, x = 1.425 9/1.528 44 = 0.93
Note3) : 802.11 a is a non-continuous transmission (duty cycle < 98%)

- 802.11n HT20



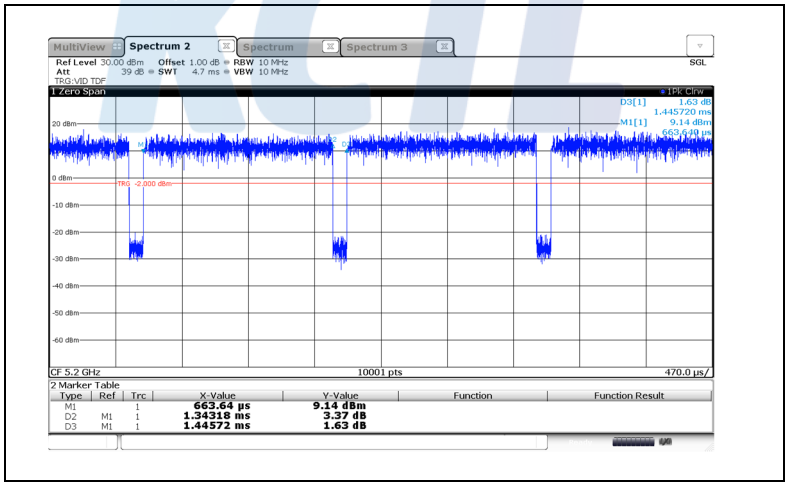
Note1) : Period : 1.437 73 ㎳, On time : 1.335 66 ㎳
Note2) : DCCF = 10log(1/x) = 10log(1/0.93) = 0.32 ㏈, x = 1.335 66/1.437 73 = 0.93
Note3) : 802.11 n HT20 is a non-continuous transmission (duty cycle < 98%)

- 802.11n HT40



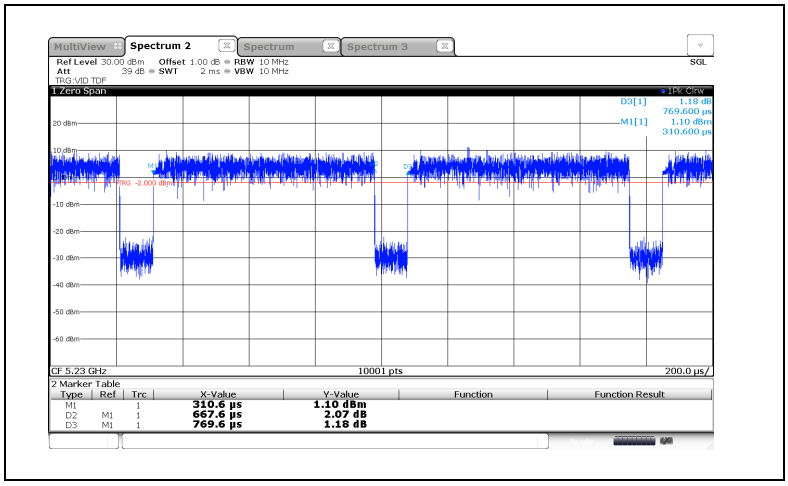
Note1) : Period : 0.765 2 ㎳, On time : 0.663 6 ㎳
Note2) : DCCF = 10log(1/x) = 10log(1/0.867) = 0.619 ㏈, x = 0.663 6/0.765 2 = 0.867
Note3) : 802.11n HT40 is a non-continuous transmission (duty cycle < 98%)

- 802.11ac VHT20



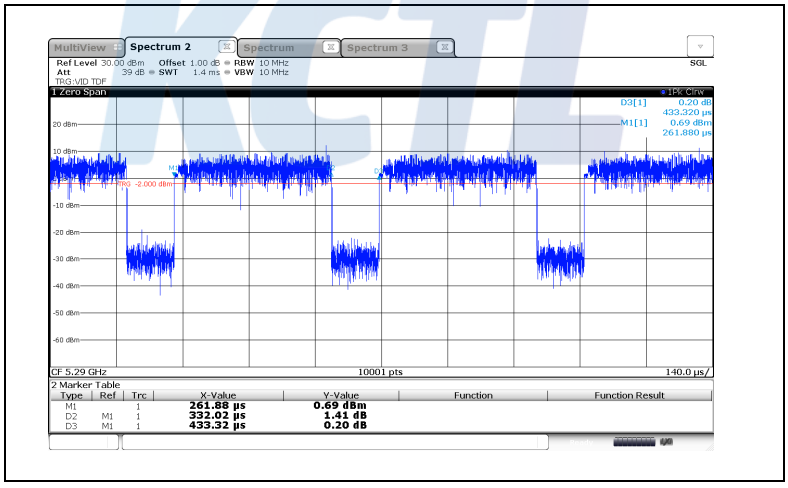
Note1) : Period : 1.445 72 ㎳, On time : 1.343 18 ㎳
Note2) : DCCF = 10log(1/x) = 10log(1/0.93) = 0.32 ㏈, x = 1.343 18/1.445 72 = 0.93
Note3) : 802.11ac VHT20 is a non-continuous transmission (duty cycle < 98%)

- 802.11ac VHT40



Note1) : Period : 0.769 6 ㎳, On time : 0.667 6 ㎳
Note2) : DCCF = 10log(1/x) = 10log(1/0.87) = 0.62 ㏈, x = 0.667 6/0.769 6 = 0.867
Note3) : 802.11ac VHT40 is a non-continuous transmission (duty cycle < 98%)

- 802.11ac VHT80



Note1) : Period : 0.433 32 ㎳, On time : 0.332 02 ㎳
Note2) : DCCF = 10log(1/x) = 10log(1/0.77) = 1.16 ㏈, x = 0.332 02/0.433 32 = 0.77
Note3) : 802.11ac VHT80 is a non-continuous transmission (duty cycle < 98%)

3. Antenna requirement

Requirement of FCC part section 15.203, 15.407:
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

- The transmitter has permanently attached Pattern Antenna (internal antenna) on board.
- The E.U.T Complies with the requirement of §15.203, §15.407

4. Summary of tests

FCC Part section(s)	Parameter	Test results
15.407(a)	Maximum conducted output power	Pass
15.407(a)	Maximum power spectral density	Pass
15.407(e)	6 dB Channel Bandwidth	Pass
15.407(a)	26 dB Channel Bandwidth	Pass
-	Occupied Bandwidth	
15.407(b), 15.205(a), 15.209(a)	Spurious emission	Pass
	Band-edge, restricted band	Pass
15.207(a)	Conducted Emissions	N/A(Note2)

Notes:

1. All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2. This test is not applicable because the EUT falls into the automotive device and it's not to be connected to the public utility(AC) power line.
3. According to exploratory test no any obvious emission were detected from 9 ㎑ to 30 ㎒. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.
4. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that X orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in X orientation
5. This product do not use Terminal Doppler Weather Radar (TDWR) Channel.
6. The test procedure(s) in this report were performed in accordance as following.
   - ANSI C63.10-2013
   - KDB 662911 D01 v02r01
   - KDB 789033 D02 v02r01
7. The worst-case data rates were:
   802.11a mode : 1Mbps
   802.11g mode : 6Mbps
   802.11n HT20 mode : MCS0
   802.11n HT40 mode : MCS0
   802.11n VHT20 mode : MCS0
   802.11n VHT40 mode : MCS0
   802.11n VHT80 mode : MCS0

5. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of k=2 to indicated a 95 % level of confidence. The measurement data shown herein meets of exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded uncertainty(±)	
Conducted RF power	1.76 dB	
Conducted spurious emissions	4.03 dB	
Radiated spurious emissions	9 kHz ~ 30 MHz:	2.28 dB
	30 MHz ~ 300 MHz	4.98 dB
	300 MHz ~ 1 000 MHz	5.14 dB
	1 GHz ~ 6 GHz	6.70 dB
	Above 6 GHz	6.60 dB
Conducted emissions	9 kHz ~ 150 kHz	3.66 dB
	150 kHz ~ 30 MHz	3.26 dB

6. Measurement results explanation example

The offset level is set in the spectrum analyzer to compensate the RF cable loss factor between EUT conducted output port and spectrum analyzer.
With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

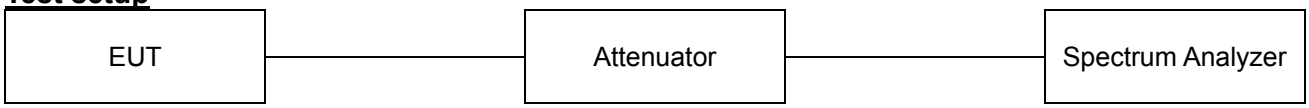
Frequency (㎒)	Factor(㏈)	Frequency (㎒)	Factor(㏈)
30	9.80	16 000	12.61
50	9.83	17 000	12.60
100	9.89	18 000	13.00
200	9.95	19 000	13.08
300	10.07	20 000	12.92
400	10.08	21 000	12.83
500	10.14	22 000	13.32
600	10.17	23 000	13.60
700	10.25	24 000	13.29
800	10.28	25 000	13.66
900	10.34	26 000	13.76
1 000	10.41	26 500	13.56
2 000	10.65	27 000	13.88
3 000	10.86	28 000	13.93
4 000	11.06	29 000	13.56
5 000	11.30	30 000	13.83
6 000	11.42	31 000	14.09
7 000	11.50	32 000	13.98
8 000	11.78	33 000	14.12
9 000	11.92	34 000	14.53
10 000	12.16	35 000	14.56
11 000	12.16	36 000	14.61
12 000	12.34	37 000	15.20
13 000	12.50	38 000	15.27
14 000	12.92	39 000	15.23
15 000	12.72	40 000	15.60

Notes:
Offset(㏈) = RF cable loss(㏈) + Attenuator(㏈)

7. Test results

7.1. Maximum conducted output power

Test setup



Limit

According to §15.407(a),

Band	EUT category		Conducted output power limit
UNII-1		Outdoor access point	1 W (30 dBm)
		Indoor access point	
		Fixed point-to-point access point	
	√	Client device	250 ㎽ (23.98 dBm)
UNII-2A	√		250 ㎽ or 11 dBm + 10logB[1)]
UNII-2C	√		250 ㎽ or 11 dBm + 10logB[1)]
UNII-3	√		1 W (30 dBm)

Note:

1) Conducted output power limit B is the 26 dB emission bandwidth.

Test procedure

ANSI C63.10-2013-Section 12.3.2.4
KDB 789033 D02 v02r01 - Section E.2.d) or e)

Test settings
Used test method is Section E.2.d)

◆ KDB 789033 D02 v02r01

Section E.2.d)
Method SA-2 (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction):

(i) Measure the duty cycle, x, of the transmitter output signal as described in II.B..
(ii) Set span to encompass the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
(iii) Set RBW = 1 ㎒
(iv) Set RBW ≥ 3 ㎒
(v) Number of points in sweep ≥ 2×span/RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
(vi) Sweep time = auto.
(vii) Detector = power averaging (rms), if available. Otherwise use sample detector mode.
(viii) Do not use sweep triggering. Allow the sweep to “free run.”
(ix) Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed to ensure that the average accurately represents the true average over the on and off periods of the transmitter.
(x) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument’s band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 ㎒ intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
(xi) Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add 10 log(1/0,25) = 6 ㏈ if the duty cycle is 25%.

Section E.2.e)
Method SA-2 Alternative (power averaging(rms) detection with slow sweep with each spectrum bin averaging across on and off times of the EUT transmissions, followed by duty cycle correction):

(i) Measure the duty cycle, x, of the transmitter output signal as described in II.B..
(ii) Set span to encompass the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
(iii) Set RBW = 1 ㎒
(iv) Set RBW ≥ 3 ㎒
(v) Number of points in sweep ≥ 2×span/RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
(vi) Manually set sweep time ≥ 10 × (number of points in sweep) × (total on/off period of the transmitted signal).
(vii) Set detector = power averaging (rms)
(viii) Perform a single sweep.
(ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument’s band power measurement

function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 ㎒ intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.

(x) Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add 10 log(1/0,25) = 6 ㏈ if the duty cycle is 25%.

Section E.3.a)
Method PM (Measurement using an RF average power meter):

(xi) 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

(xii) If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in Ⅱ

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

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

Section E.3.b)
Method PM-G (Measurement using a gated RF average power meter):

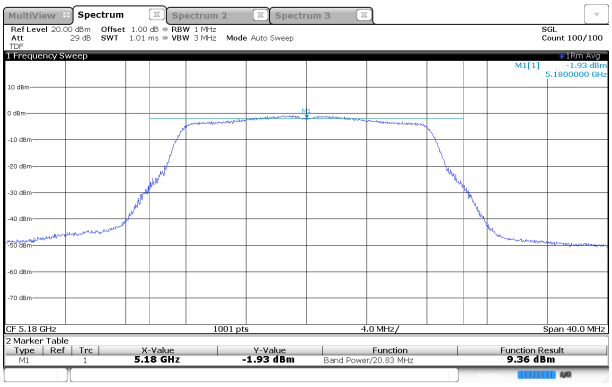
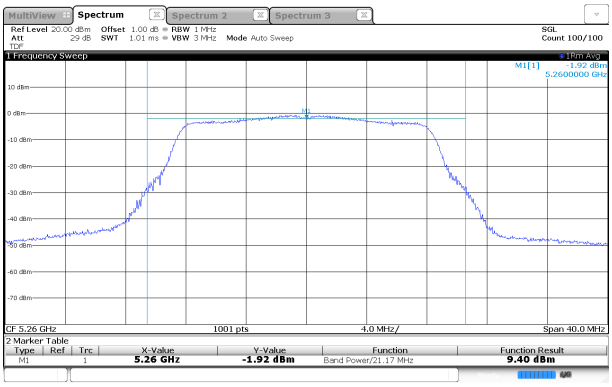
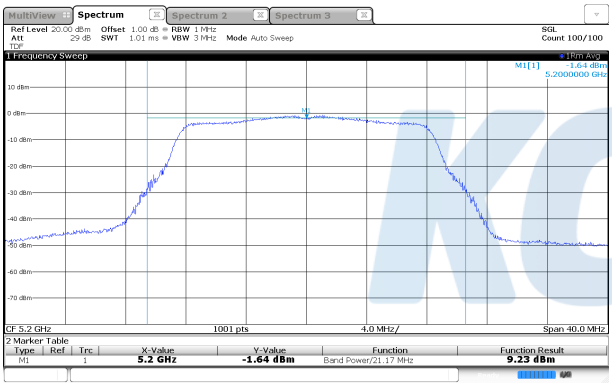
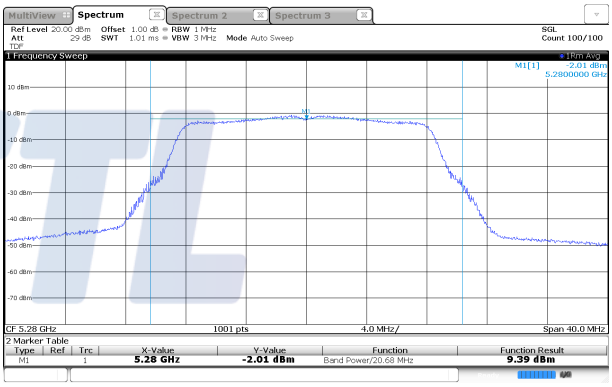
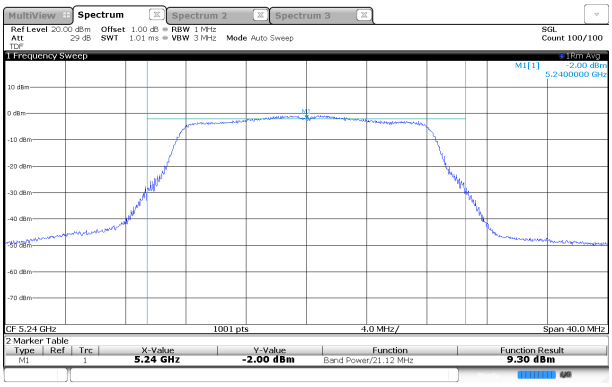
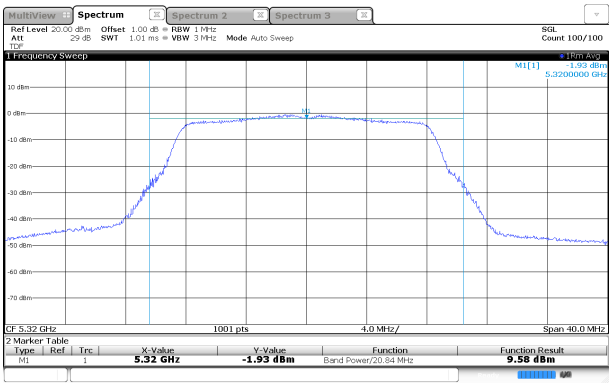
Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle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

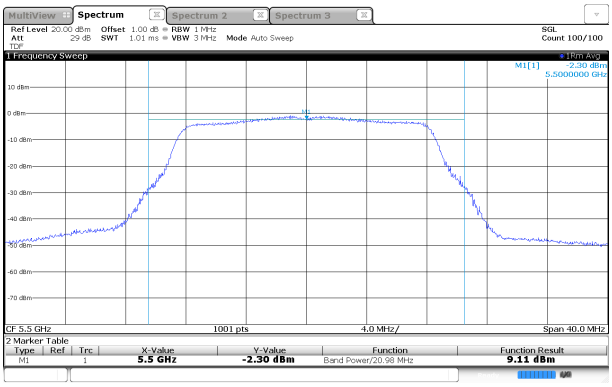
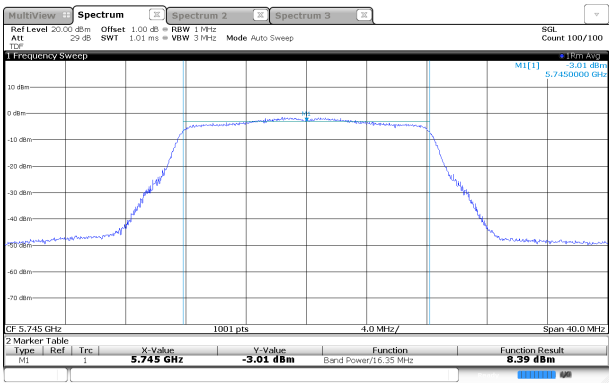
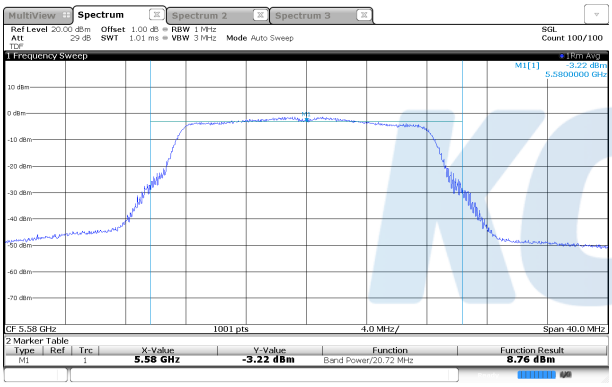
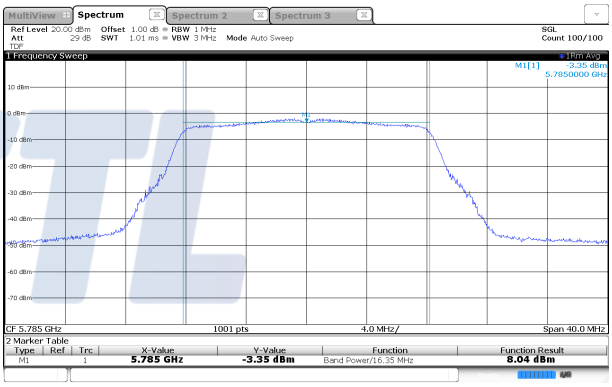
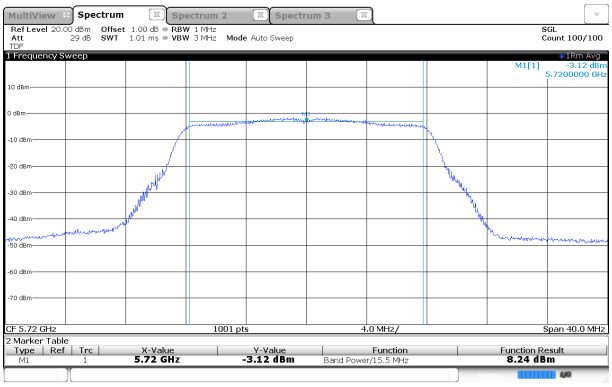
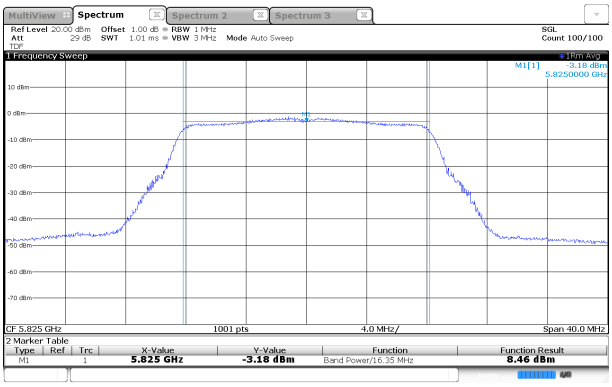
Test results

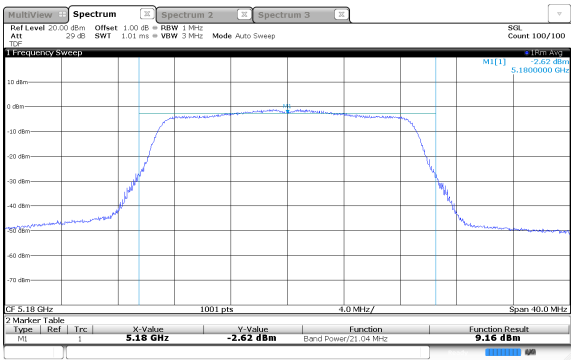
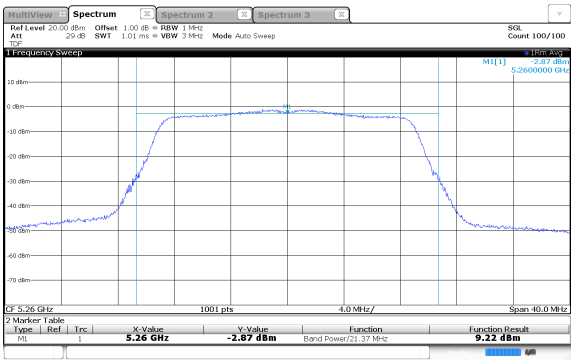
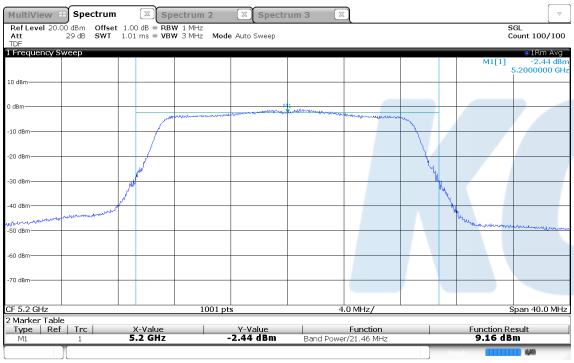
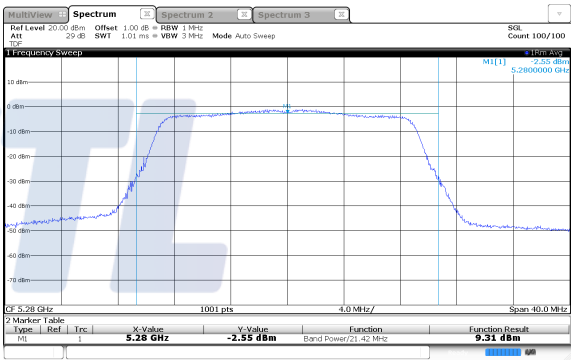
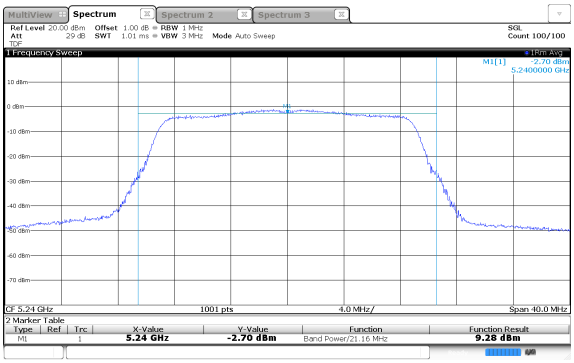
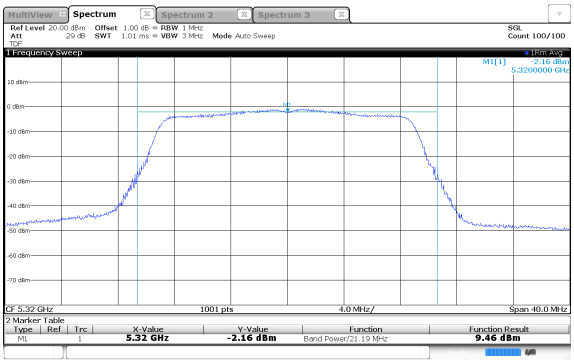
Test mode	Band	Frequency (㎒)	Measured power (dBm)	DCCF (dB)	Conducted output power (dBm)	Conducted Power Limit (dBm)
802.11a	UNII-1	5 180	9.36	0.30	9.66	23.98
		5 200	9.23	0.30	9.53	
		5 240	9.30	0.30	9.60	
	UNII-2A	5 260	9.40	0.30	9.70	23.98
		5 280	9.39	0.30	9.69	
		5 320	9.58	0.30	9.88	
	UNII-2C	5 500	9.11	0.30	9.41	23.98
		5 580	8.76	0.30	9.06	
		5 720	8.24	0.30	8.54	22.90
	UNII-3	5 745	8.39	0.30	8.69	30.00
		5 785	8.04	0.30	8.34	
		5 825	8.46	0.30	8.76	
802.11n HT20	UNII-1	5 180	9.16	0.32	9.48	23.98
		5 200	9.16	0.32	9.48	
		5 240	9.28	0.32	9.60	
	UNII-2A	5 260	9.22	0.32	9.54	23.98
		5 280	9.31	0.32	9.63	
		5 320	9.46	0.32	9.78	
	UNII-2C	5 500	8.96	0.32	9.28	23.98
		5 580	8.90	0.32	9.22	
		5 720	8.41	0.32	8.73	23.01
	UNII-3	5 745	8.19	0.32	8.51	30.00
		5 785	8.02	0.32	8.34	
		5 825	8.33	0.32	8.65	
802.11n HT40	UNII-1	5 190	4.04	0.62	4.66	23.98
		5 230	4.24	0.62	4.86	
	UNII-2A	5 270	8.82	0.62	9.44	23.98
		5 310	8.74	0.62	9.36	
	UNII-2C	5 510	8.48	0.62	9.10	23.98
		5 550	8.25	0.62	8.87	
		5 710	7.85	0.62	8.47	
	UNII-3	5 755	7.87	0.62	8.49	30.00
		5 795	7.37	0.62	7.99	

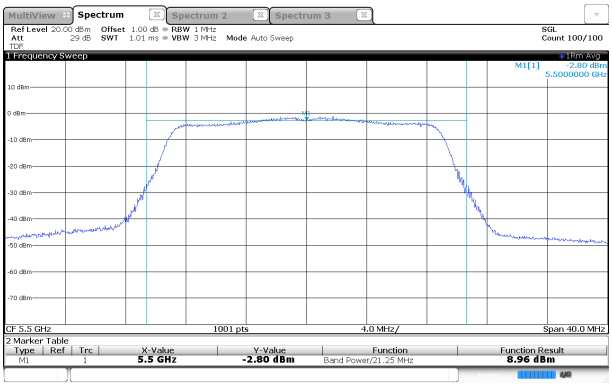
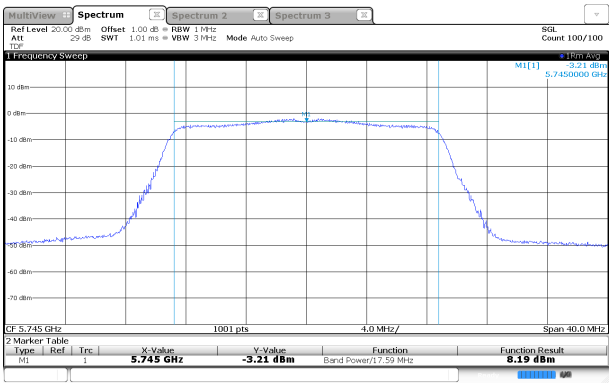
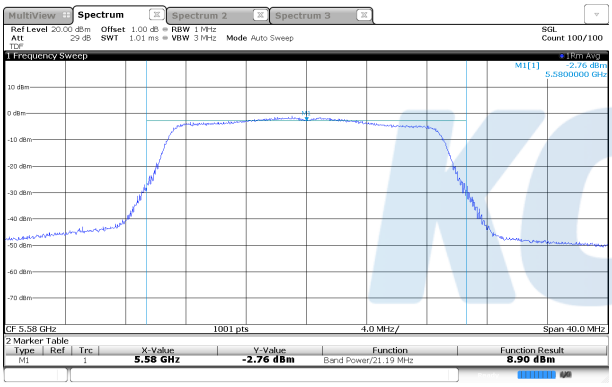
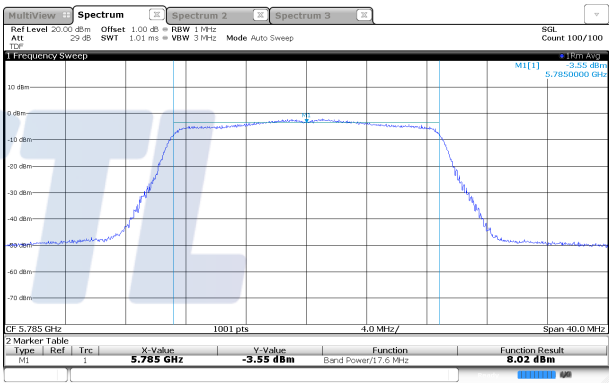
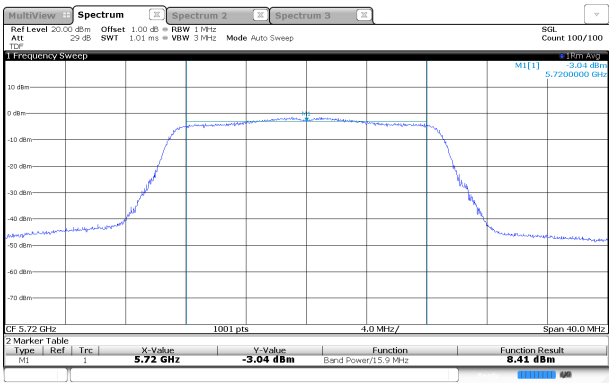
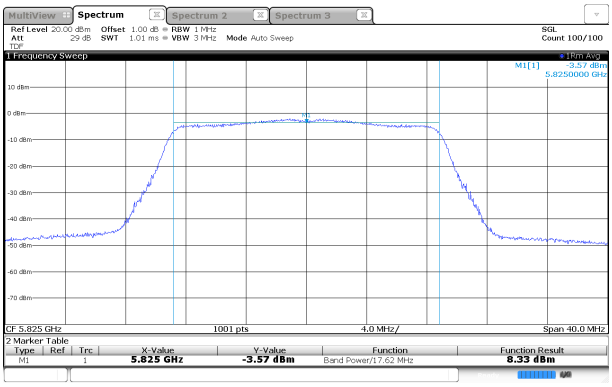
Test mode	Band	Freq (㎒)	Measured power (dBm)	DCCF (dB)	Conducted output power (dBm)	Conducted Power Limit (dBm)
802.11ac VHT20	UNII-1	5 180	9.10	0.32	9.42	23.98
		5 200	9.05	0.32	9.37	
		5 240	9.15	0.32	9.47	
	UNII-2A	5 260	9.20	0.32	9.52	23.98
		5 280	9.25	0.32	9.57	
		5 320	9.40	0.32	9.72	
	UNII-2C	5 500	9.09	0.32	9.41	23.98
		5 580	8.94	0.32	9.26	
		5 720	8.43	0.32	8.75	22.95
	UNII-3	5 745	8.16	0.32	8.48	30.00
		5 785	7.93	0.32	8.25	
		5 825	8.45	0.32	8.77	
802.11ac VHT40	UNII-1	5 190	4.25	0.62	4.87	23.98
		5 230	4.26	0.62	4.88	
	UNII-2A	5 270	8.64	0.62	9.26	23.98
		5 310	8.64	0.62	9.26	
	UNII-2C	5 510	8.58	0.62	9.20	23.98
		5 550	8.27	0.62	8.89	
		5 710	7.84	0.62	8.46	
	UNII-3	5 755	7.82	0.62	8.44	30.00
		5 795	7.33	0.62	7.95	
802.11ac VHT80	UNII-1	5 210	3.50	1.16	4.66	23.98
	UNII-2A	5 290	7.06	1.16	8.22	23.98
	UNII-2C	5 530	7.86	1.16	9.02	23.98
		5 690	7.54	1.16	8.70	
	UNII-3	5 775	7.05	1.16	8.21	30.00

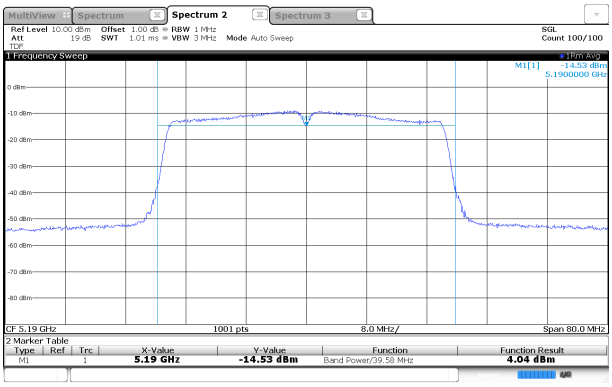
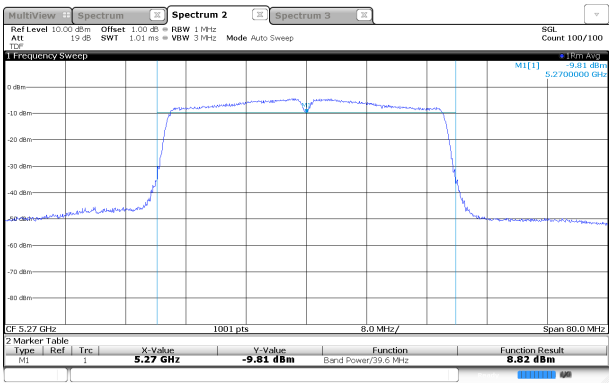
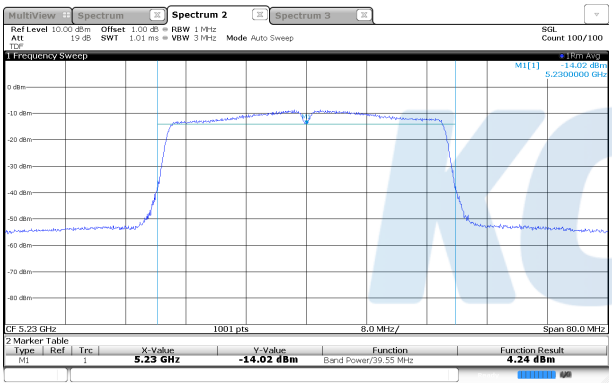
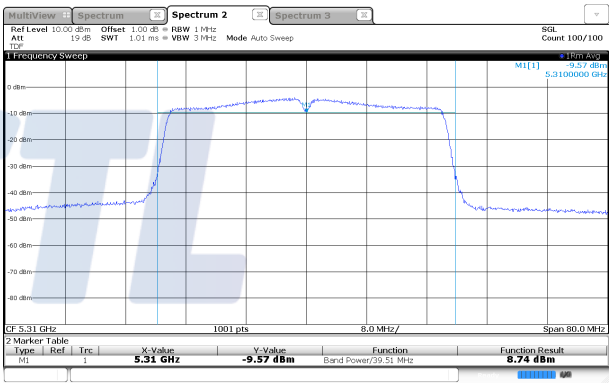
Note:
1. Conducted Output power Calculation:
Conducted Output power = Measured power(dB m) + DCCF (dB)

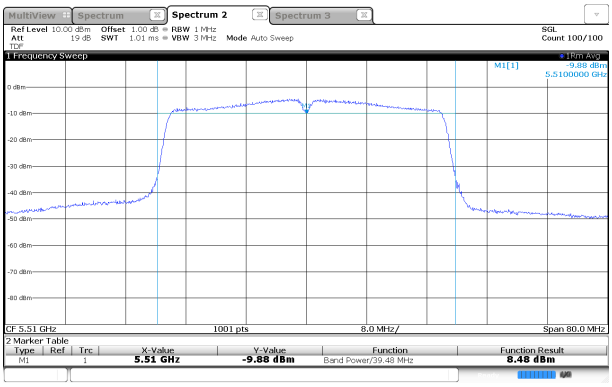
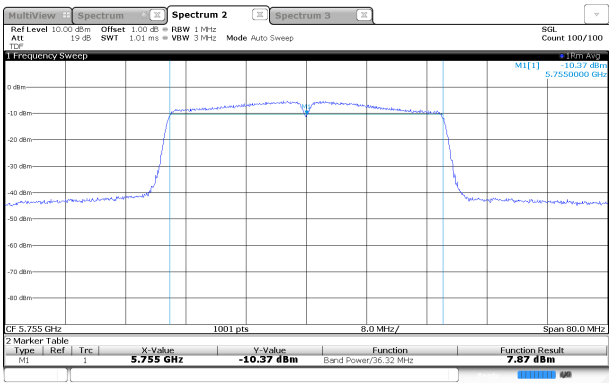
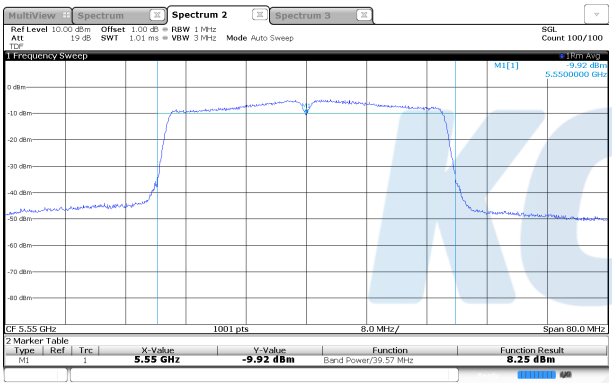
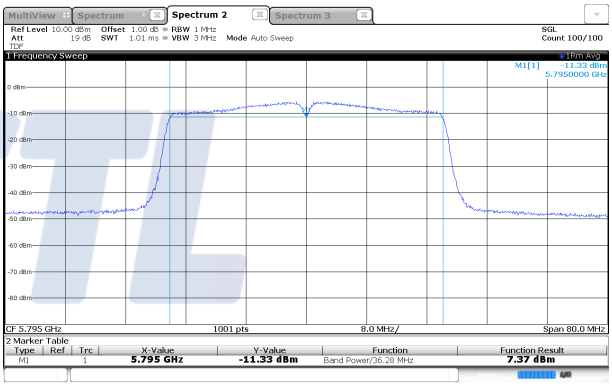
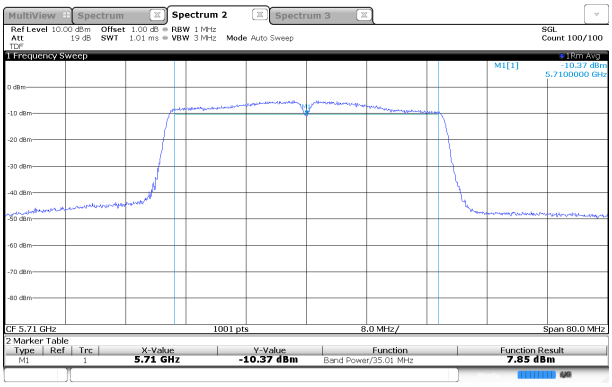
UNII-1 / 802.11a / Low ch.	UNII-2A / 802.11a / Low ch.
	
UNII-1 / 802.11a / Mid ch.	**UNII-2A / 802.11a / Mid ch.**
	
UNII-1 / 802.11a / High ch.	**UNII-2A / 802.11a / High ch.**
	

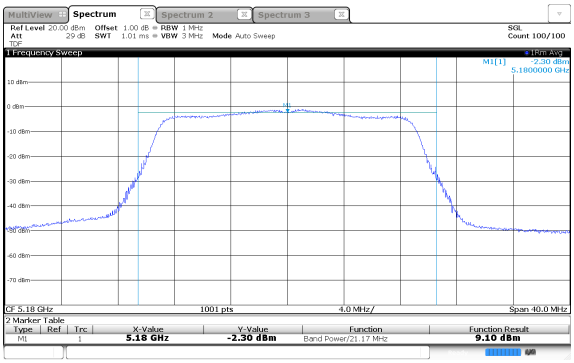
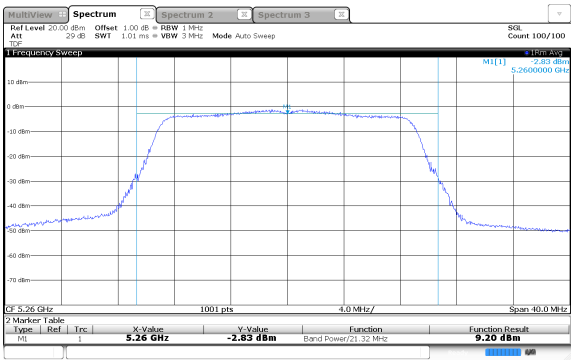
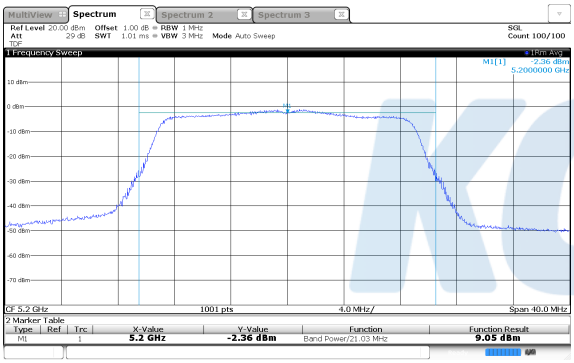
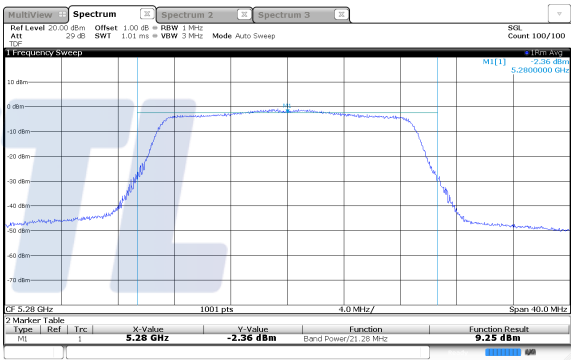
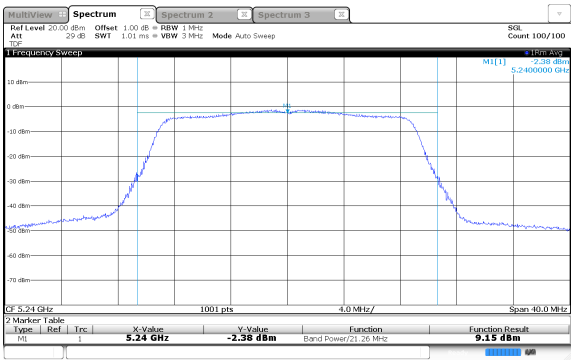
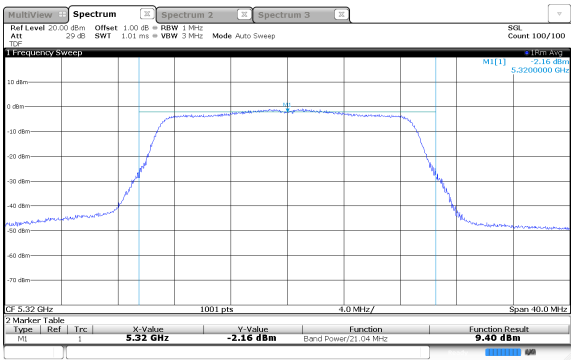
UNII-2C / 802.11a / Low ch.	UNII-3 / 802.11a / Low ch.
	
UNII-2C / 802.11a / Mid ch.	**UNII-3 / 802.11a / Mid ch.**
	
UNII-2C / 802.11a / High ch.	**UNII-3 / 802.11a / High ch.**
	

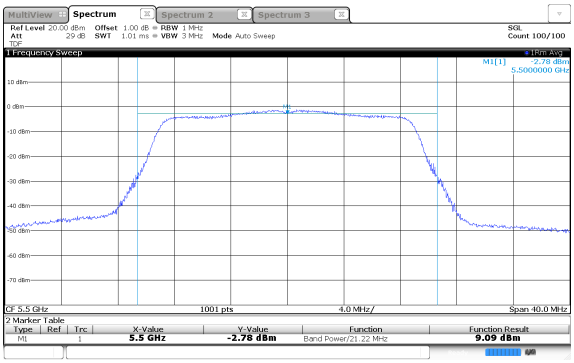
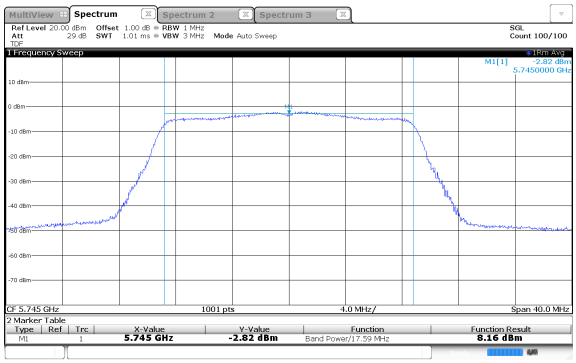
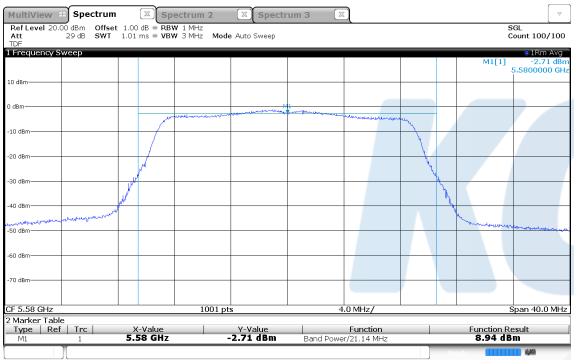
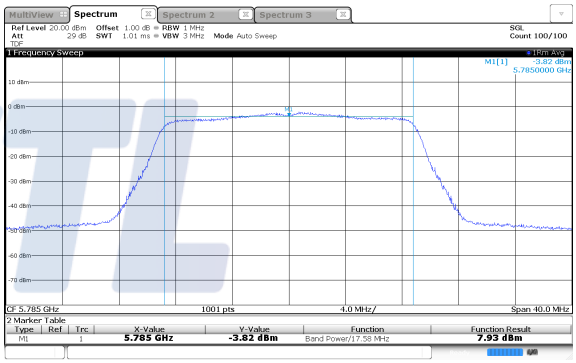
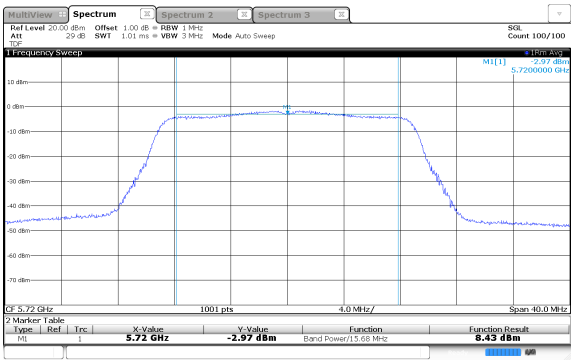
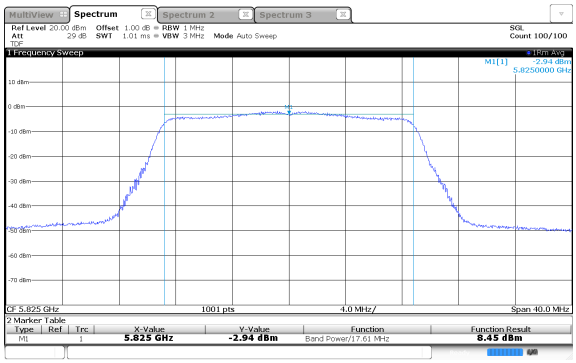
UNII-1 / 802.11n HT20 / Low ch.	UNII-2A / 802.11n HT20 / Low ch.
	
UNII-1 / 802.11n HT20 / Mid ch.	**UNII-2A / 802.11n HT20 / Mid ch.**
	
UNII-1 / 802.11n HT20 / High ch.	**UNII-2A / 802.11n HT20 / High ch.**
	

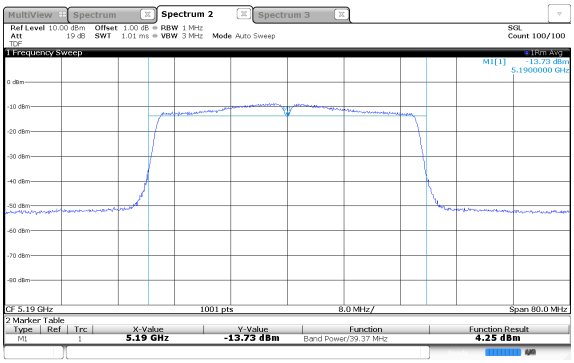
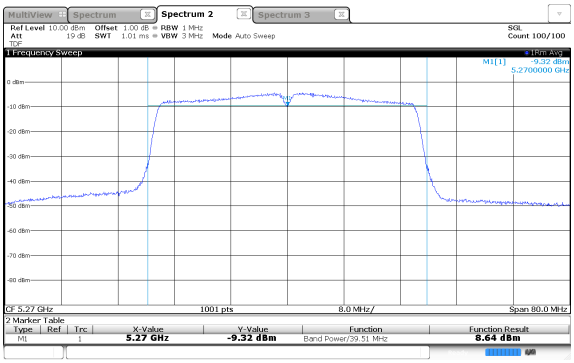
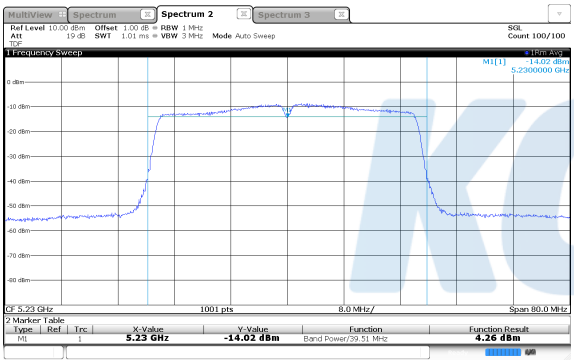
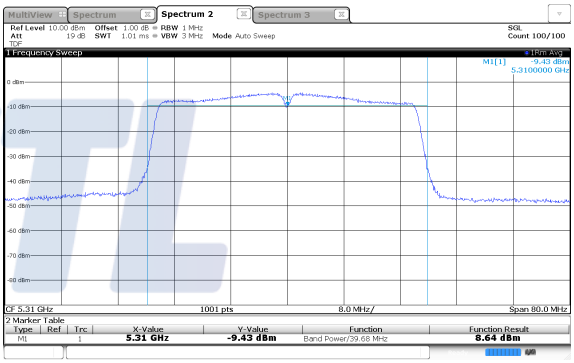
UNII-2C / 802.11n HT20 / Low ch.	UNII-3 / 802.11n HT20 / Low ch.
	
UNII-2C / 802.11n HT20 / Mid ch.	**UNII-3 / 802.11n HT20 / Mid ch.**
	
UNII-2C / 802.11n HT20 / High ch.	**UNII-3 / 802.11n HT20 / High ch.**
	

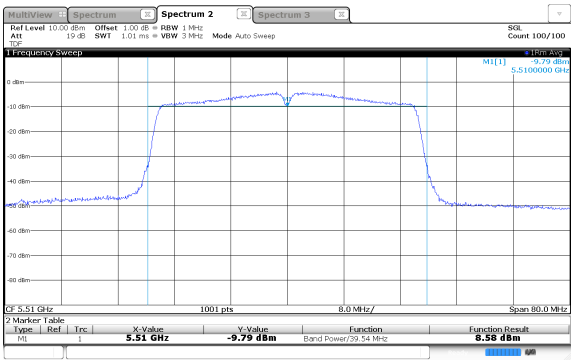
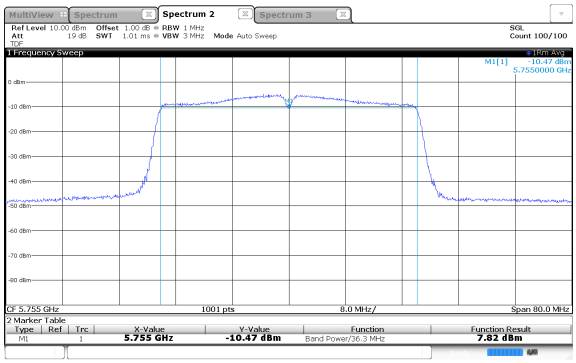
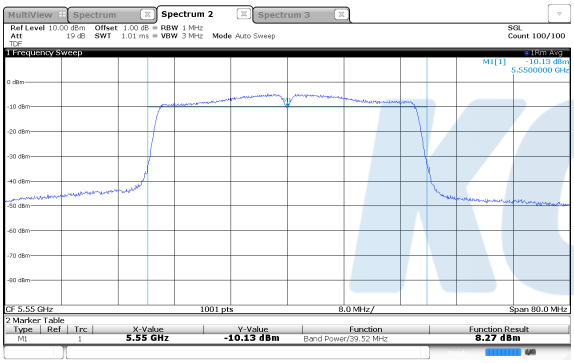
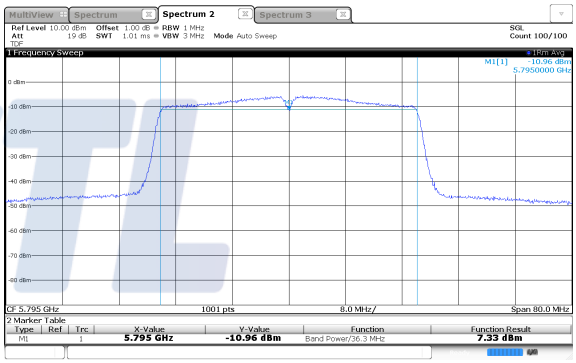
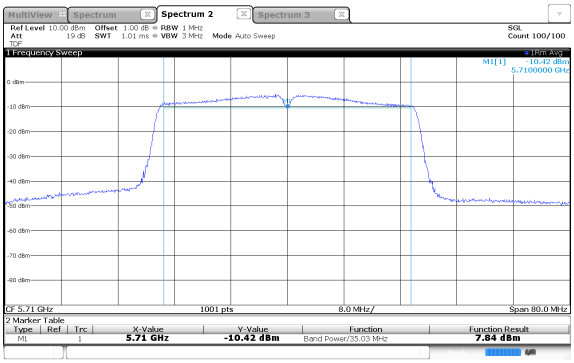
UNII-1 / 802.11n HT40 / Low ch.	UNII-2A / 802.11n HT40 / Low ch.
	
UNII-1 / 802.11n HT40 / High ch.	**UNII-2A / 802.11n HT40 / High ch.**
	

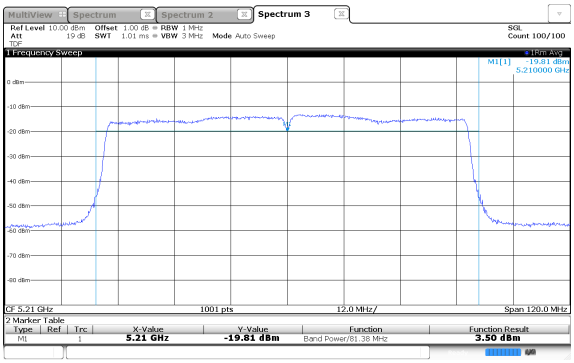
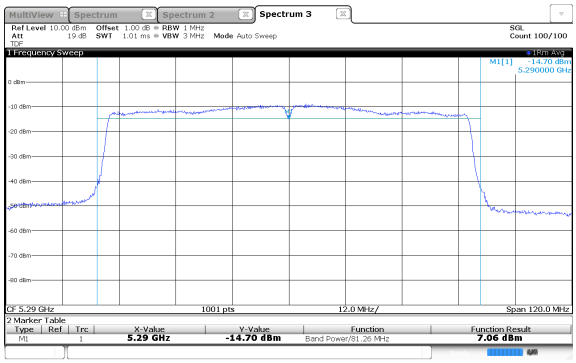
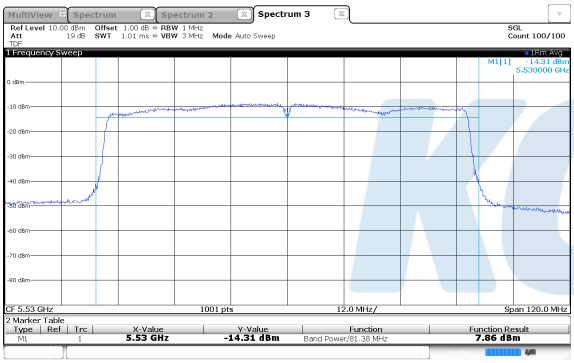
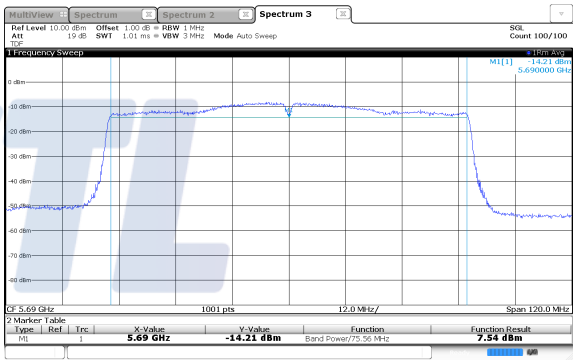
UNII-2C / 802.11n HT40 / Low ch.	UNII-3 / 802.11n HT40 / Low ch.
	
UNII-2C / 802.11n HT40 / Mid ch.	**UNII-3 / 802.11n HT40 / High ch.**
	
UNII-2C / 802.11n HT40 / High ch.	
	Blank

UNII-1 / 802.11ac VHT20 / Low ch.	UNII-2A / 802. 11ac VHT20 / Low ch.
	
UNII-1 / 802. 11ac VHT20 / Mid ch.	**UNII-2A / 802. 11ac VHT20 / Mid ch.**
	
UNII-1 / 802. 11ac VHT20 / High ch.	**UNII-2A / 802. 11ac VHT20 / High ch.**
	

UNII-2C / 802.11ac VHT20 / Low ch.	UNII-3 / 802.11ac VHT20 / Low ch.
	
UNII-2C / 802.11ac VHT20 / Mid ch.	**UNII-3 / 802.11ac VHT20 / Mid ch.**
	
UNII-2C / 802.11ac VHT20 / High ch.	**UNII-3 / 802.11ac VHT20 / High ch.**
	

UNII-1 / 802.11ac VHT40 / Low ch.	UNII-2A / 802.11ac VHT40 / Low ch.
	
UNII-1 / 802.11ac VHT40 / High ch.	**UNII-2A / 802.11ac VHT40 / High ch.**
	

UNII-2C / 802.11ac VHT40 / Low ch.	UNII-3 / 802.11ac VHT40 / Low ch.
	
UNII-2C / 802.11ac VHT40 / Mid ch.	**UNII-3 / 802.11ac VHT40 / High ch.**
	
UNII-2C / 802.11ac VHT40 / High ch.	
	Blank

UNII-1 / 802.11ac VHT80 / Low ch.	UNII-2A / 802.11ac VHT80 / Low ch.
	
UNII-2C / 802.11ac VHT80 / Low ch.	**UNII-2C / 802.11ac VHT80 / High ch.**
	
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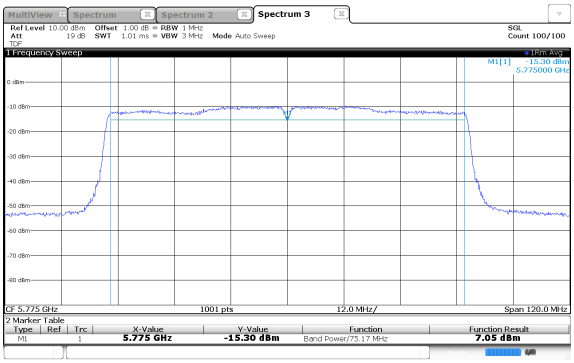
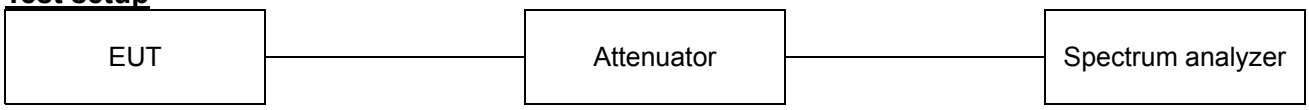
	Blank

7.2. Maximum Power Spectral Density

Test setup



Limit

According to §15.407(a),

Band	EUT category		Limit
UNII-1		Outdoor access point	17dBm /㎒
		Indoor access point	
		Fixed point-to-point access point	
	√	Client device	11 dBm /㎒
UNII-2A	√		11 dBm /㎒
UNII-2C	√		11 dBm /㎒
UNII-3	√		30 dBm /500 ㎑

Notes:

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 if the antenna exceed 6 dBi.

Test procedure

ANSI C63.10-2013 Section 12.5
KDB 789033 D02 v02r01 - Section F

Test settings

Section F

The rules requires “maximum power spectral density” measurements where the intent is to measure the maximum value of the time average of the power spectral density measured during a period of continuous transmission. Refer to III.A for additional guidance for devices that use channel aggregation.

1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in 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. Search function on the instrument to find the peak of the spectrum and record its value.
3. 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 II.E.2.g) (viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
4. The result is the Maximum PSD over 1㎒ reference bandwidth
5. For devices operating in the bands 5.15-5.25 ㎓, 5.25-5.35 ㎓, and 5.47-5.725 ㎓, the preceding procedures make use of 1 ㎒ RBW to satisfy directly the 1 ㎒ reference

bandwidth specified in Section 15.407(a)(5). For devices operating in the band 5.725-5.85 ㎓, the rules specify a measurement bandwidth of 500 ㎑. Many spectrum analyzers do not have 500 ㎑ RBW, thus a narrower RBW may need to be used. The rules permit the use of RBWs less than 1㎒, or 500 ㎑, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth(i.e., 1 ㎒, or 500 ㎑). If measurements are performed using a reduced resolution bandwidth (< 1 ㎒, or < 500 ㎑) and integrated over 1 ㎒, or 500 ㎑ bandwidth, the following adjustments to the procedures apply:

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

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

Test results

Test mode	Band	Frequency (㎒)	Measured PSD (dB m/㎒)	DCCF (dB)	Maximum PSD (dB m/㎒)	Limit (dB m/㎒)
802.11a	UNII-1	5 180	-1.14	0.30	-0.84	11
		5 200	-1.25	0.30	-0.95	
		5 240	-1.23	0.30	-0.93	
	UNII-2A	5 260	-0.87	0.30	-0.57	11
		5 280	-0.66	0.30	-0.36	
		5 320	-0.44	0.30	-0.14	
	UNII-2C	5 500	-0.75	0.30	-0.45	11
		5 580	-0.81	0.30	-0.51	
		5 720	-0.90	0.30	-0.60	
802.11n HT20	UNII-1	5 180	-1.35	0.32	-1.03	11
		5 200	-1.58	0.32	-1.26	
		5 240	-1.43	0.32	-1.11	
	UNII-2A	5 260	-0.87	0.32	-0.55	11
		5 280	-1.03	0.32	-0.71	
		5 320	-0.94	0.32	-0.62	
	UNII-2C	5 500	-0.87	0.32	-0.55	11
		5 580	-0.99	0.32	-0.67	
		5 720	-1.51	0.32	-1.19	
802.11n HT40	UNII-1	5 190	-8.75	0.62	-8.13	11
		5 230	-8.83	0.62	-8.21	
	UNII-2A	5 270	-3.96	0.62	-3.34	11
		5 310	-4.64	0.62	-4.02	
	UNII-2C	5 510	-4.79	0.62	-4.17	11
		5 550	-4.81	0.62	-4.19	
		5 710	-4.79	0.62	-4.17	

Test mode	Band	Frequency (㎒)	Measured PSD (dB m/㎒)	DCCF (dB)	Maximum PSD (dB m/㎒)	Limit (dB m/㎒)
802.11ac VHT20	UNII-1	5 180	-1.30	0.32	-0.98	11
		5 200	-1.38	0.32	-1.06	
		5 240	-1.47	0.32	-1.15	
	UNII-2A	5 260	-0.82	0.32	-0.50	11
		5 280	-0.67	0.32	-0.35	
		5 320	-0.84	0.32	-0.52	
	UNII-2C	5 500	-1.17	0.32	-0.85	11
		5 580	-1.27	0.32	-0.95	
		5 720	-1.47	0.32	-1.15	
802.11ac VHT40	UNII-1	5 190	-8.91	0.62	-8.29	11
		5 230	-9.00	0.62	-8.38	
	UNII-2A	5 270	-4.43	0.62	-3.81	11
		5 310	-4.33	0.62	-3.71	
	UNII-2C	5 510	-4.34	0.62	-3.72	11
		5 550	-4.55	0.62	-3.93	
		5 710	-4.69	0.62	-4.07	
802.11ac VHT80	UNII-1	5 210	-12.54	1.16	-11.38	11
	UNII-2A	5 290	-8.30	1.16	-7.14	11
	UNII-2C	5 530	-8.56	1.16	-7.40	11
		5 690	-8.04	1.16	-6.88	

Test mode	Band	Frequency (㎒)	Measured PSD (dBm/500 ㎑)	Duty Factor (dB)	Maximum PSD (dBm /500 ㎑)	Limit (dBm /500 ㎑)
802.11a	UNII-3	5 745	-4.09	0.30	-3.79	30
		5 785	-4.27	0.30	-3.97	
		5 825	-3.95	0.30	-3.65	
802.11n HT20		5 745	-4.20	0.32	-3.88	
		5 785	-5.00	0.32	-4.68	
		5 825	-4.35	0.32	-4.03	
802.11n HT40		5 755	-8.09	0.62	-7.47	
		5 795	-8.59	0.62	-7.97	
802.11ac VHT20		5 745	-4.47	0.32	-4.15	
		5 785	-5.12	0.32	-4.80	
		5 825	-4.91	0.32	-4.59	
802.11ac VHT40		5 755	-8.29	0.62	-7.67	
		5 795	-8.42	0.62	-7.81	
802.11ac VHT80		5 775	-11.69	1.16	-10.53	

Notes:

1. Maximum PSD calculation

   Maximum PSD = Measured PSD(dB m) + DCCF (dB)

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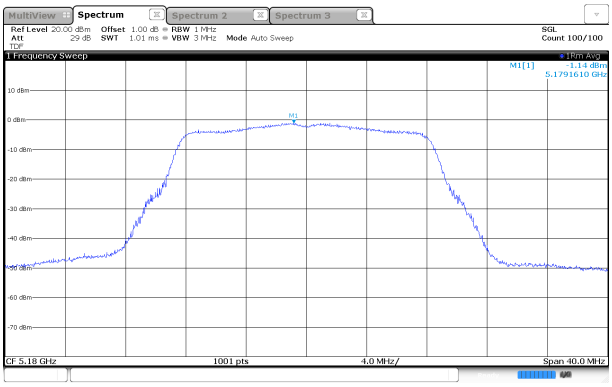	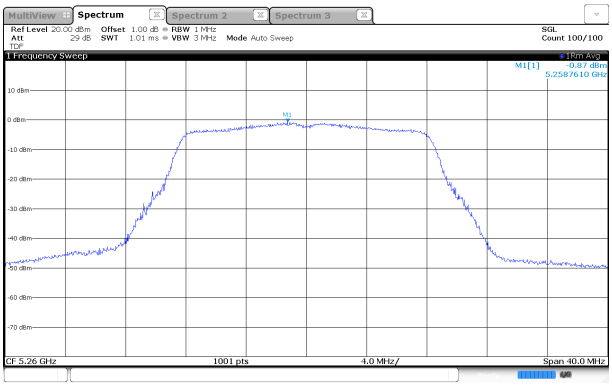
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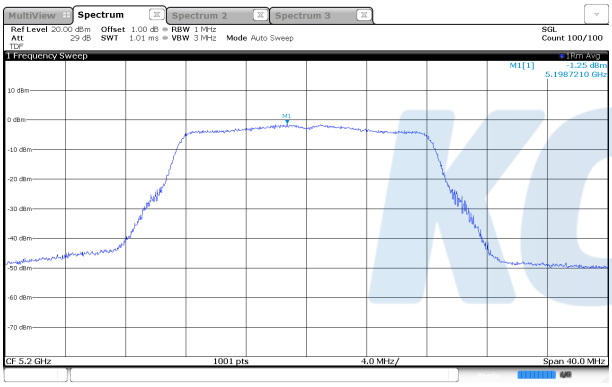	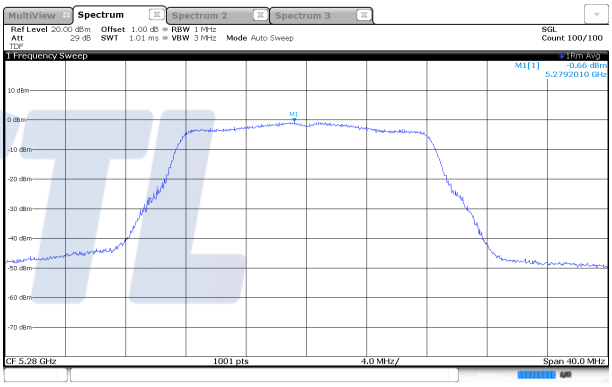
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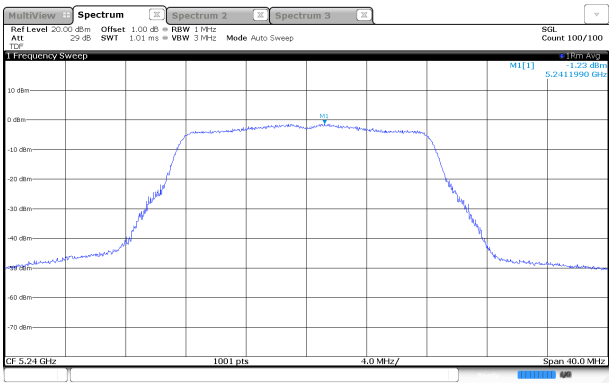	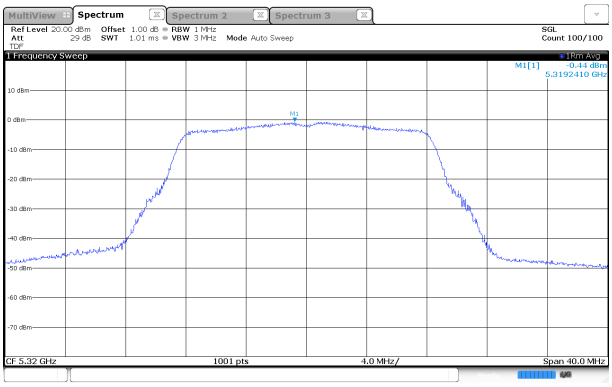

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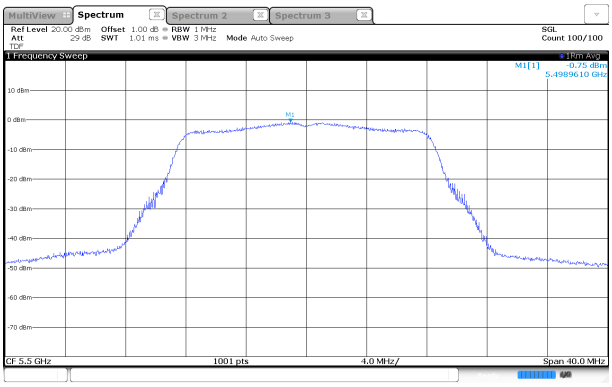	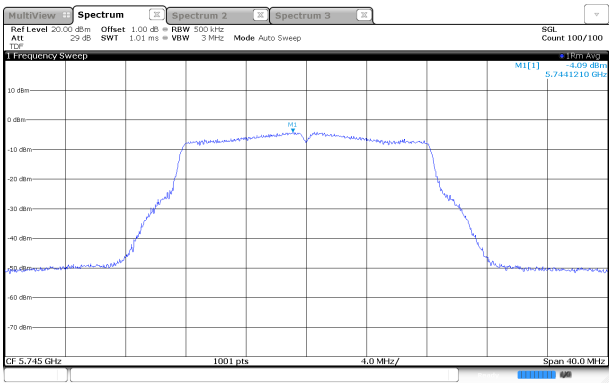
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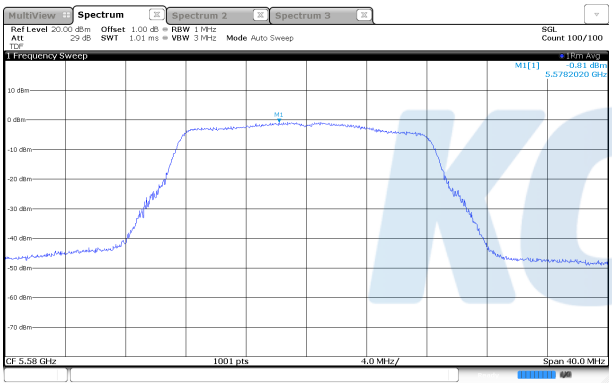	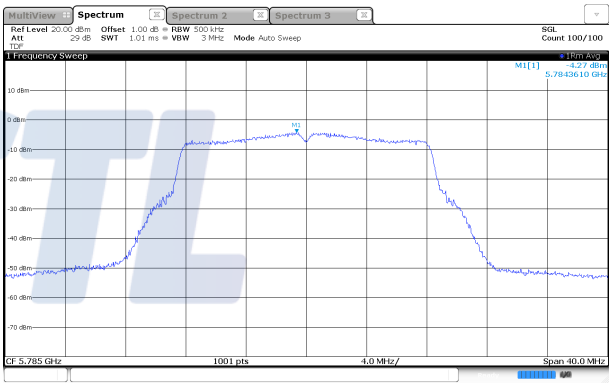
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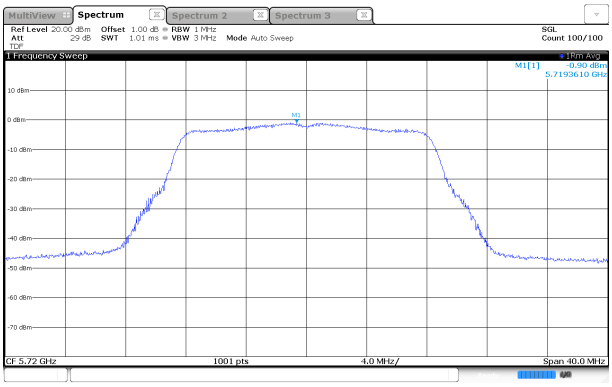	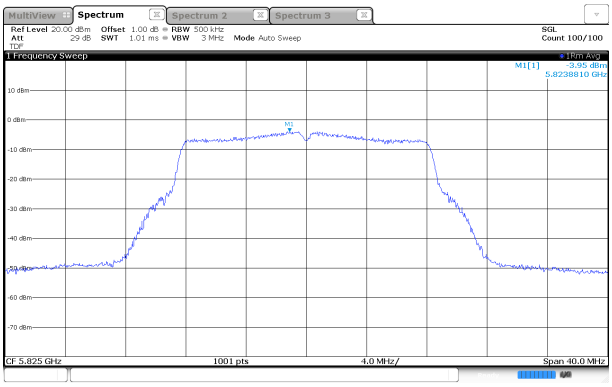

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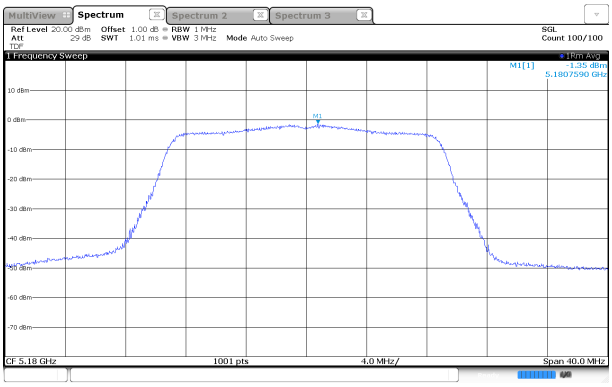	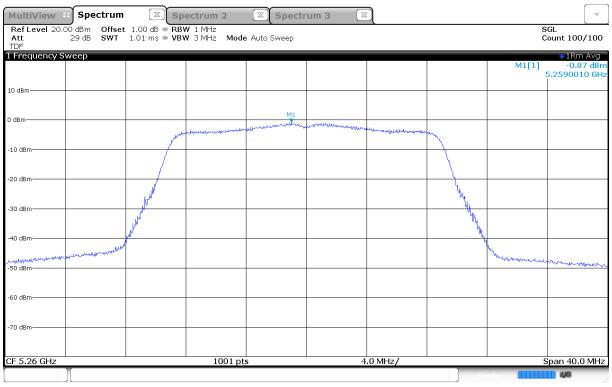
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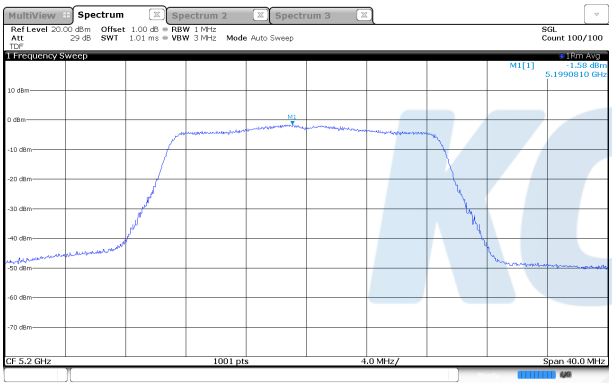	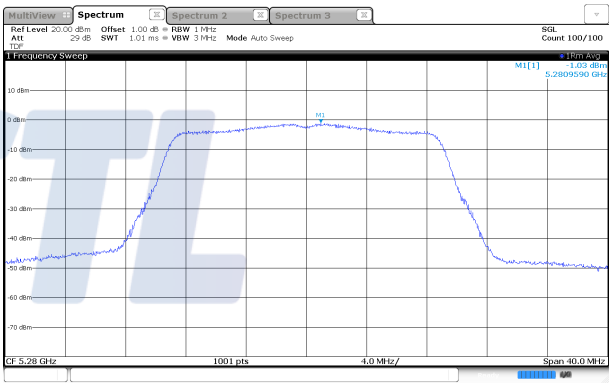
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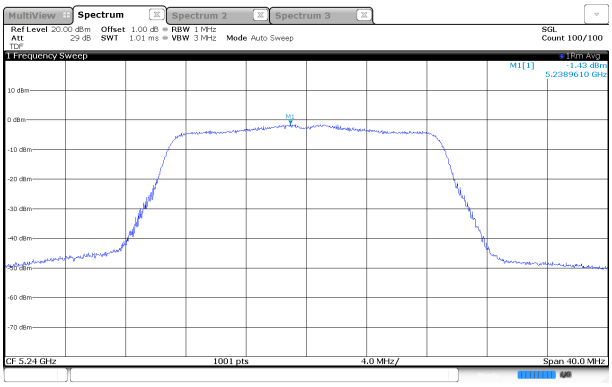	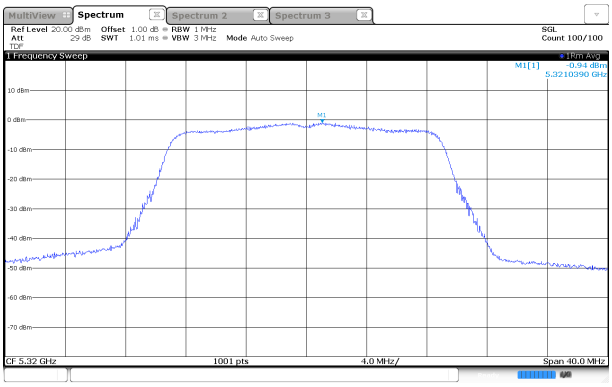

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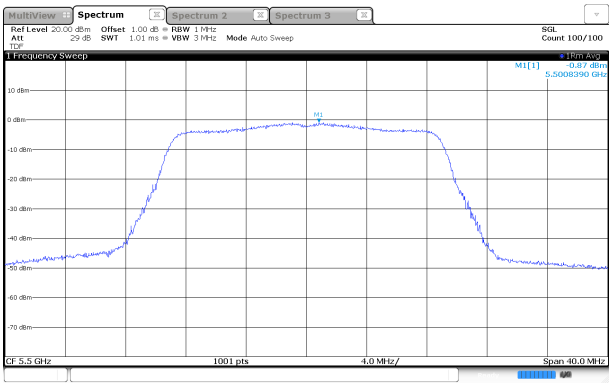	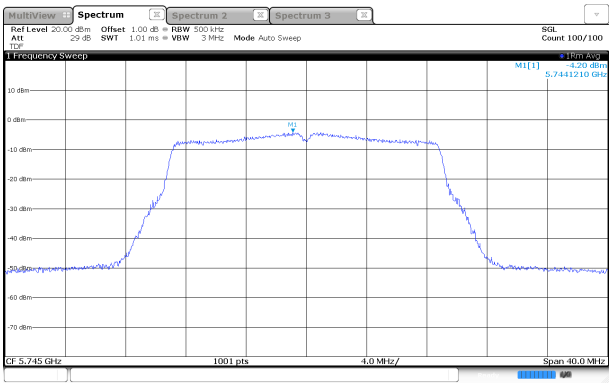
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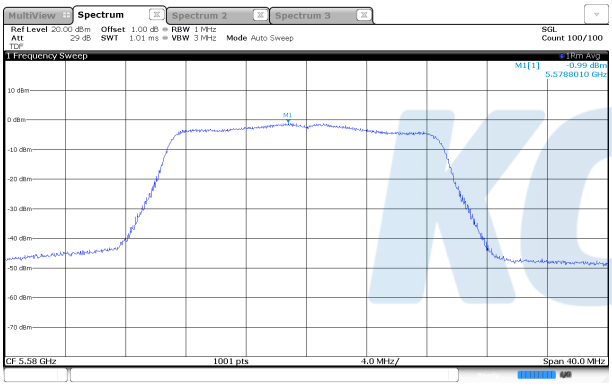	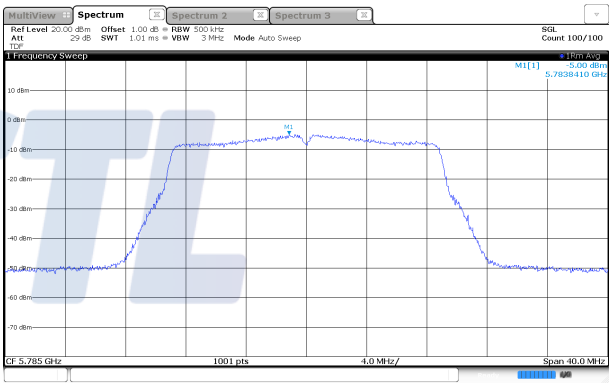
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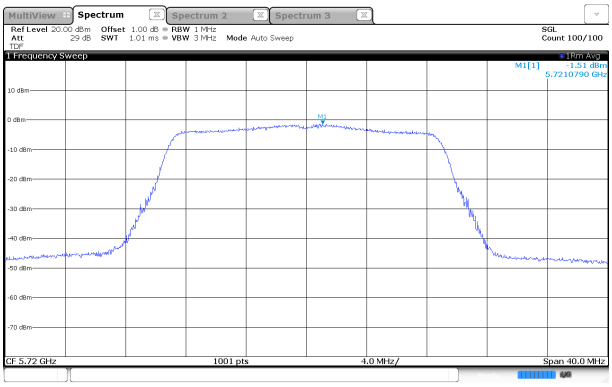	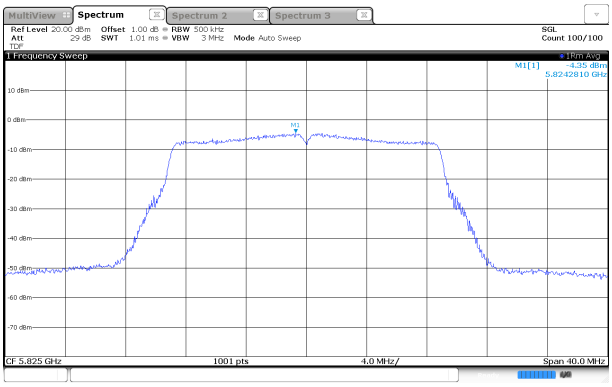

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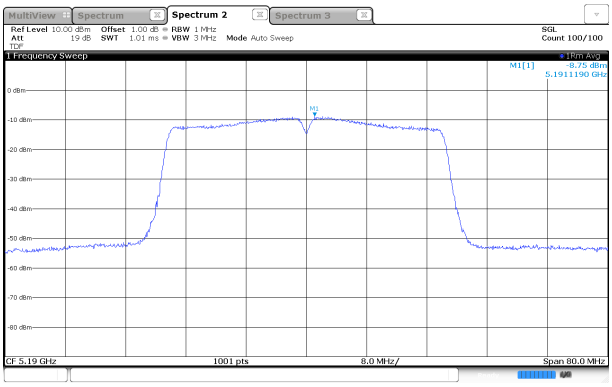	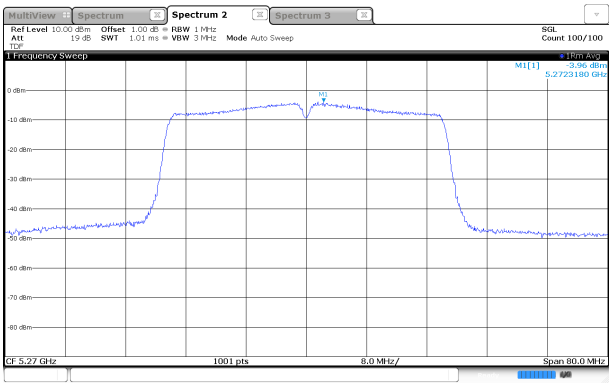
UNII-1 / 802.11n HT40 / High ch.	**UNII-2A / 802.11n HT40 / High ch.**