Test Mode: TX / EEE 802.11n HT20 MHz (CH High) **Tested by:** Saber Huang

Ambient temperature: 24°C **Relative humidity:** 52% RH **Date:** February 24, 2017

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1999.000	49.88	-5.01	44.87	74.00	-29.13	V	Peak
2458.000	48.04	-2.49	45.55	74.00	-28.45	V	Peak
4249.000	41.62	2.47	44.09	74.00	-29.91	V	Peak
4915.000	54.50	4.70	59.20	74.00	-14.80	V	Peak
4915.000	36.53	4.70	41.23	54.00	-12.77	V	AVG
6094.000	40.87	6.23	47.10	74.00	-26.90	V	Peak
7390.000	44.94	8.46	53.40	74.00	-20.60	V	Peak
1765.000	51.76	-6.35	45.41	74.00	-28.59	H	Peak
2215.000	48.36	-3.82	44.54	74.00	-29.46	H	Peak
2467.000	47.74	-2.44	45.30	74.00	-28.70	H	Peak
3340.000	43.34	-0.79	42.55	74.00	-31.45	H	Peak
4429.000	41.38	3.10	44.48	74.00	-29.52	H	Peak
4924.000	46.09	4.73	50.82	74.00	-23.18	H	Peak

REMARKS:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

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Combine with Antenna 0 and Antenna 1

Test Mode: TX/ IEEE 802.11n HT40 MHz (CH Low) **Tested by:** Saber Huang

Ambient temperature: 24°C **Relative humidity:** 52% RH **Date:** February 24, 2017

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1999.000	49.67	-5.01	44.66	74.00	-29.34	V	Peak
2422.000	47.16	-2.69	44.47	74.00	-29.53	V	Peak
3484.000	44.07	-0.55	43.52	74.00	-30.48	V	Peak
4051.000	42.14	1.77	43.91	74.00	-30.09	V	Peak
4843.000	50.58	4.47	55.05	74.00	-18.95	V	Peak
4843.000	38.65	4.47	43.12	54.00	-10.88	V	AVG
5635.000	41.14	5.93	47.07	74.00	-26.93	V	Peak
2197.000	48.25	-3.92	44.33	74.00	-29.67	H	Peak
2791.000	45.57	-1.74	43.83	74.00	-30.17	H	Peak
3619.000	42.92	-0.02	42.90	74.00	-31.10	H	Peak
4249.000	41.66	2.47	44.13	74.00	-29.87	H	Peak
4843.000	45.33	4.47	49.80	74.00	-24.20	H	Peak
5401.000	41.74	5.69	47.43	74.00	-26.57	H	Peak

REMARKS:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

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Test Mode: TX / IEEE 802.11n HT40 MHz (CH Mid) **Tested by:** Saber Huang

Ambient temperature: 24°C **Relative humidity:** 52% RH **Date:** February 24, 2017

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1990.000	48.91	-5.06	43.85	74.00	-30.15	V	Peak
2521.000	46.41	-2.22	44.19	74.00	-29.81	V	Peak
3484.000	44.76	-0.55	44.21	74.00	-29.79	V	Peak
4402.000	42.49	3.01	45.50	74.00	-28.50	V	Peak
4870.000	50.42	4.56	54.98	74.00	-19.02	V	Peak
4870.000	44.76	4.56	49.32	54.00	-4.68	V	AVG
5995.000	40.76	6.08	46.84	74.00	-27.16	V	Peak
2080.000	46.17	-4.56	41.61	74.00	-32.39	H	Peak
2449.000	46.09	-2.54	43.55	74.00	-30.45	H	Peak
3349.000	44.25	-0.77	43.48	74.00	-30.52	H	Peak
3853.000	42.67	0.97	43.64	74.00	-30.36	H	Peak
4258.000	41.81	2.50	44.31	74.00	-29.69	H	Peak
4879.000	44.94	4.59	49.53	74.00	-24.47	H	Peak

REMARKS:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

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Test Mode: TX/ IEEE 802.11n HT40 MHz (CH High) **Tested by:** Saber Huang

Ambient temperature: 24°C **Relative humidity:** 52% RH **Date:** February 24, 2017

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1756.000	54.76	-6.36	48.40	74.00	-25.60	V	Peak
2458.000	49.51	-2.49	47.02	74.00	-26.98	V	Peak
2818.000	45.98	-1.69	44.29	74.00	-29.71	V	Peak
3484.000	45.37	-0.55	44.82	74.00	-29.18	V	Peak
4366.000	43.43	2.88	46.31	74.00	-27.69	V	Peak
4906.000	49.17	4.67	53.84	74.00	-20.16	V	Peak
4906.000	45.16	4.67	49.83	54.00	-4.17	V	AVG
1999.000	53.39	-5.01	48.38	74.00	-25.62	H	Peak
2458.000	49.19	-2.49	46.70	74.00	-27.30	H	Peak
4888.000	44.28	4.61	48.89	74.00	-25.11	H	Peak
1162.000	52.58	-7.94	44.64	74.00	-29.36	H	Peak
3214.000	43.24	-1.00	42.24	74.00	-31.76	H	Peak
3772.000	43.09	0.63	43.72	74.00	-30.28	H	Peak

REMARKS:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

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7.3. 6dB BANDWIDTH MEASUREMENT

7.3.1. LIMITS

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz. The minimum 6 dB bandwidth shall be at least 500 kHz.

7.3.2. TEST INSTRUMENTS

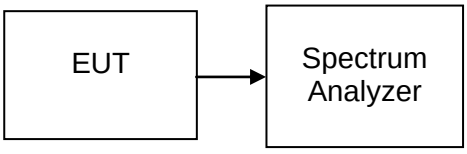
Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Calibration Due
Spectrum Analyzer	Agilent	N9010A	MY52221469	02/21/2017	02/20/2018

7.3.3. TEST PROCEDURES (please refer to measurement standard)

8.2 Option 2:

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ⩾ 3 RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ⩾ 6 dB.

7.3.4. TEST SETUP



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7.3.5. TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b

Channel	Frequency (MHz)	Bandwidth (MHz)		Limit (kHz)	Test Result
		Antenna 0	Antenna 1		
Low	2412	7.048	7.033	>500	PASS
Mid	2437	7.049	6.577		
High	2462	7.057	7.061		

Test mode: IEEE 802.11g

Channel	Frequency (MHz)	Bandwidth (MHz)		Limit (kHz)	Test Result
		Antenna 0	Antenna 1		
Low	2412	15.120	15.320	>500	PASS
Mid	2437	15.110	15.130		
High	2462	15.120	15.110		

Test mode: IEEE 802.11n HT20 MHz

Channel	Frequency (MHz)	Bandwidth (MHz)		Limit (kHz)	Test Result
		Antenna 0	Antenna 1		
Low	2412	15.130	15.120	>500	PASS
Mid	2437	15.120	15.450		
High	2462	15.130	15.120		

Test mode: IEEE 802.11n HT40 MHz

Channel	Frequency (MHz)	Bandwidth (MHz)		Limit (kHz)	Test Result
		Antenna 0	Antenna 1		
Low	2422	33.820	33.820	>500	PASS
Mid	2437	33.810	33.810		
High	2452	33.800	33.810		

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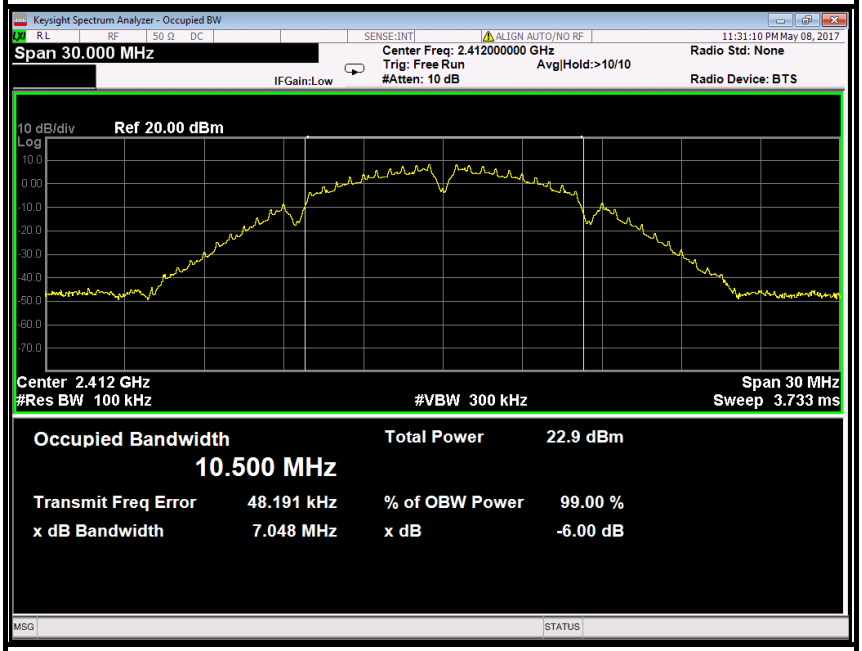
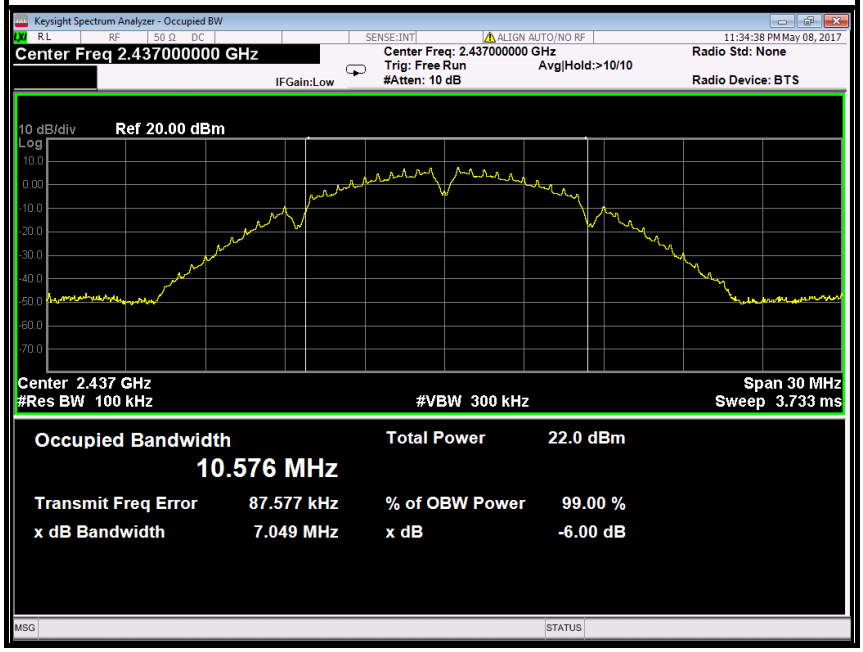
Test Plot

IEEE 802.11b mode (Antenna 0)

6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)



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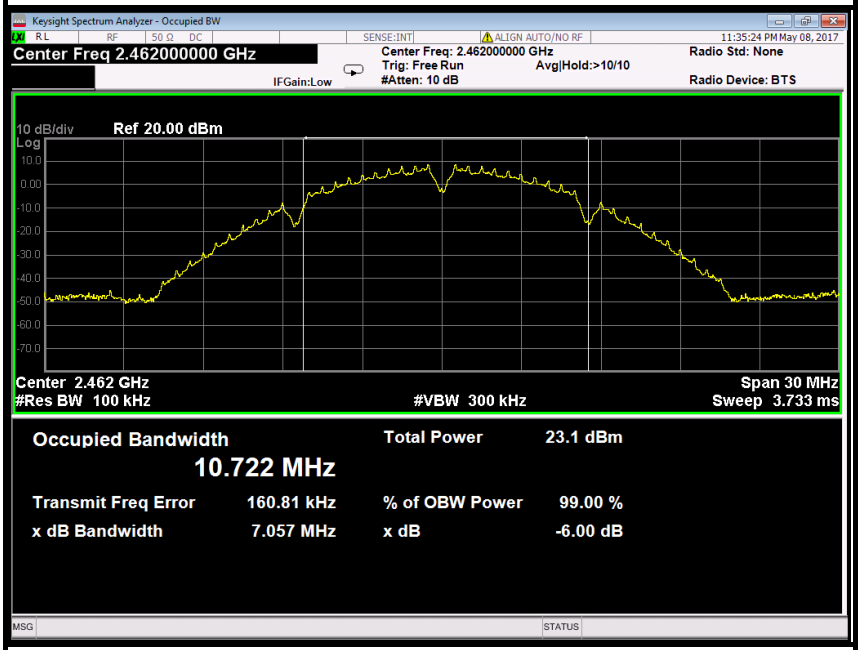
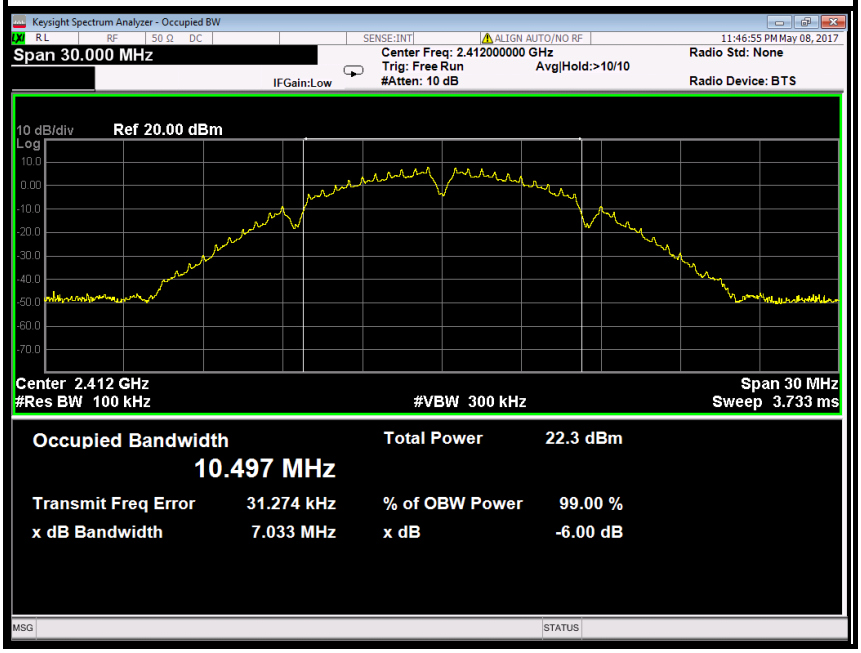
6dB Bandwidth (CH High)



IEEE 802.11b mode (Antenna 1)

6dB Bandwidth (CH Low)



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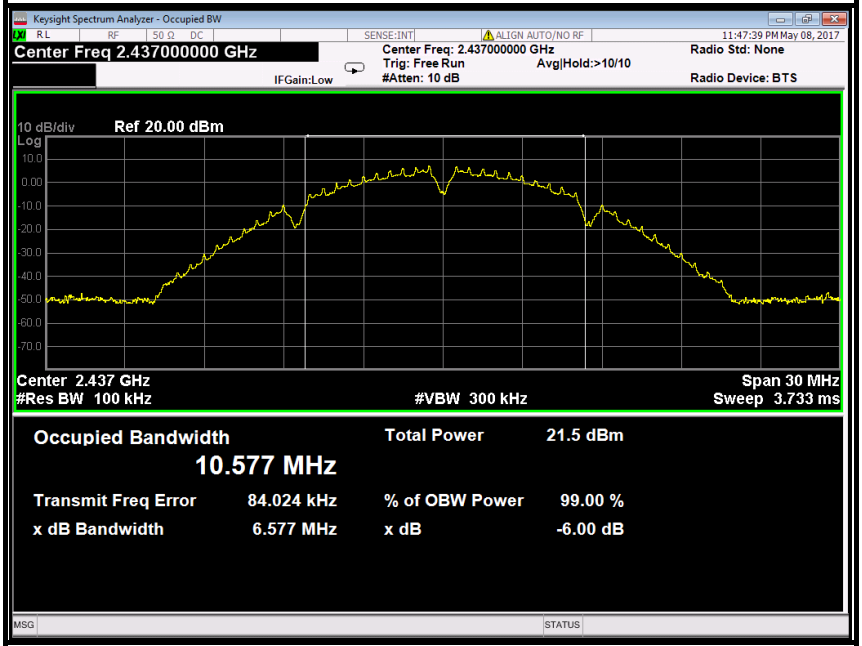
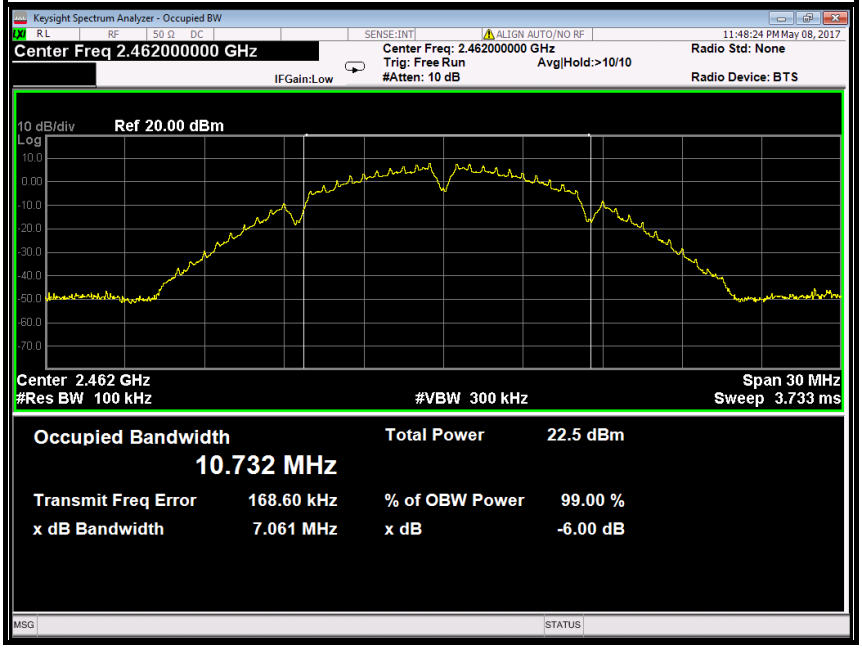
6dB Bandwidth (CH Mid)



6dB Bandwidth (CH High)



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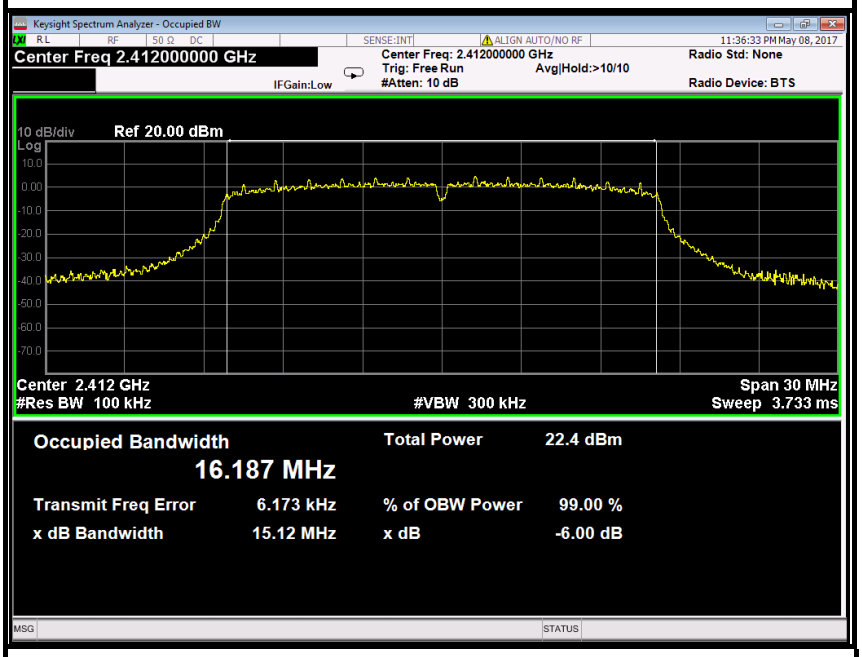
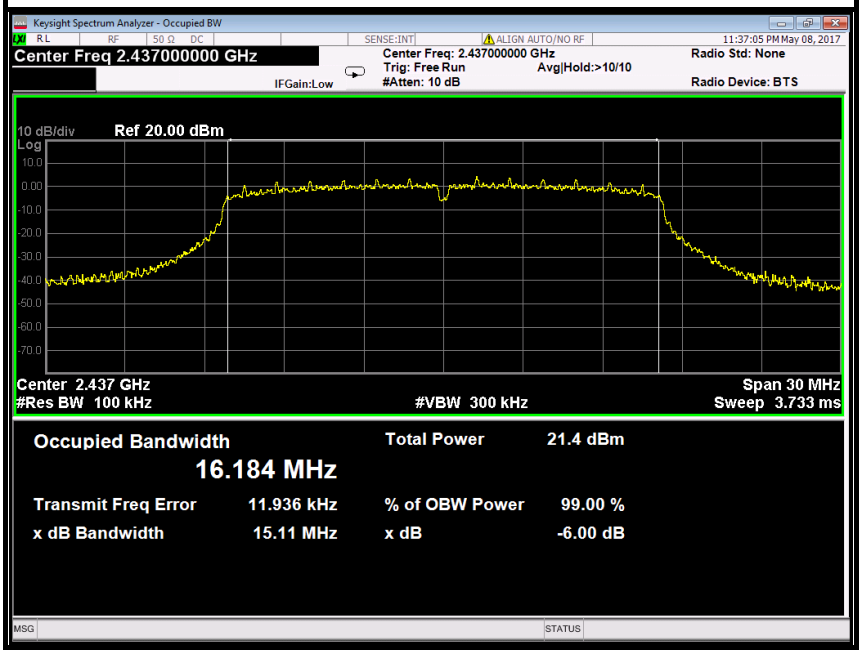
IEEE 802.11g mode (Antenna 0)

6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)



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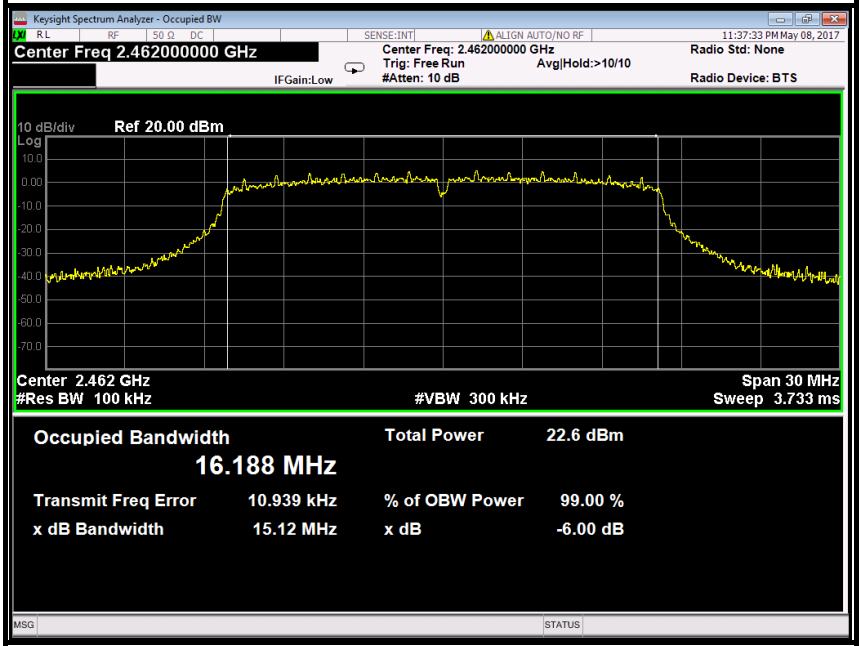
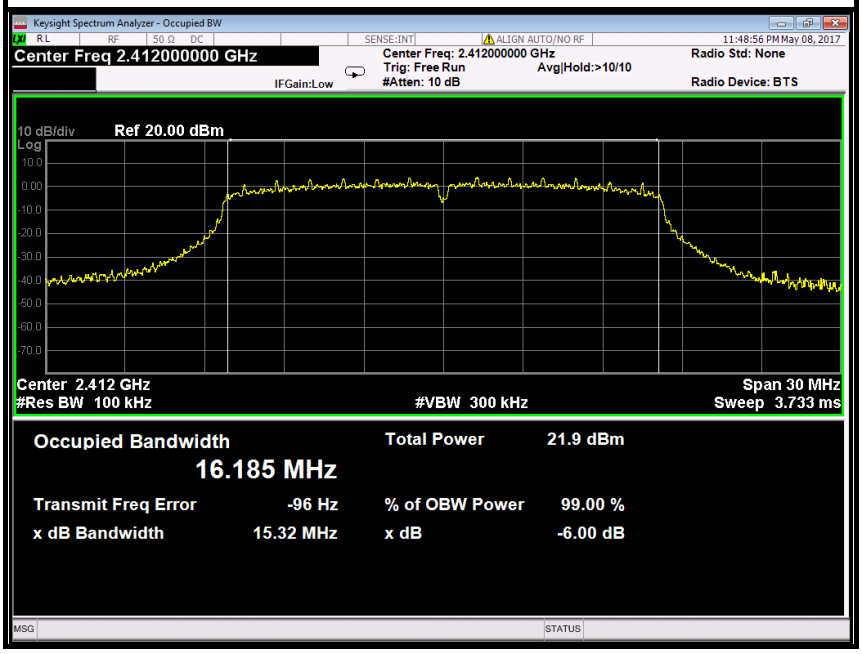
6dB Bandwidth (CH High)



IEEE 802.11g mode (Antenna 1)

6dB Bandwidth (CH Low)



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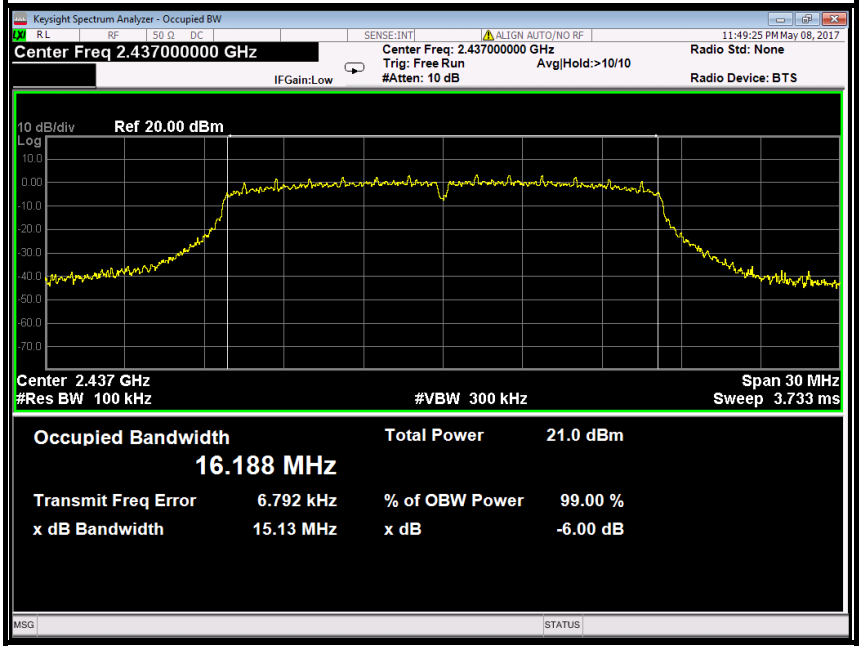
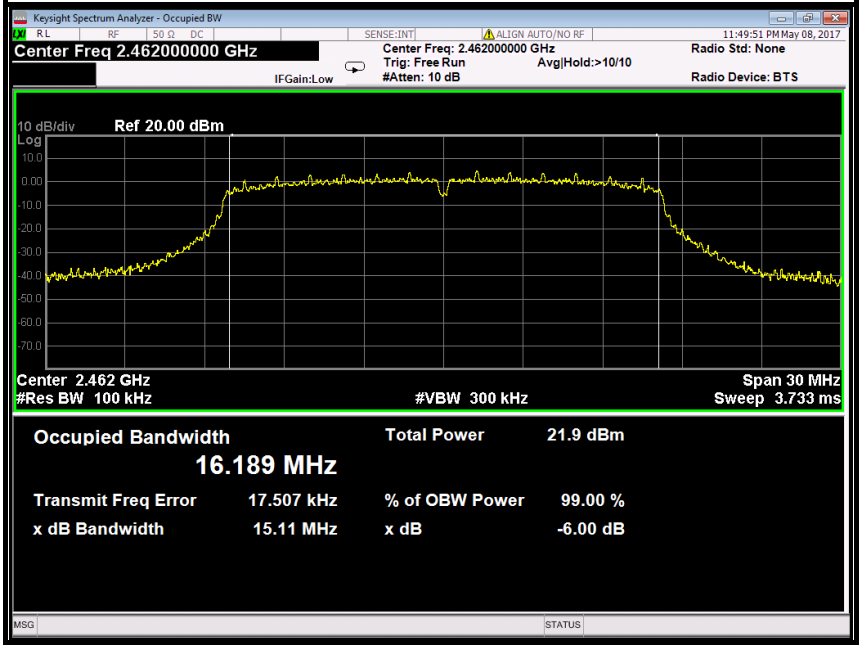
6dB Bandwidth (CH Mid)



6dB Bandwidth (CH High



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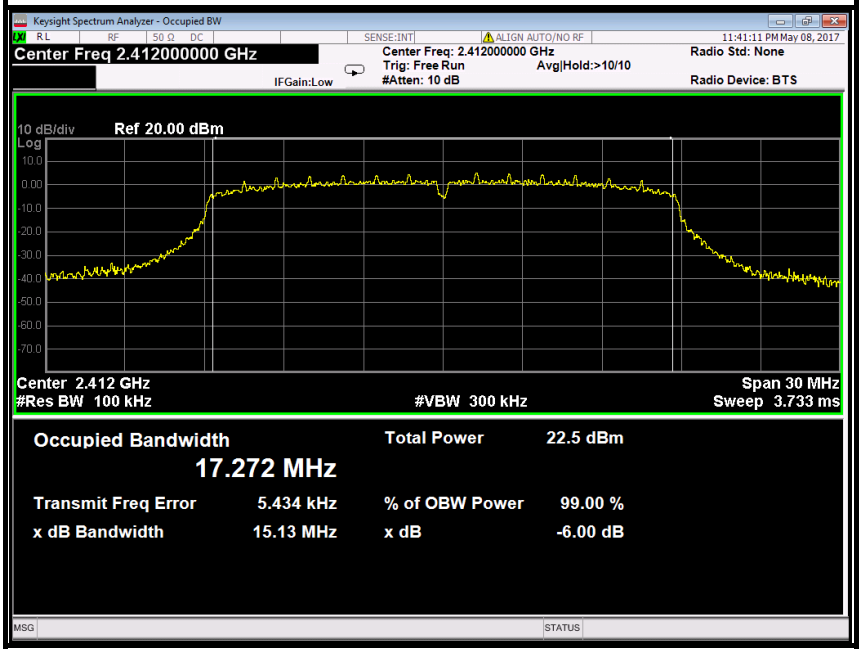
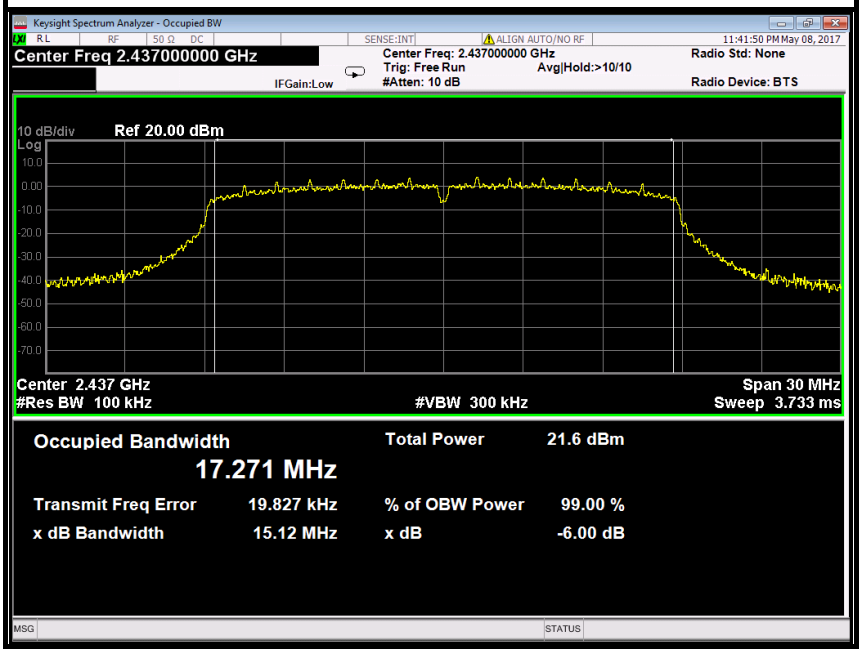
IEEE 802.11n HT20 MHz mode (Antenna 0)

6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)



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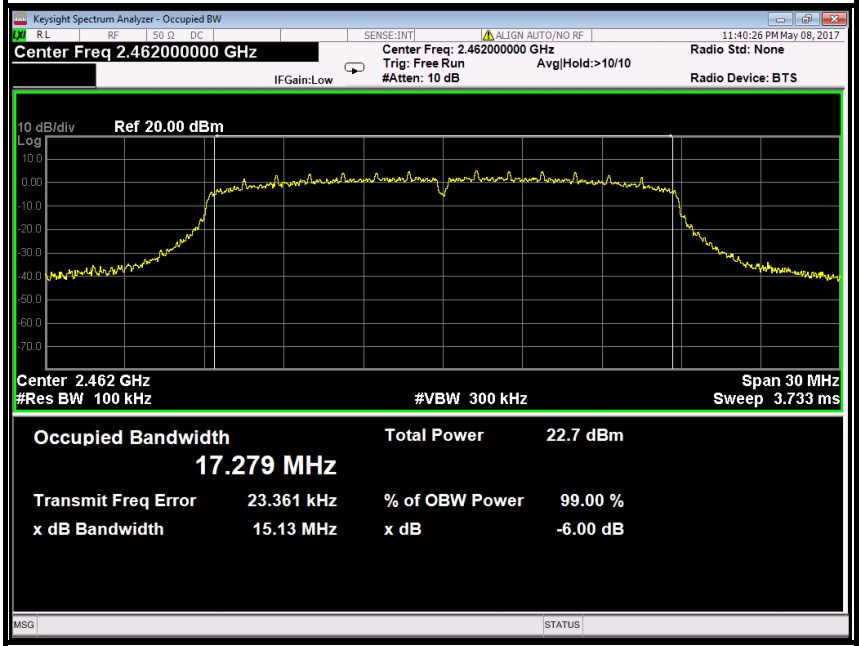
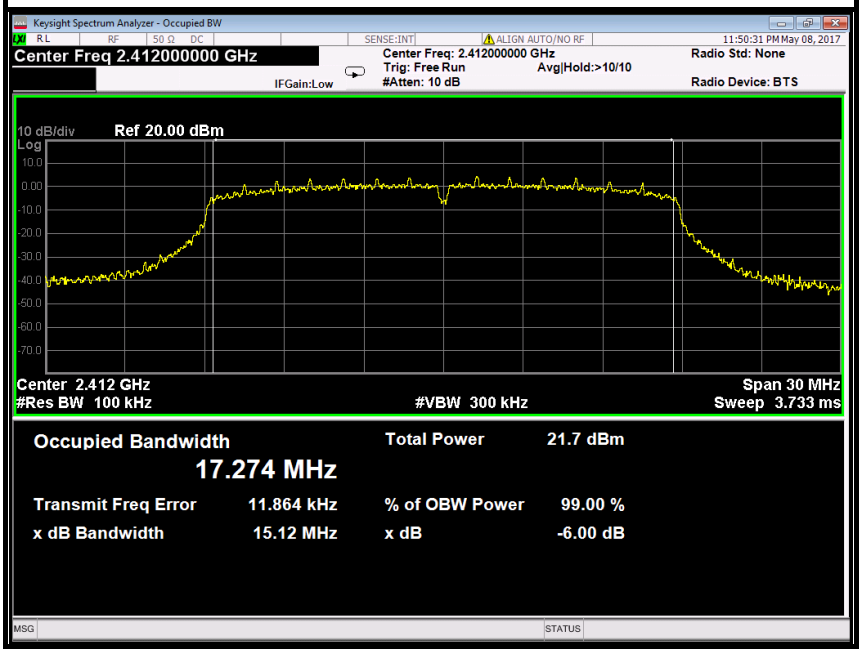
6dB Bandwidth (CH High)



IEEE 802.11n HT20 MHz mode (Antenna 1)

6dB Bandwidth (CH Low)



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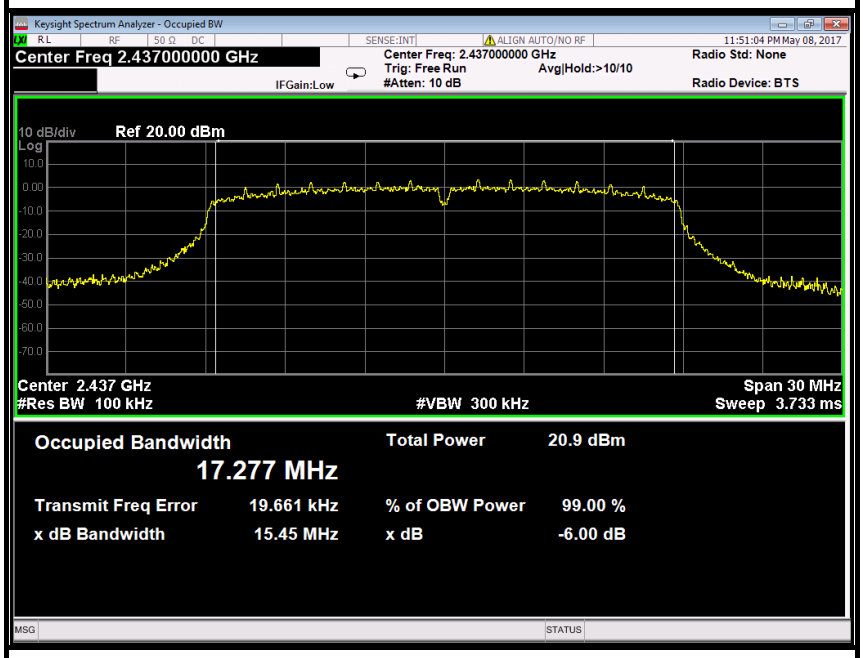
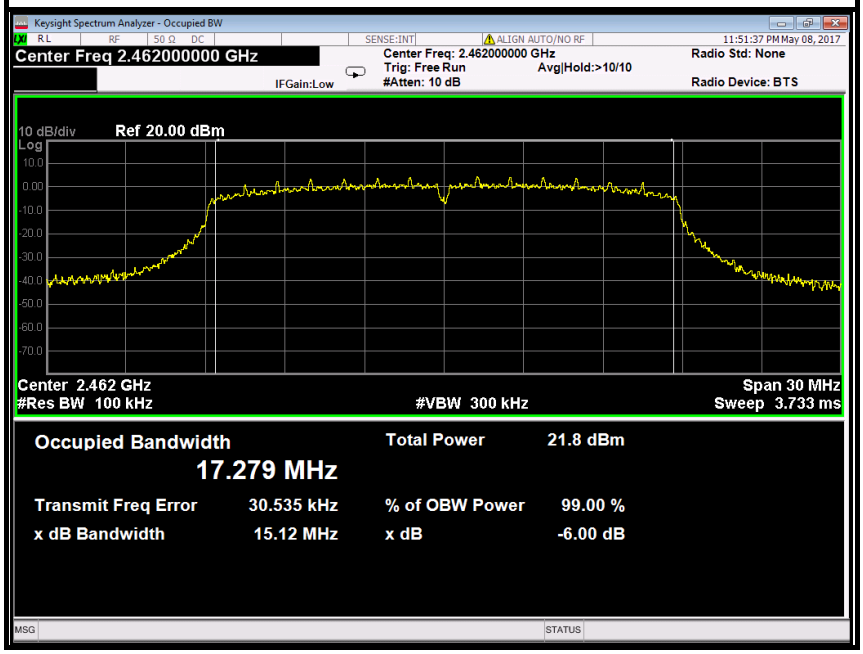
6dB Bandwidth (CH Mid)



6dB Bandwidth (CH High)



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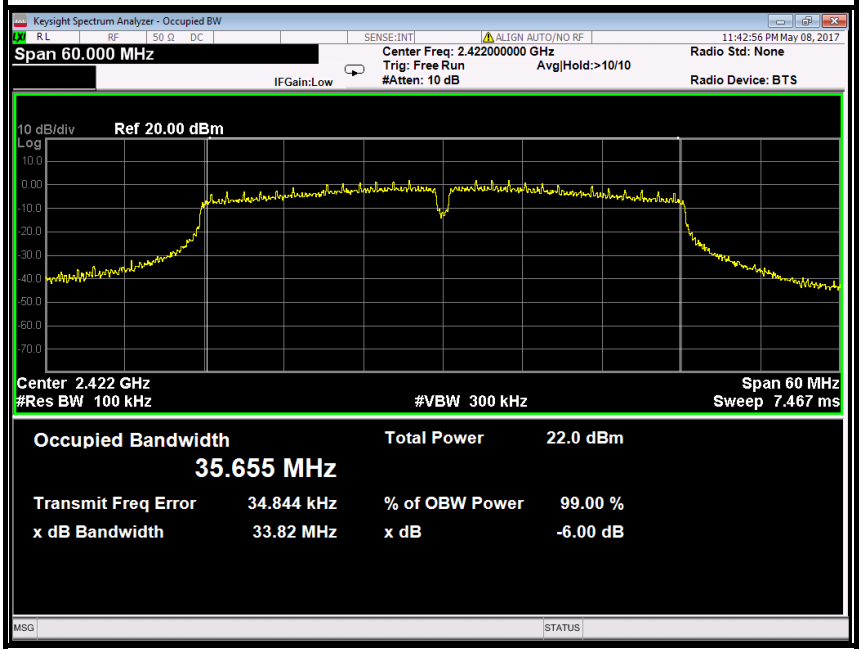
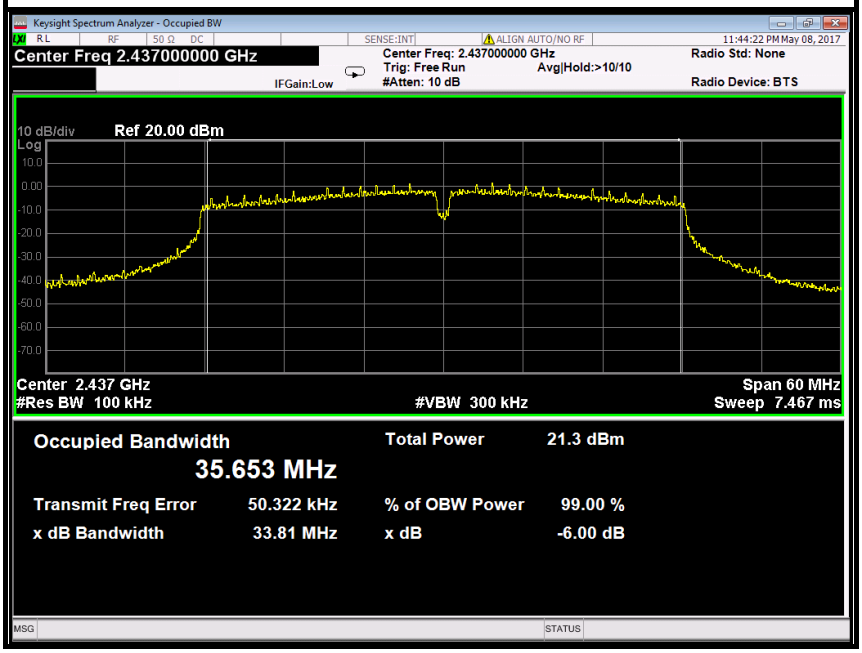
IEEE 802.11n HT40 MHz mode (Antenna 0)

6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)



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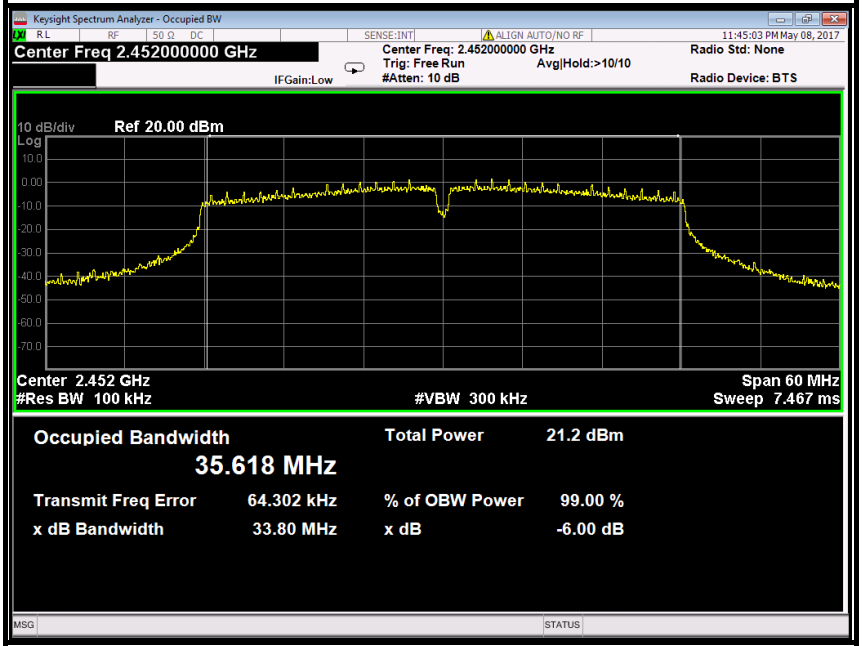
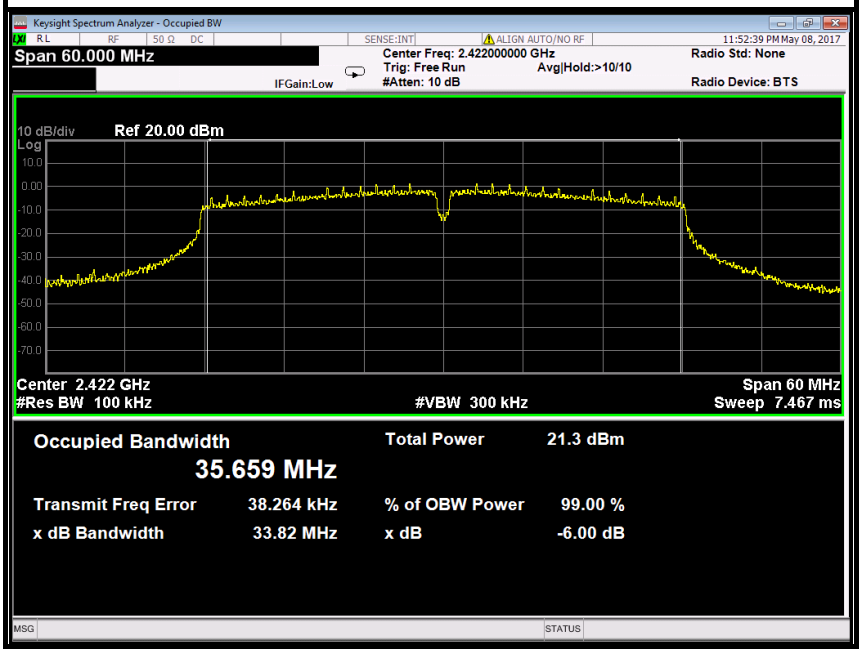
6dB Bandwidth (CH High)



IEEE 802.11n HT40 MHz mode (Antenna 1)

6dB Bandwidth (CH Low)



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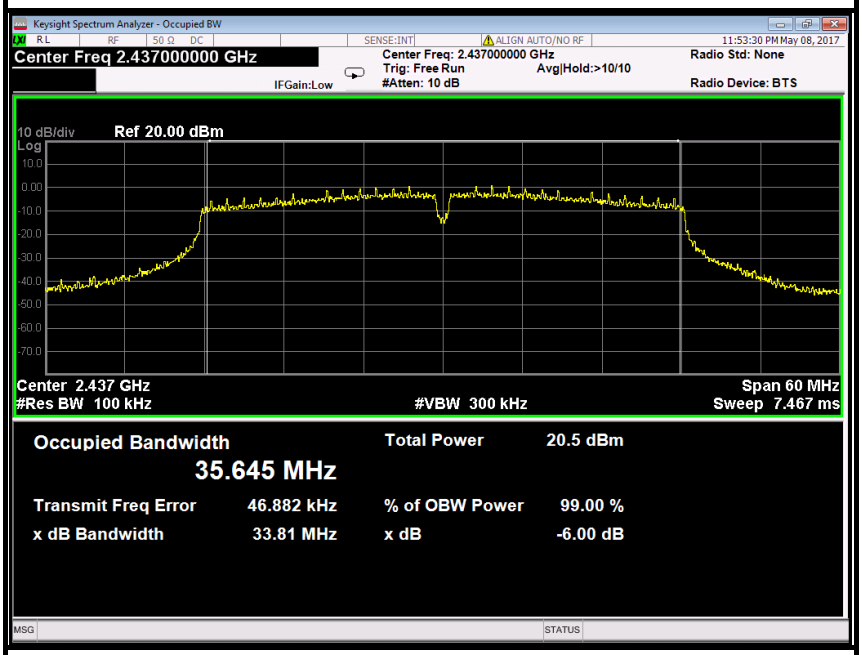
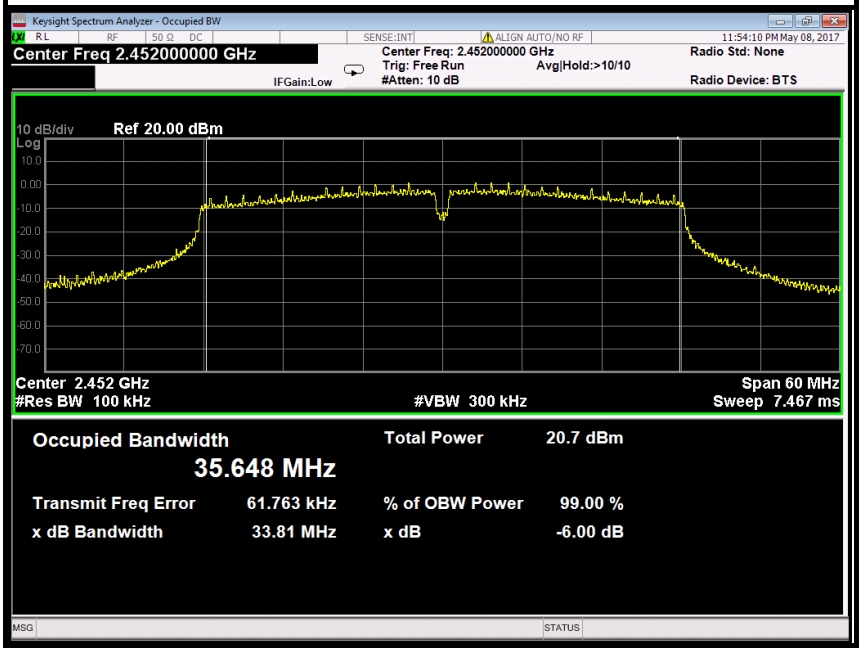
6dB Bandwidth (CH Mid)



6dB Bandwidth (CH High)



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7.4. ANTENNA GAIN

MEASUREMENT

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For normal WLAN devices, the DSSS mode is used.

MEASUREMENT PARAMETERS

Measurement parameter	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	3 MHz
Video bandwidth	3 MHz
Trace-Mode	Max hold

LIMITS

FCC	IC
Antenna Gain	
6 dBi	

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TEST RESULTS

IEEE 802.11b mode (Antenna 0)

T_{nom}	V_{nom}	Lowest channel 2412MHz	Middle channel 2437MHz	Highest channel 2462MHz
Conducted power [dBm/MHz] Measured with DSSS modulation		9.65	8.88	8.71
Radiated power [dBm/MHz] Measured with DSSS modulation		13.81	13.05	12.87
Gain [dBi] Calculated		4.16	4.17	4.16
Measurement uncertainty		± 1.5 dB (cond.) / ± 3 dB (rad.)		

IEEE 802.11b mode (Antenna 1)

T_{nom}	V_{nom}	Lowest channel 2412MHz	Middle channel 2437MHz	Highest channel 2462MHz
Conducted power [dBm/MHz] Measured with DSSS modulation		8.49	8.39	8.41
Radiated power [dBm/MHz] Measured with DSSS modulation		12.65	12.37	12.86
Gain [dBi] Calculated		4.16	3.98	4.45
Measurement uncertainty		± 1.5 dB (cond.) / ± 3 dB (rad.)		

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7.5. PEAK OUTPUT POWER

7.5.1. LIMITS

The maximum peak output power of the intentional radiator shall not exceed the following:

1. According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
2. According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

7.5.2. TEST INSTRUMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Calibration Due
Power Meter	Anritsu	ML2495A	1204003	02/21/2017	02/20/2018
Power Sensor	Anritsu	MA2411B	1126150	02/21/2017	02/20/2018

7.5.3. TEST PROCEDURES (please refer to measurement standard)

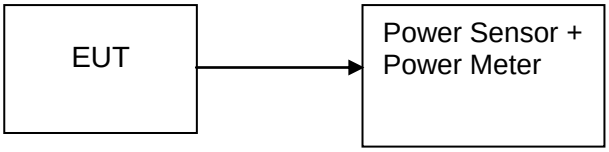
9.1.1 RBW ≥ *DTS bandwidth*

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the *DTS bandwidth*.
a) Set the RBW ≥ *DTS bandwidth*.
b) Set VBW ≥ 3 RBW.
c) Set span ≥ 3 x RBW
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

9.1.3 PKPM1 Peak power meter method

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

7.5.4. TEST SETUP



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7.5.5. TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b (Antenna 0)

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Peak / AVG	Limit (dBm)	Result
Low	2412	20.40	0.10965	Peak	28	PASS
Mid	2437	19.60	0.09120			PASS
High	2462	19.40	0.08710			PASS
Low	2412	17.50	0.05623	AVG	28	PASS
Mid	2437	16.70	0.04677			PASS
High	2462	16.50	0.04467			PASS

Test mode: IEEE 802.11b (Antenna 1)

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Peak / AVG	Limit (dBm)	Result
Low	2412	19.20	0.08318	Peak	28	PASS
Mid	2437	19.10	0.08128			PASS
High	2462	19.10	0.08128			PASS
Low	2412	16.30	0.04266	AVG	28	PASS
Mid	2437	16.20	0.04169			PASS
High	2462	16.20	0.04169			PASS

Test mode: IEEE 802.11g (Antenna 0)

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Peak / AVG	Limit (dBm)	Result
Low	2412	25.40	0.34674	Peak	28	PASS
Mid	2437	25.70	0.37154			PASS
High	2462	25.10	0.32359			PASS
Low	2412	16.40	0.04365	AVG	28	PASS
Mid	2437	16.70	0.04677			PASS
High	2462	16.40	0.04365			PASS

Remark: Limit=30–(Gain-6)

The beamforming gain=10log(N)=3, Antenna Gain=5+3

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Test mode: IEEE 802.11g (Antenna 1)

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Peak / AVG	Limit (dBm)	Result
Low	2412	25.00	0.31623	Peak	28	PASS
Mid	2437	23.90	0.24547			PASS
High	2462	24.30	0.26915			PASS
Low	2412	15.90	0.03890	AVG	28	PASS
Mid	2437	15.10	0.03236			PASS
High	2462	15.30	0.03388			PASS

Test mode: IEEE 802.11n HT20 MHz(Combine with Antenna 0 and Antenna 1)

Channel	Frequency (MHz)	Output Power (dBm)			Output Power (W)	Peak / AVG	Limit (dBm)	Result
		Antenna 0	Antenna 1	Total				
Low	2412	25.40	24.60	28.03	0.63514	Peak	28	PASS
Mid	2437	25.40	24.20	27.85	0.60976			PASS
High	2462	24.80	24.20	27.52	0.56502			PASS
Low	2412	16.60	16.10	19.37	0.08645	AVG	28	PASS
Mid	2437	16.80	15.40	19.17	0.08254			PASS
High	2462	16.50	15.40	19.00	0.07934			PASS

Test mode: IEEE 802.11n HT40 MHz(Combine with Antenna 0 and Antenna 1)

Channel	Frequency (MHz)	Output Power (dBm)			Output Power (W)	Peak / AVG	Limit (dBm)	Result
		Antenna 0	Antenna 1	Total				
Low	2422	24.10	22.80	26.51	0.44759	Peak	28	PASS
Mid	2437	23.90	22.50	26.27	0.42330			PASS
High	2452	23.70	22.80	26.28	0.42497			PASS
Low	2422	16.50	15.40	19.00	0.07934	AVG	28	PASS
Mid	2437	16.40	14.80	18.68	0.07385			PASS
High	2452	16.40	15.10	18.81	0.07601			PASS

Remark: Limit=30–(Gain-6)

The beamforming gain=10log(N)=3, Antenna Gain=5+3

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7.6. BAND EDGES MEASUREMENT

7.6.1. LIMITS

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

7.6.2. TEST INSTRUMENTS

Radiated Emission Test Site 966(2)					
Name of Equipment	**Manufacturer**	**Model Number**	**Serial Number**	**Last Calibration**	**Due Calibration**
PSA Series Spectrum Analyzer	Agilent	N9010A	MY55370330	02/21/2017	02/20/2018
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100783	02/21/2017	02/20/2018
Amplifier	EMEC	EM330	060661	03/18/2017	03/17/2018
High Noise Amplifier	Agilent	8449B	3008A01838	02/21/2017	02/20/2018
Loop Antenna	COM-POWER	AL-130	121044	09/25/2016	09/24/2017
Bilog Antenna	SCHAFFNER	CBL6143	5082	02/21/2017	02/20/2018
Horn Antenna	SCHWARZBECK	BBHA9120	D286	02/28/2017	02/27/2018
Board-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170-497	02/28/2017	02/27/2018
Turn Table	N/A	N/A	N/A	N.C.R	N.C.R
Antenna Tower	SUNOL	TLT2	N/A	N.C.R	N.C.R
Controller	Sunol Sciences	SC104V	022310-1	N.C.R	N.C.R
Controller	CT	N/A	N/A	N.C.R	N.C.R
Temp. / Humidity Meter	Anymetre	JR913	N/A	02/21/2017	02/20/2018
Test S/W	FARAD	LZ-RF / CCS-SZ-3A2			

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The FCC Site Registration number is 101879.

3. N.C.R = No Calibration Required.

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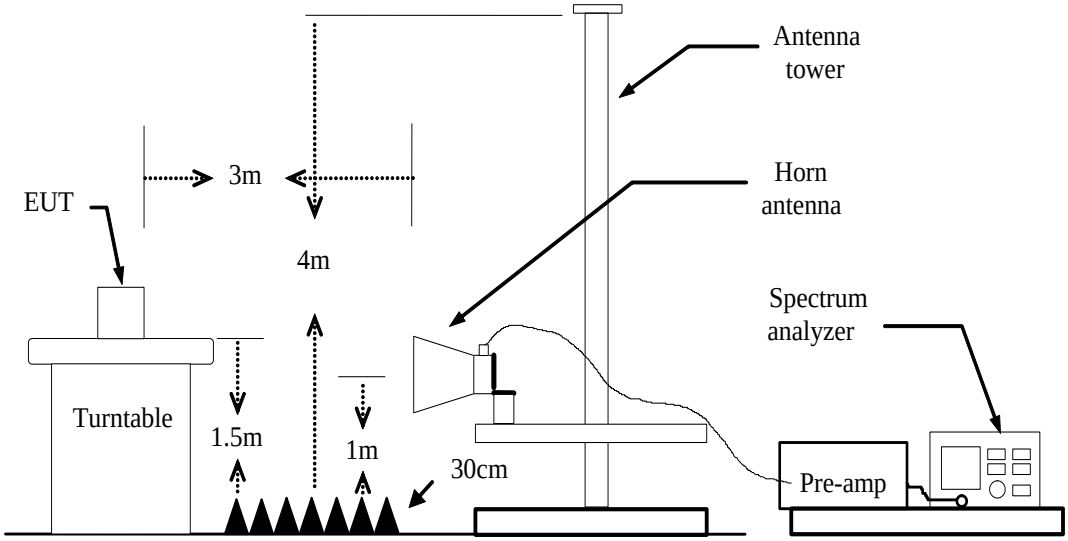
7.6.3. TEST PROCEDURES (please refer to measurement standard)

1. The EUT is placed on a turntable, which is 1.5m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
   (a) PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO
   (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO / Detector=PEAK
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

7.6.4. TEST SETUP



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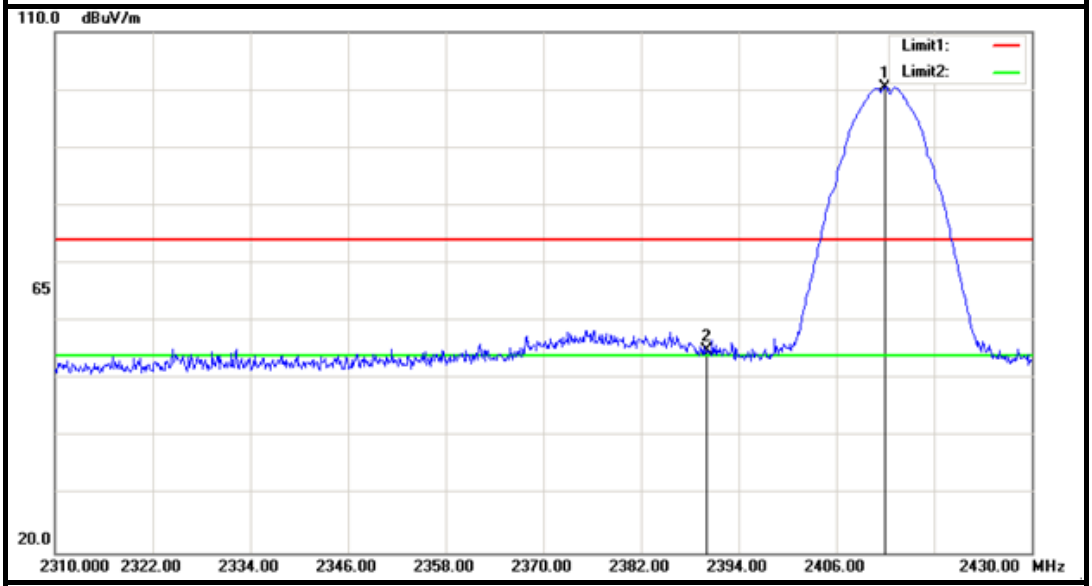
7.6.5. TEST RESULTS

Test Plot

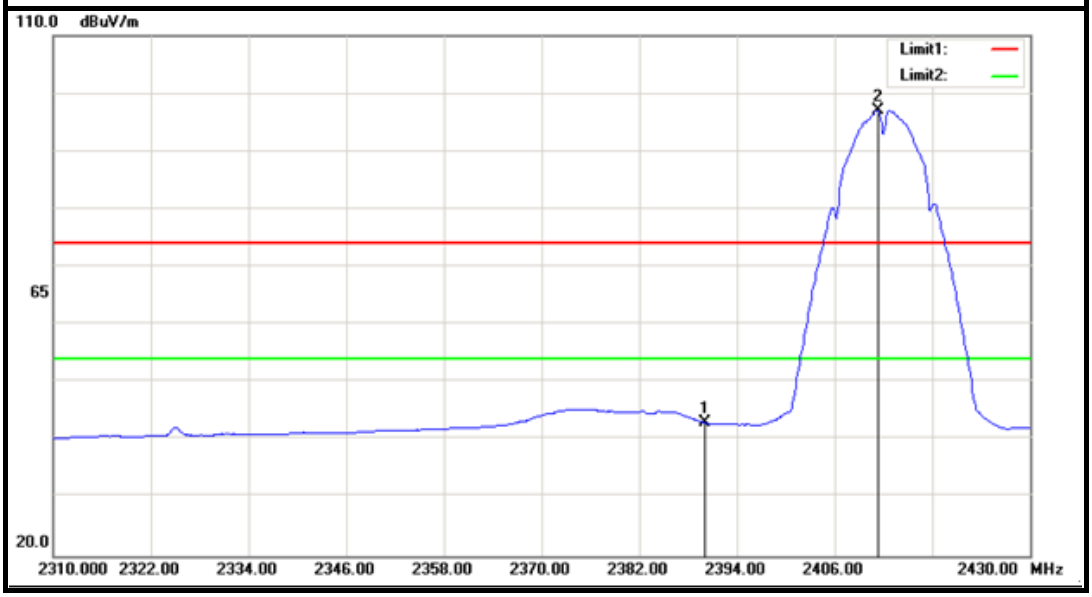
IEEE 802.11b mode (Antenna 0)

Band Edges (CH Low)

Detector mode: Peak **Polarity: Vertical**



Detector mode: Average **Polarity: Vertical**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2412.000	103.29	-2.74	100.55	---	---	Peak	Vertical
2	2390.000	57.91	-2.86	55.05	74.00	-18.95	Peak	Vertical
1	2411.280	99.89	-2.75	97.14	---	---	Average	Vertical
2	2390.000	45.88	-2.86	43.02	54.00	-10.98	Average	Vertical

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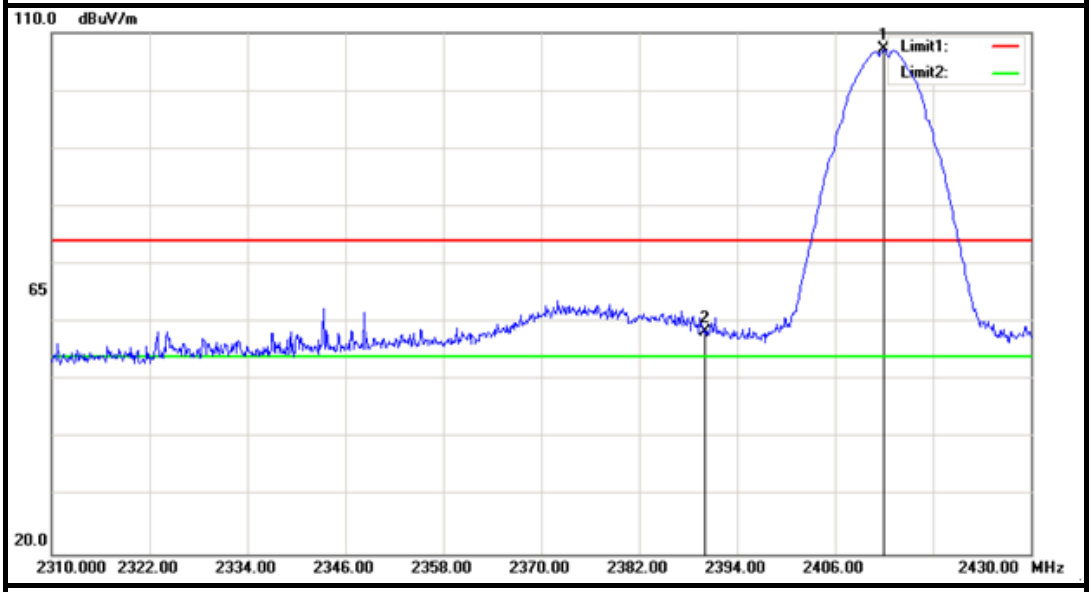
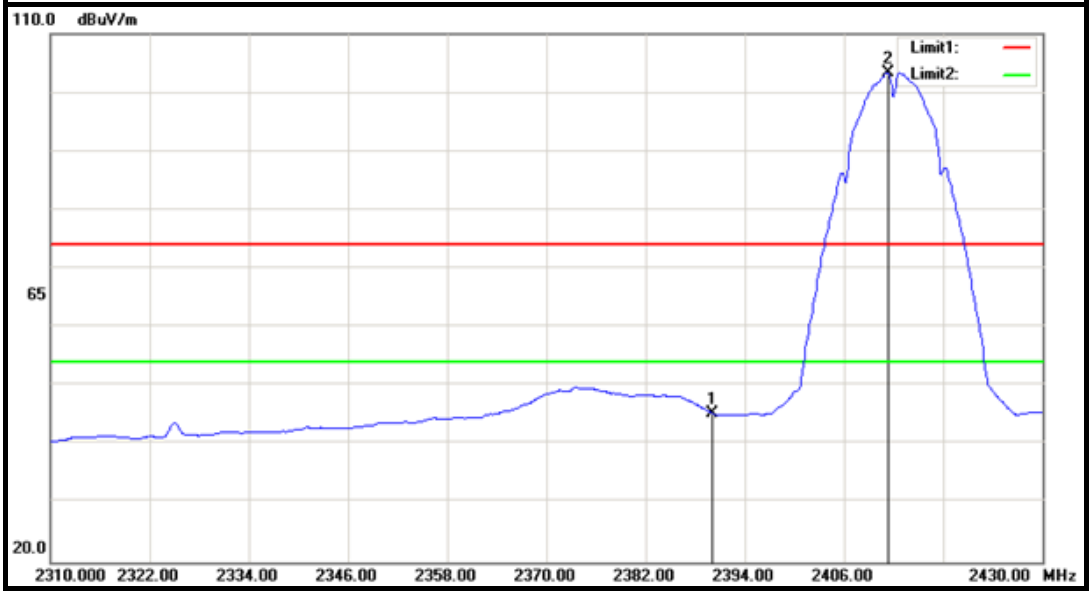
Detector mode: Peak **Polarity: Horizontal**



Detector mode: Average **Polarity: Horizontal**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2412.000	109.83	-2.74	107.09	---	---	Peak	Horizontal
2	2390.000	61.28	-2.86	58.42	74.00	-15.58	Peak	Horizontal
1	2411.280	106.22	-2.75	103.47	---	---	Average	Horizontal
2	2390.000	48.27	-2.86	45.41	54.00	-8.59	Average	Horizontal

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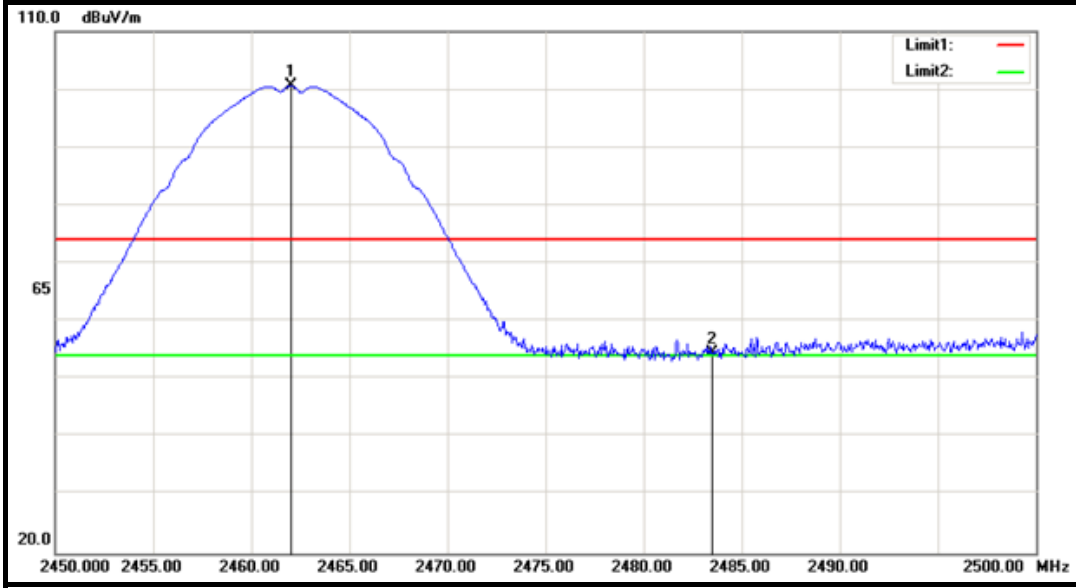
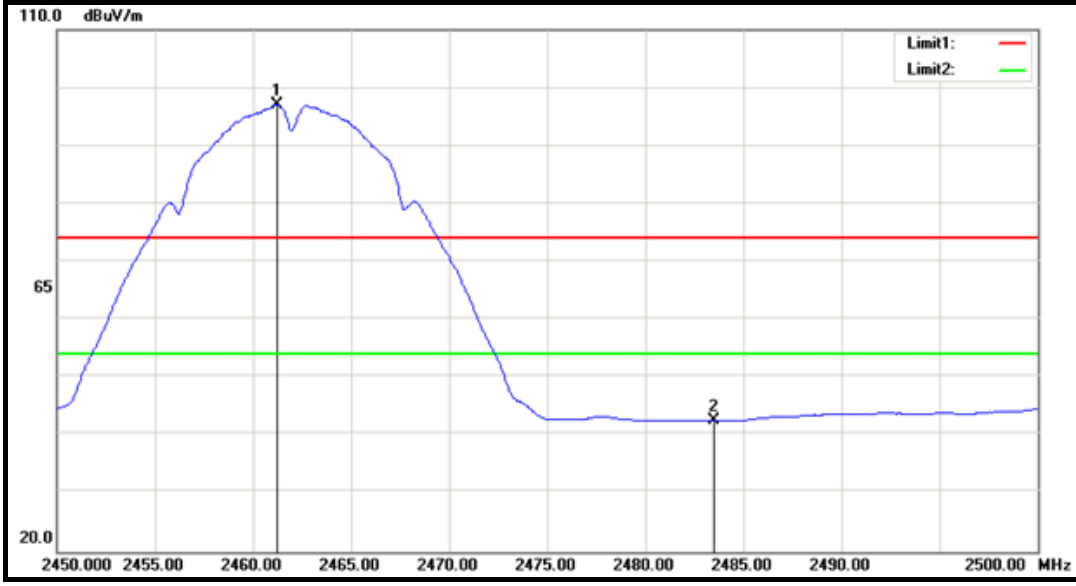
Band Edges (CH High)

Detector mode: Peak **Polarity: Vertical**



Detector mode: Average **Polarity: Vertical**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2462.050	103.12	-2.47	100.65	---	---	Peak	Vertical
2	2483.500	56.97	-2.35	54.62	74.00	-19.38	Peak	Vertical
1	2461.250	99.64	-2.47	97.17	---	---	Average	Vertical
2	2483.500	44.98	-2.35	42.63	54.00	-11.37	Average	Vertical

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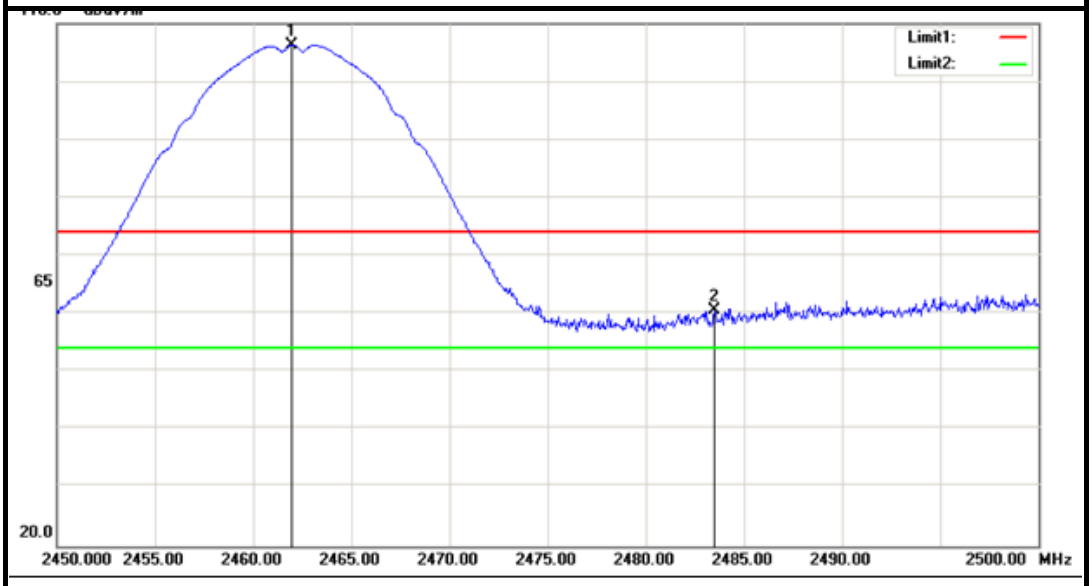
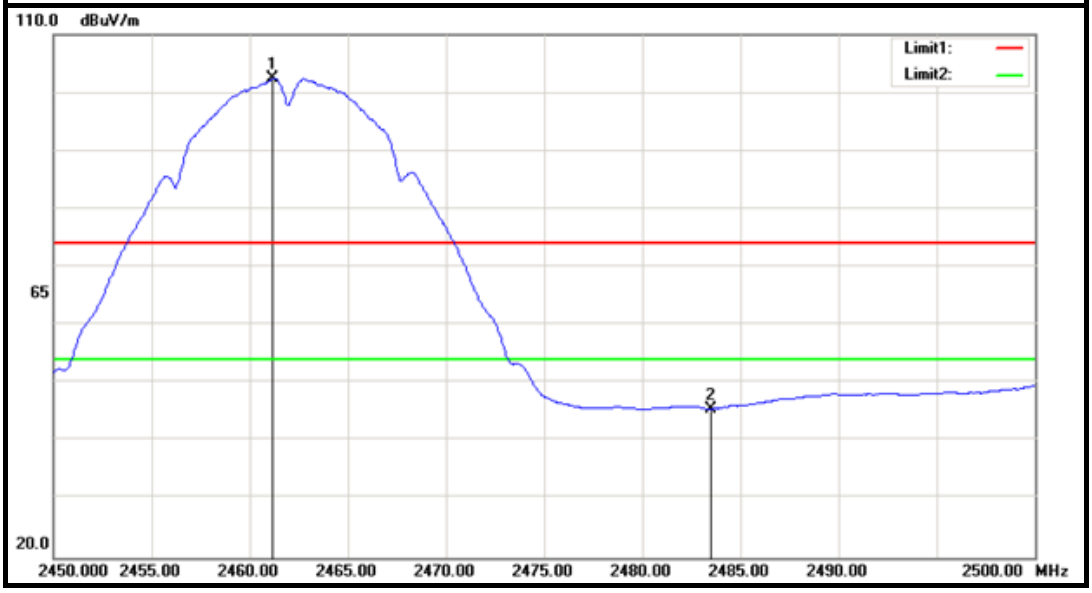
Detector mode: Peak **Polarity: Horizontal**



Detector mode: Average **Polarity: Horizontal**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2461.950	108.80	-2.47	106.33	---	---	Peak	Horizontal
2	2483.500	63.03	-2.35	60.68	74.00	-13.32	Peak	Horizontal
1	2461.150	104.90	-2.47	102.43	---	---	Average	Horizontal
2	2483.500	47.90	-2.35	45.55	54.00	-8.45	Average	Horizontal

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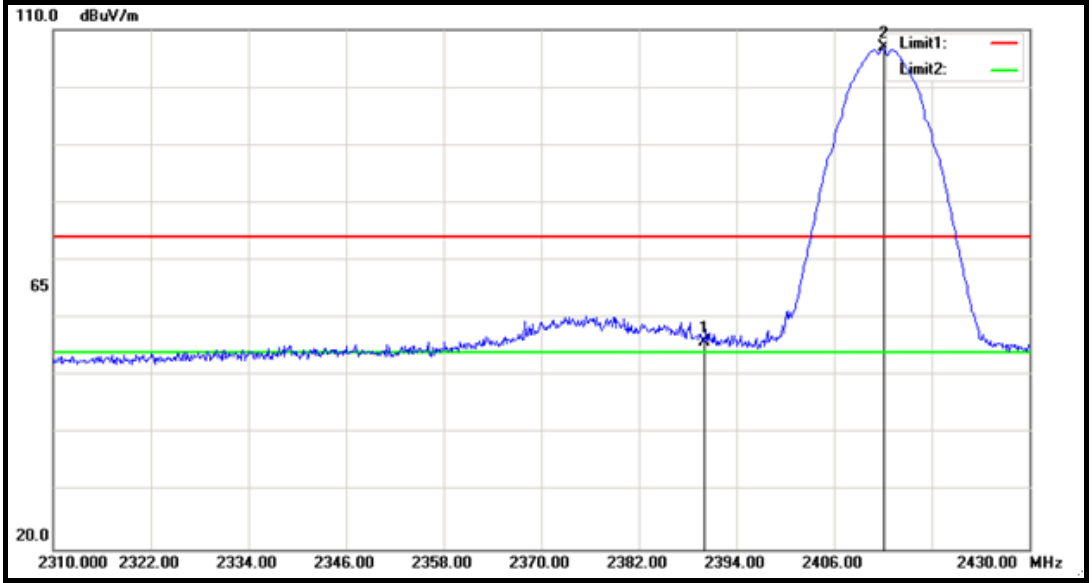
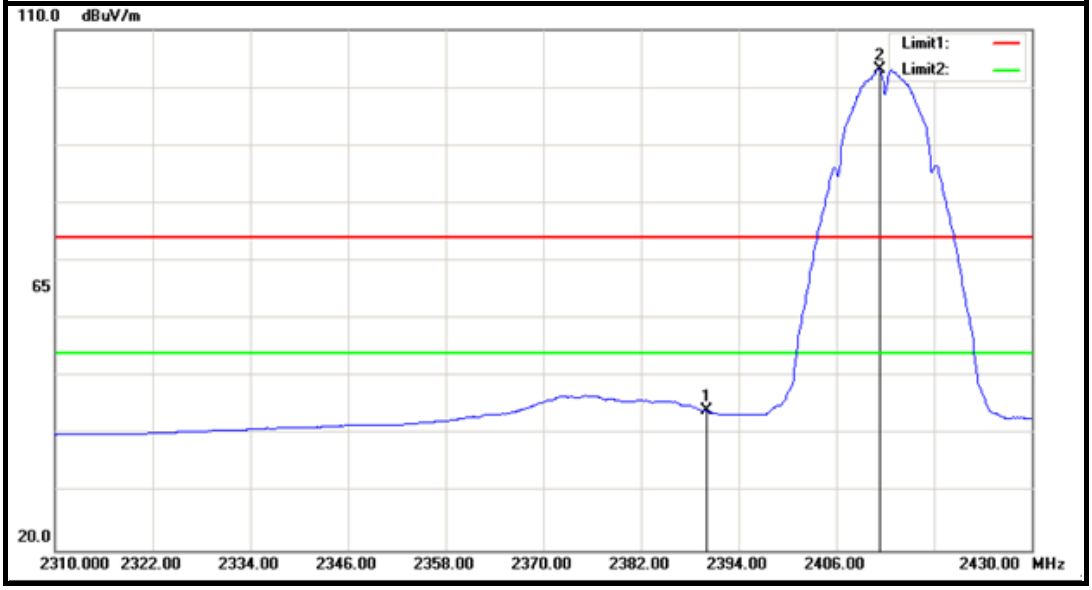
IEEE 802.11b mode (Antenna 1)
Band Edges (CH Low)

Detector mode: Peak **Polarity: Vertical**



Detector mode: Average **Polarity: Vertical**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2412.120	109.62	-2.74	106.88	---	---	Peak	Vertical
2	2390.000	58.74	-2.86	55.88	74.00	-18.12	Peak	Vertical
1	2411.280	105.97	-2.75	103.22	---	---	Average	Vertical
2	2390.000	46.95	-2.86	44.09	54.00	-9.91	Average	Vertical

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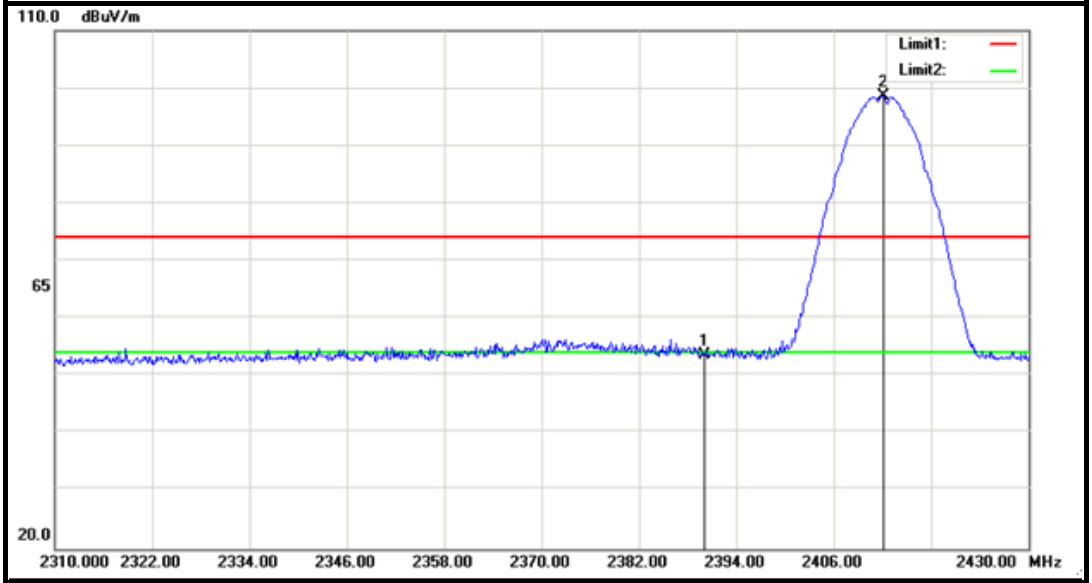
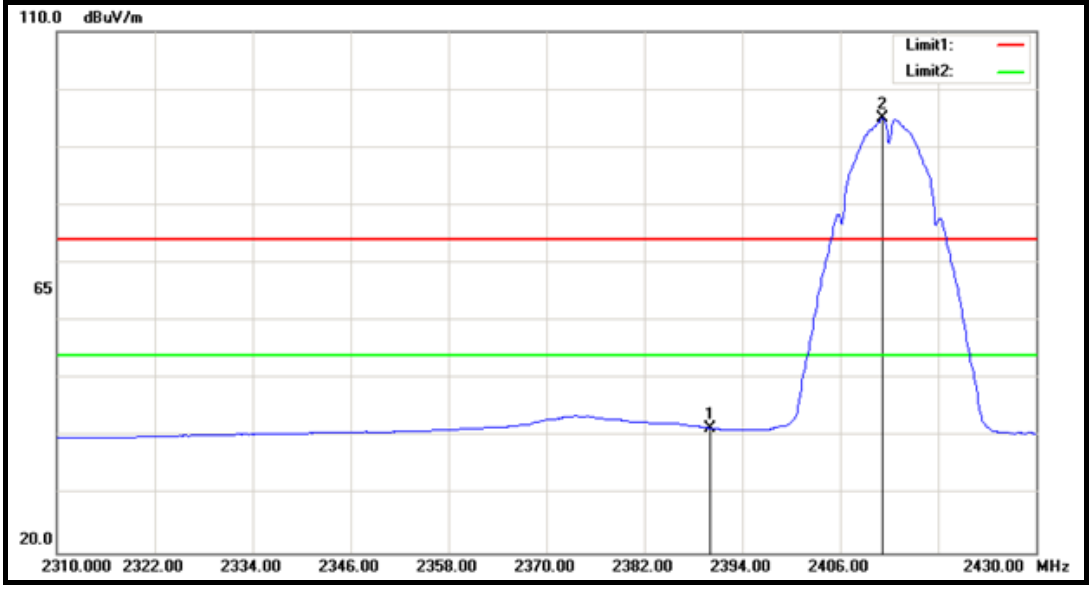
Detector mode: Peak **Polarity: Horizontal**



Detector mode: Average **Polarity: Horizontal**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2412.120	101.43	-2.74	98.69	---	---	Peak	Horizontal
2	2390.000	56.41	-2.86	53.55	74.00	-20.45	Peak	Horizontal
1	2411.160	97.89	-2.75	95.14	---	---	Average	Horizontal
2	2390.000	44.44	-2.86	41.58	54.00	-12.42	Average	Horizontal

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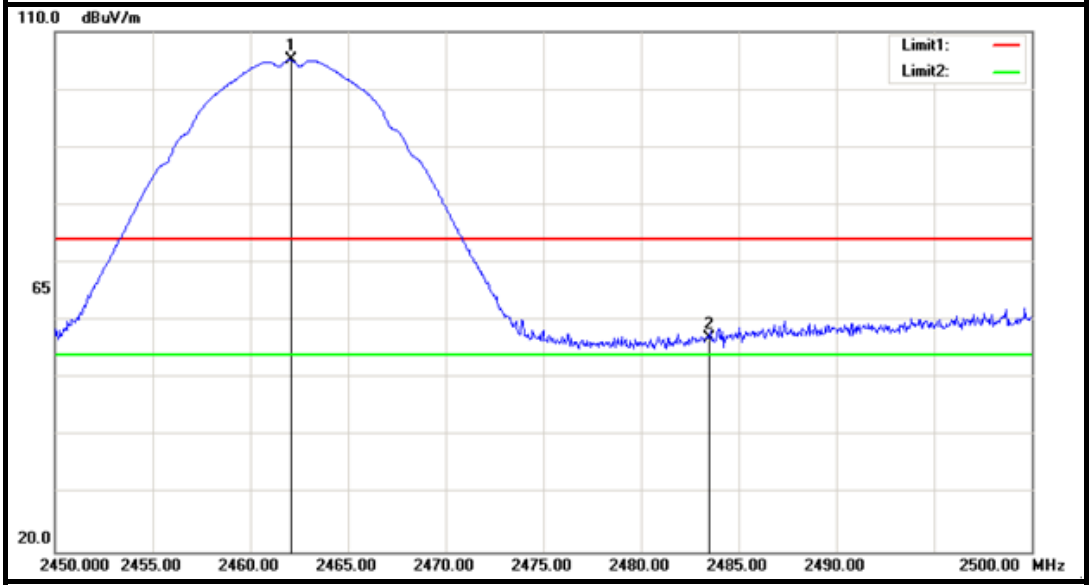
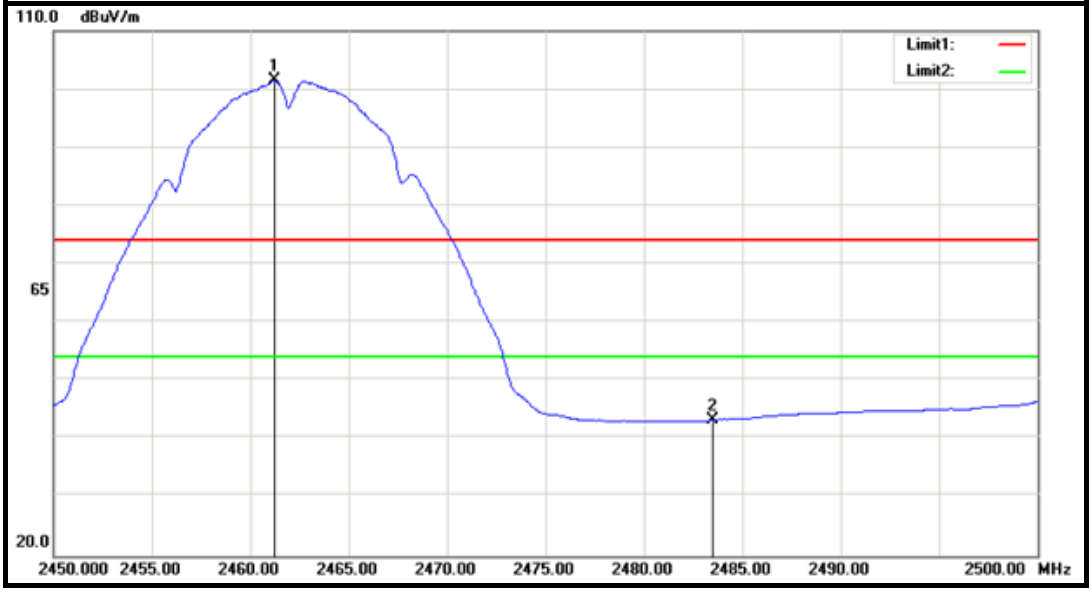
Band Edges (CH High)

Detector mode: Peak **Polarity: Vertical**



Detector mode: Average **Polarity: Vertical**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2462.100	107.63	-2.47	105.16	---	---	Peak	Vertical
2	2483.500	59.35	-2.35	57.00	74.00	-17.00	Peak	Vertical
1	2461.200	103.96	-2.47	101.49	---	---	Average	Vertical
2	2483.500	45.68	-2.35	43.33	54.00	-10.67	Average	Vertical

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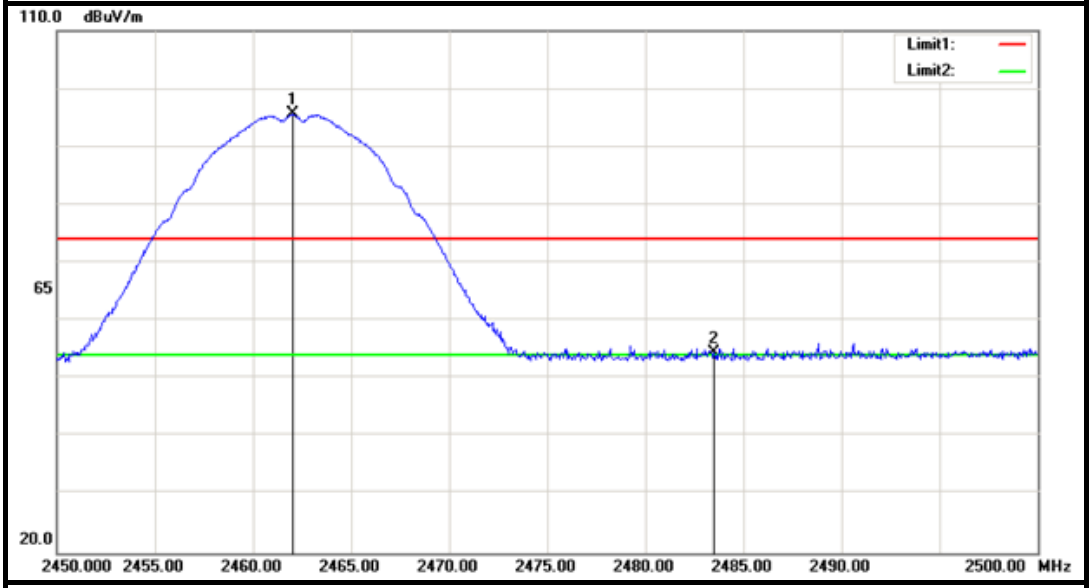
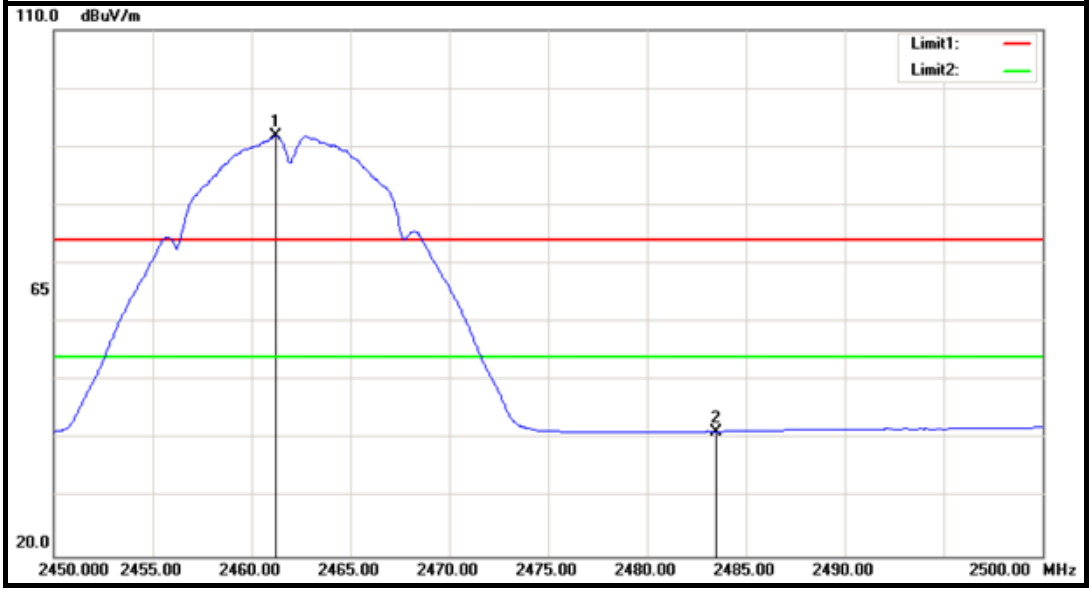
Detector mode: Peak **Polarity: Horizontal**



Detector mode: Average **Polarity: Horizontal**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2462.000	98.13	-2.47	95.66	---	---	Peak	Horizontal
2	2483.500	56.97	-2.35	54.62	74.00	-19.38	Peak	Horizontal
1	2461.200	94.32	-2.47	91.85	---	---	Average	Horizontal
2	2483.500	43.70	-2.35	41.35	74.00	-32.65	Average	Horizontal

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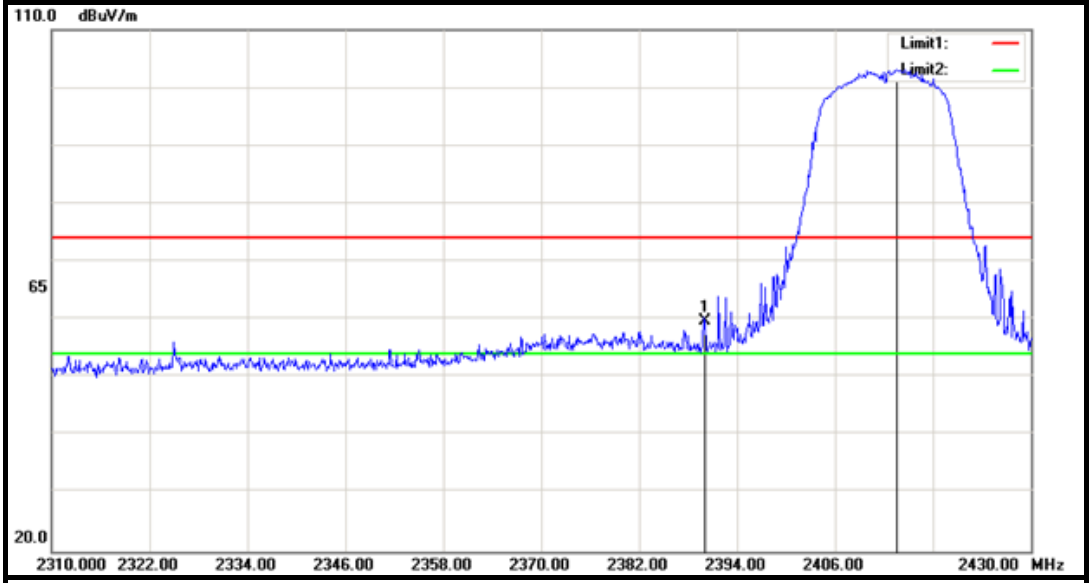
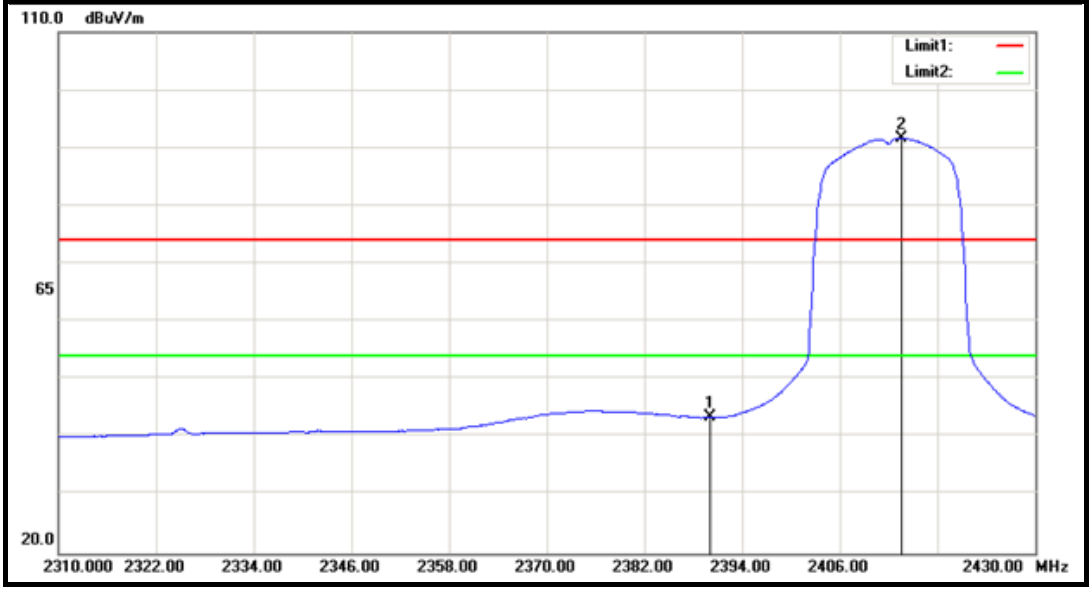
IEEE 802.11g mode (Antenna 0)
Band Edges (CH Low)

Detector mode: Peak **Polarity: Vertical**



Detector mode: Average **Polarity: Vertical**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2413.560	105.86	-2.73	103.13	---	---	Peak	Vertical
2	2390.000	62.54	-2.86	59.68	74.00	-14.32	Peak	Vertical
1	2413.560	94.50	-2.73	91.77	---	---	Average	Vertical
2	2390.000	46.29	-2.86	43.43	54.00	-10.57	Average	Vertical

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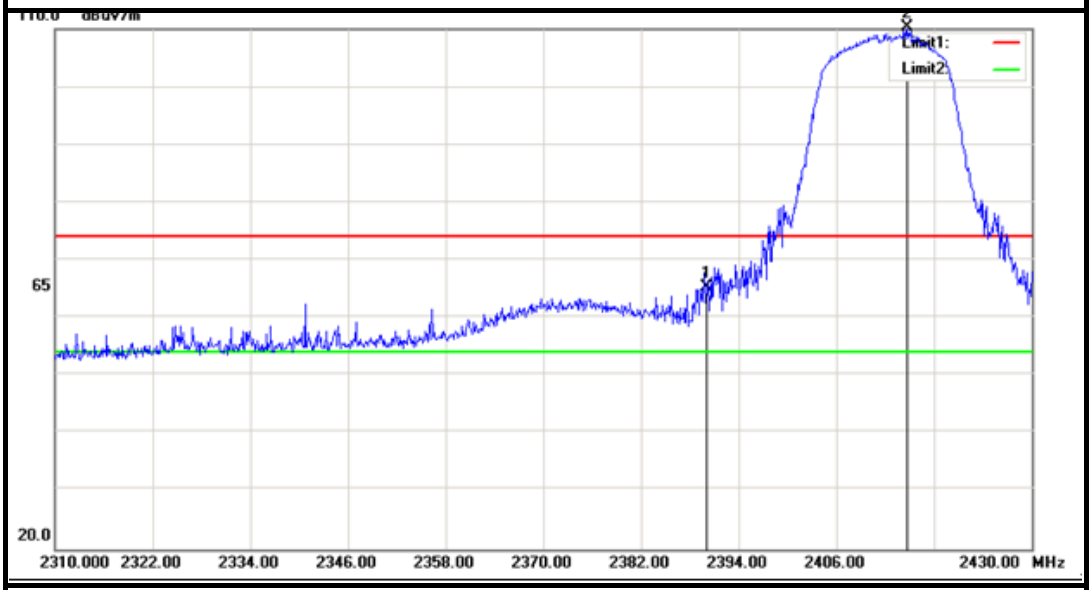
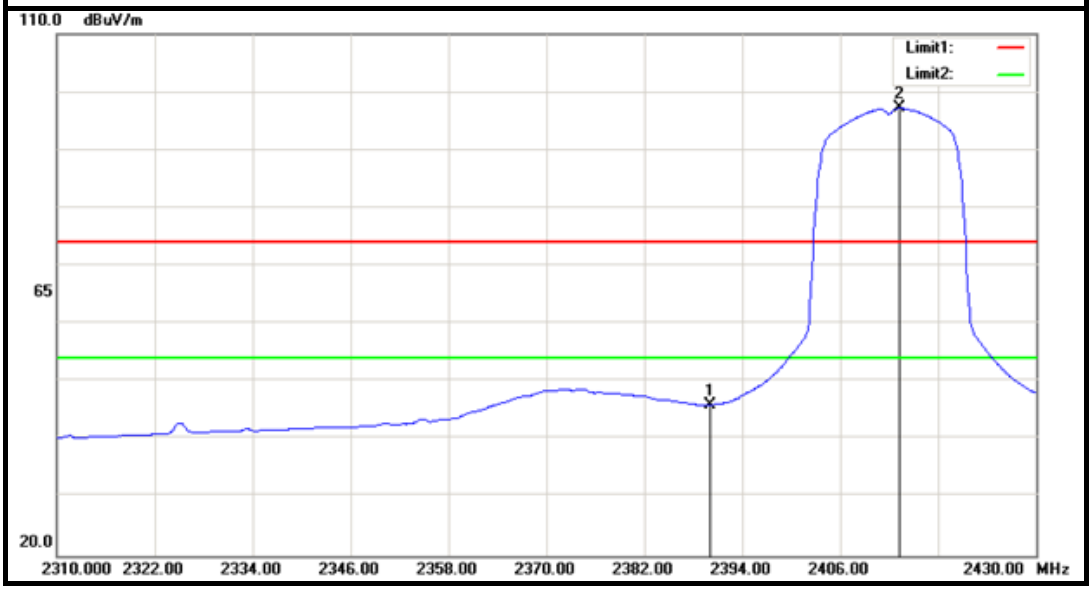
Detector mode: Peak **Polarity: Horizontal**



Detector mode: Average **Polarity: Horizontal**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2414.760	113.00	-2.73	110.27	---	---	Peak	Horizontal
2	2390.000	68.16	-2.86	65.30	74.00	-8.70	Peak	Horizontal
1	2413.320	99.98	-2.73	97.25	---	---	Average	Horizontal
2	2390.000	48.88	-2.86	46.02	74.00	-27.98	Average	Horizontal

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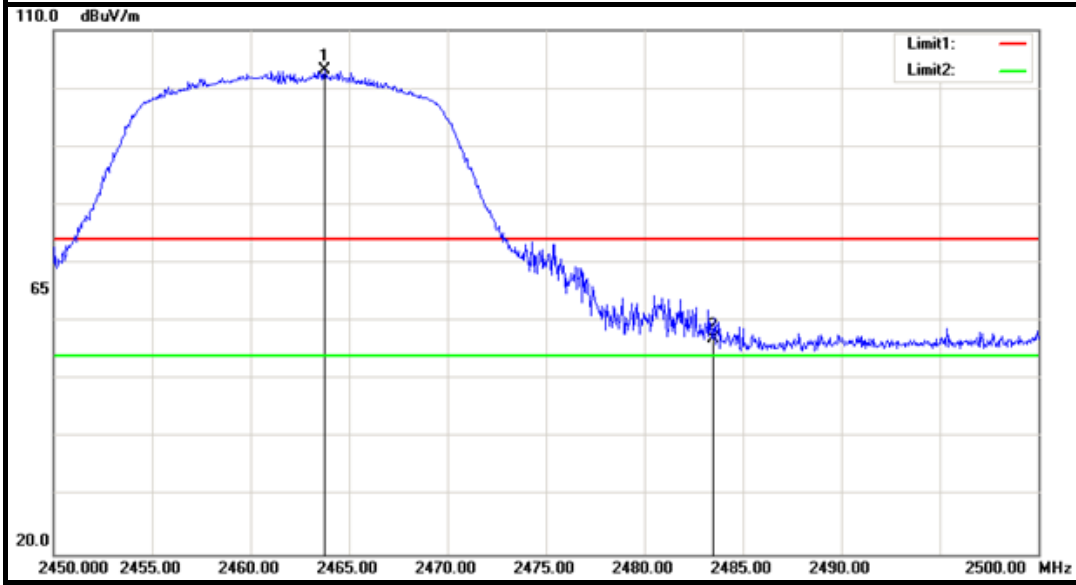
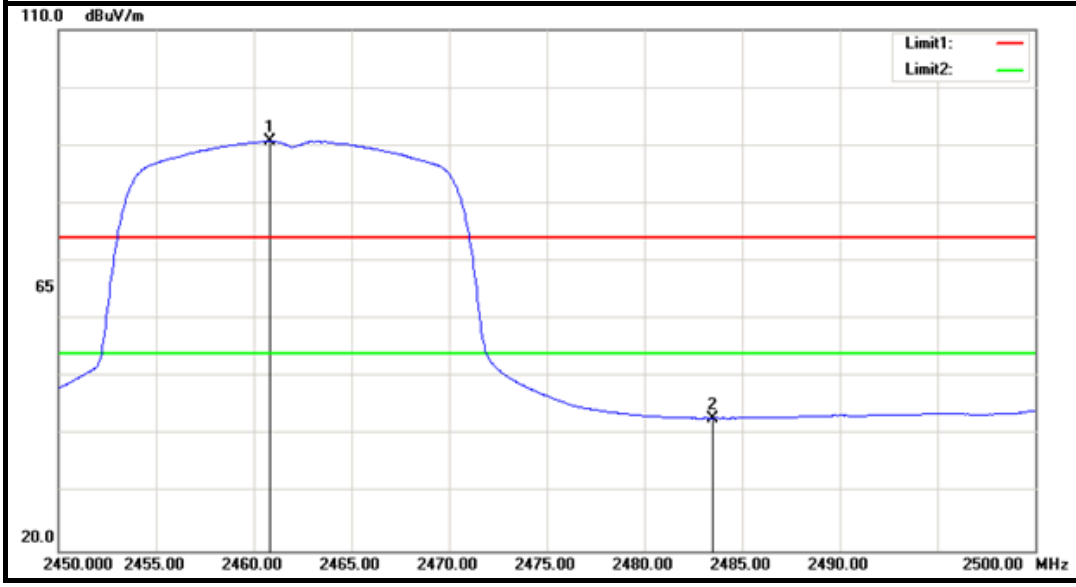
Band Edges (CH High)

Detector mode: Peak **Polarity: Vertical**



Detector mode: Average **Polarity: Vertical**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2463.750	105.51	-2.46	103.05	---	---	Peak	Vertical
2	2483.500	59.33	-2.35	56.98	74.00	-17.02	Peak	Vertical
1	2460.850	93.22	-2.47	90.75	---	---	Average	Vertical
2	2483.500	45.29	-2.35	42.94	54.00	-11.06	Average	Vertical

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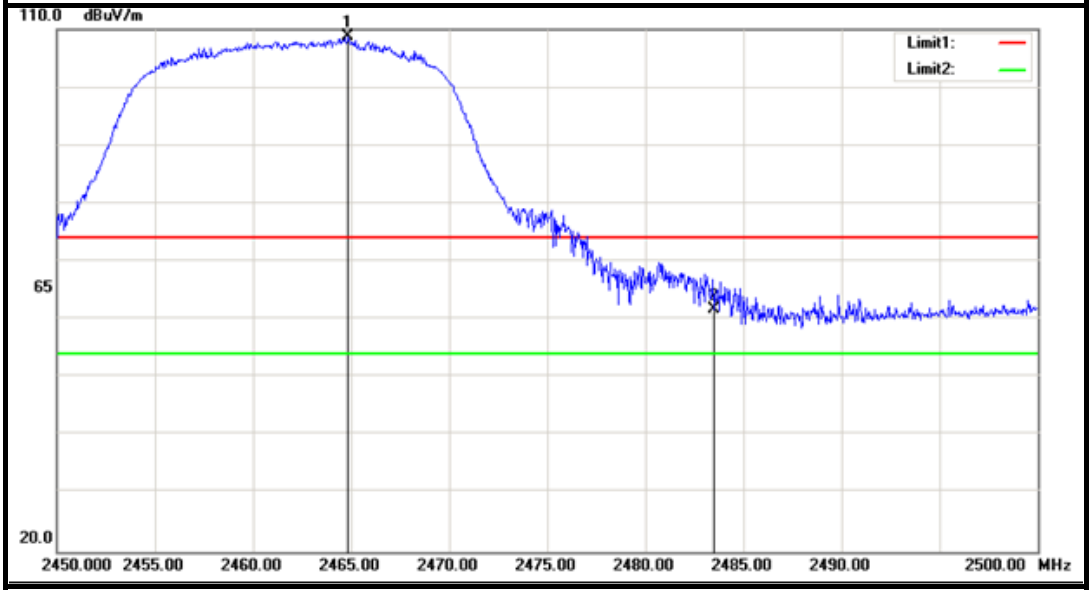
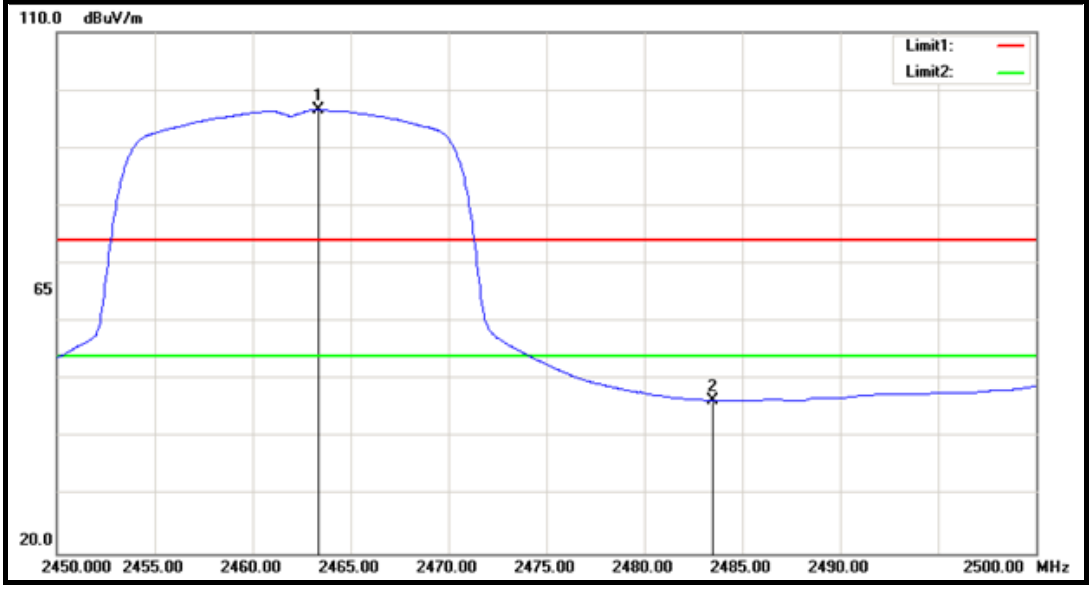
Detector mode: Peak **Polarity: Horizontal**



Detector mode: Average **Polarity: Horizontal**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2464.850	111.18	-2.45	108.73	---	---	Peak	Horizontal
2	2483.500	64.01	-2.35	61.66	74.00	-12.34	Peak	Horizontal
1	2463.350	99.03	-2.46	96.57	---	---	Average	Horizontal
2	2483.500	48.78	-2.35	46.43	54.00	-7.57	Average	Horizontal

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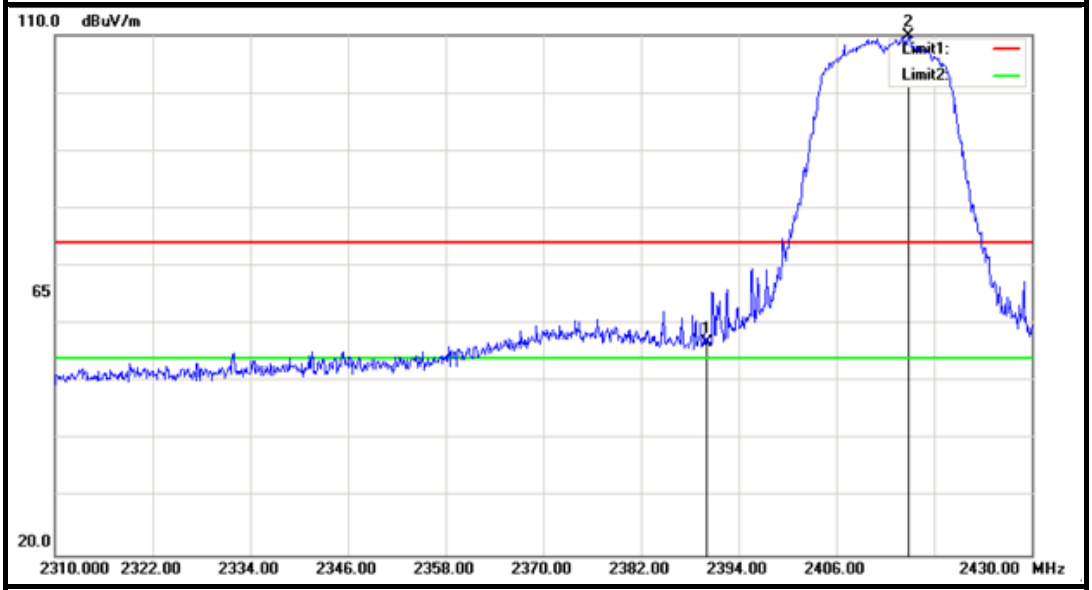
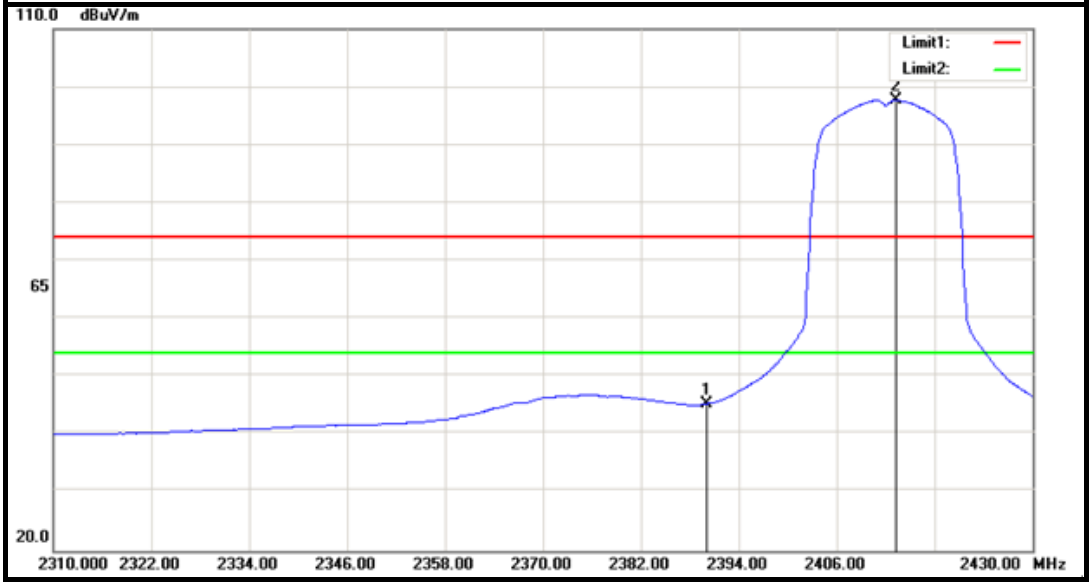
IEEE 802.11g mode (Antenna 1)
Band Edges (CH Low)

Detector mode: Peak **Polarity: Vertical**



Detector mode: Average **Polarity: Vertical**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2414.880	112.68	-2.73	109.95	---	---	Peak	Vertical
2	2390.000	59.69	-2.86	56.83	74.00	-17.17	Peak	Vertical
1	2413.200	100.51	-2.74	97.77	---	---	Average	Vertical
2	2390.000	48.20	-2.86	45.34	54.00	-8.66	Average	Vertical

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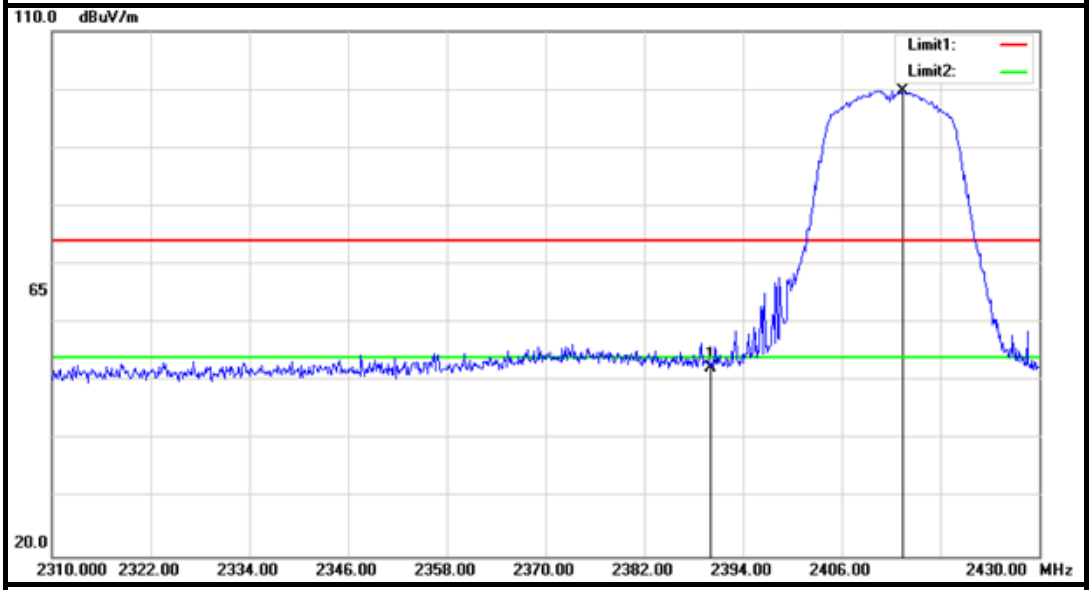
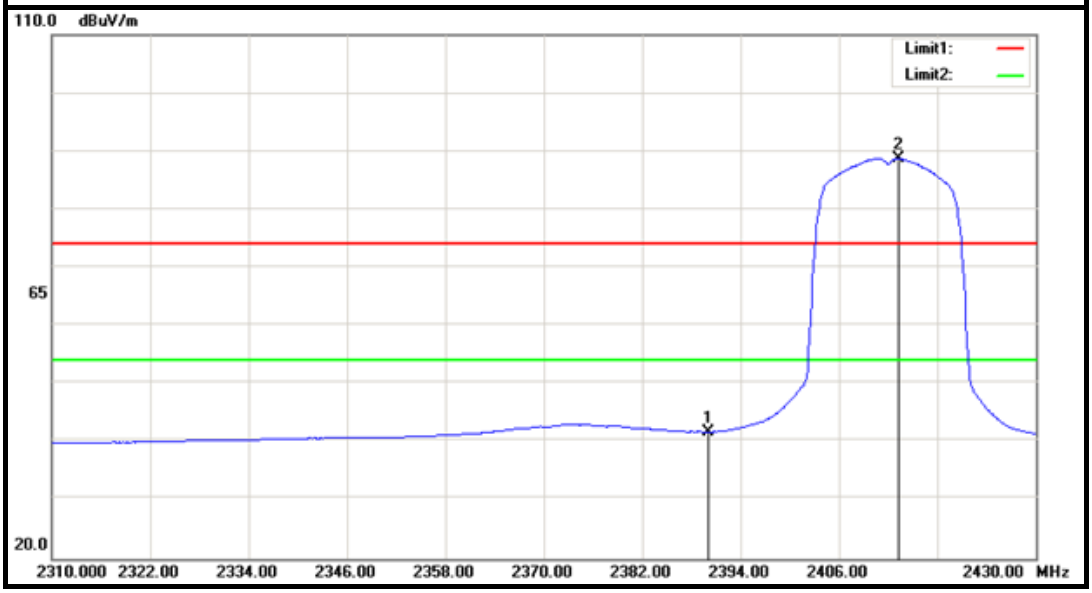
Detector mode: Peak **Polarity: Horizontal**



Detector mode: Average **Polarity: Horizontal**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2413.440	102.50	-2.73	99.77	---	---	Peak	Horizontal
2	2390.000	55.19	-2.86	52.33	74.00	-21.67	Peak	Horizontal
1	2413.200	91.47	-2.74	88.73	---	---	Average	Horizontal
2	2390.000	44.66	-2.86	41.80	54.00	-12.20	Average	Horizontal

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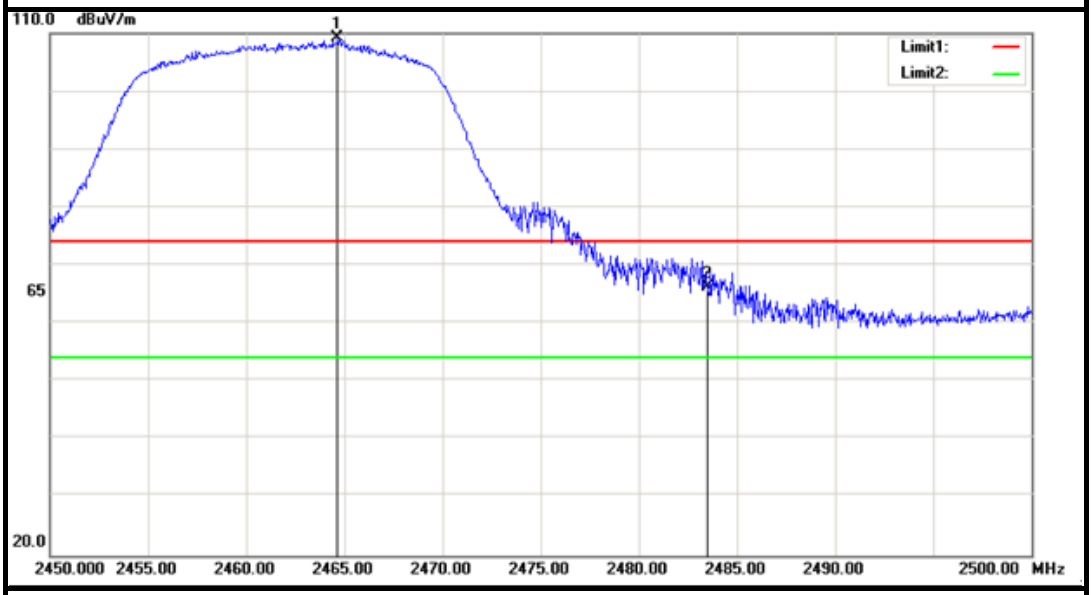
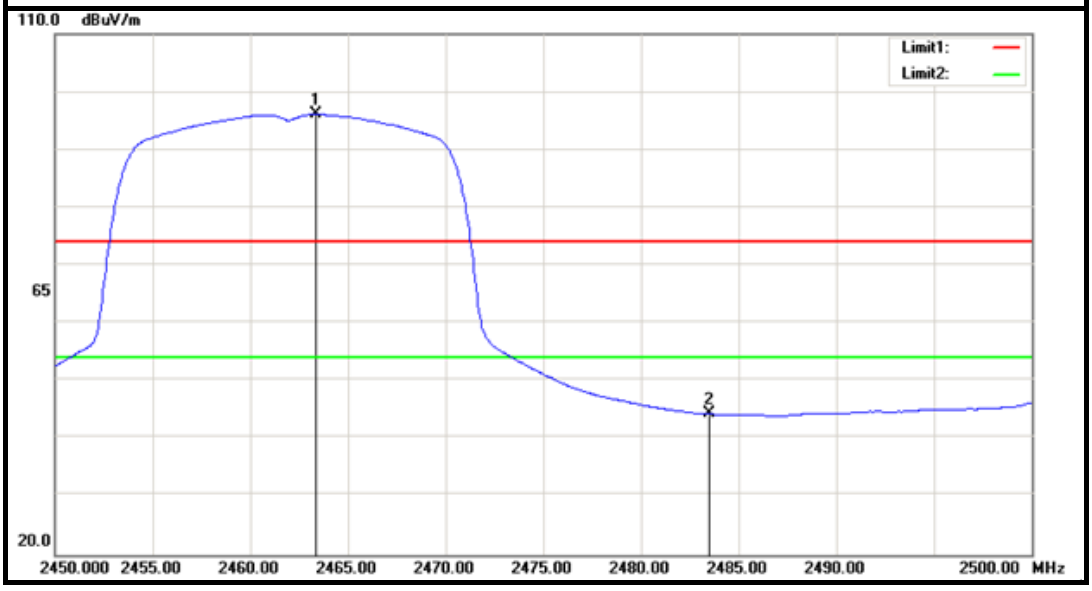
Band Edges (CH High)

Detector mode: Peak **Polarity: Vertical**



Detector mode: Average **Polarity: Vertical**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2464.650	111.65	-2.45	109.20	---	---	Peak	Vertical
2	2483.500	68.55	-2.35	66.20	74.00	-7.80	Peak	Vertical
1	2463.350	98.60	-2.46	96.14	---	---	Average	Vertical
2	2483.500	46.68	-2.35	44.33	54.00	-9.67	Average	Vertical

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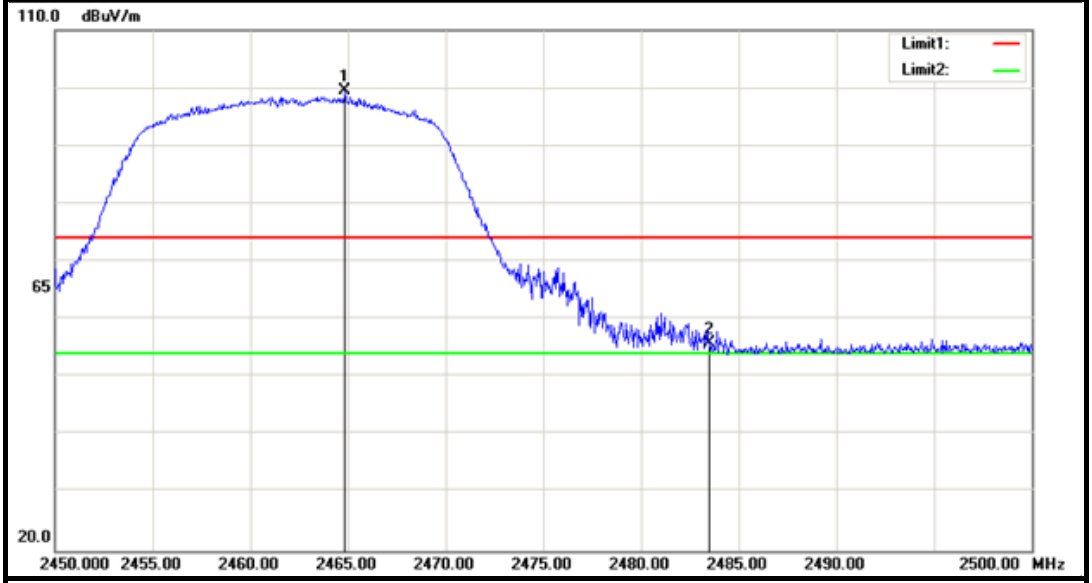
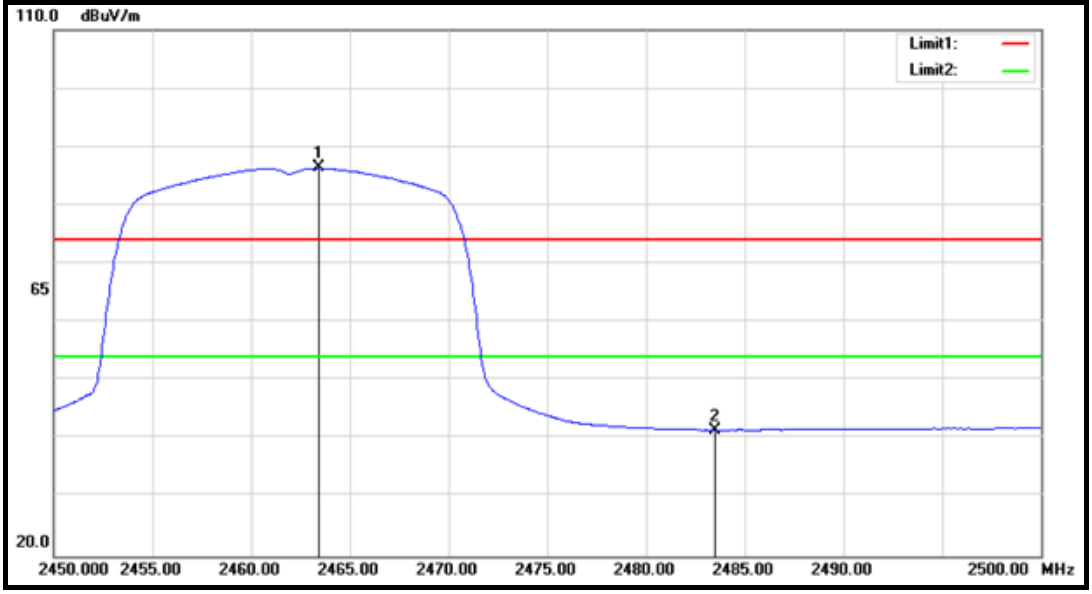
Detector mode: Peak **Polarity: Horizontal**



Detector mode: Average **Polarity: Horizontal**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2464.850	101.95	-2.45	99.50	---	---	Peak	Horizontal
2	2483.500	58.32	-2.35	55.97	74.00	-18.03	Peak	Horizontal
1	2463.450	88.84	-2.46	86.38	---	---	Average	Horizontal
2	2483.500	43.94	-2.35	41.59	54.00	-12.41	Average	Horizontal

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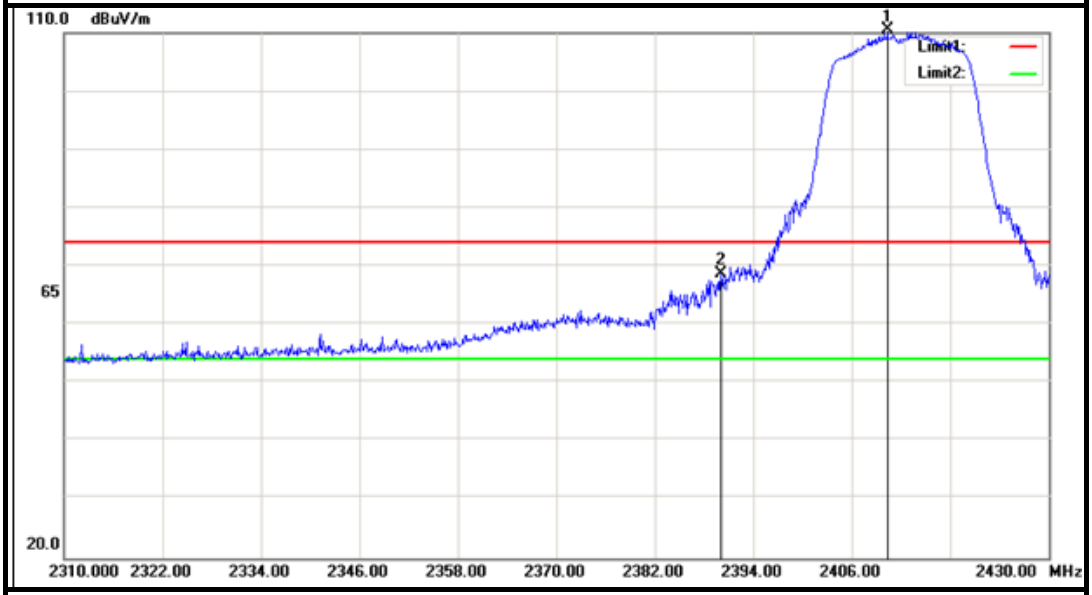
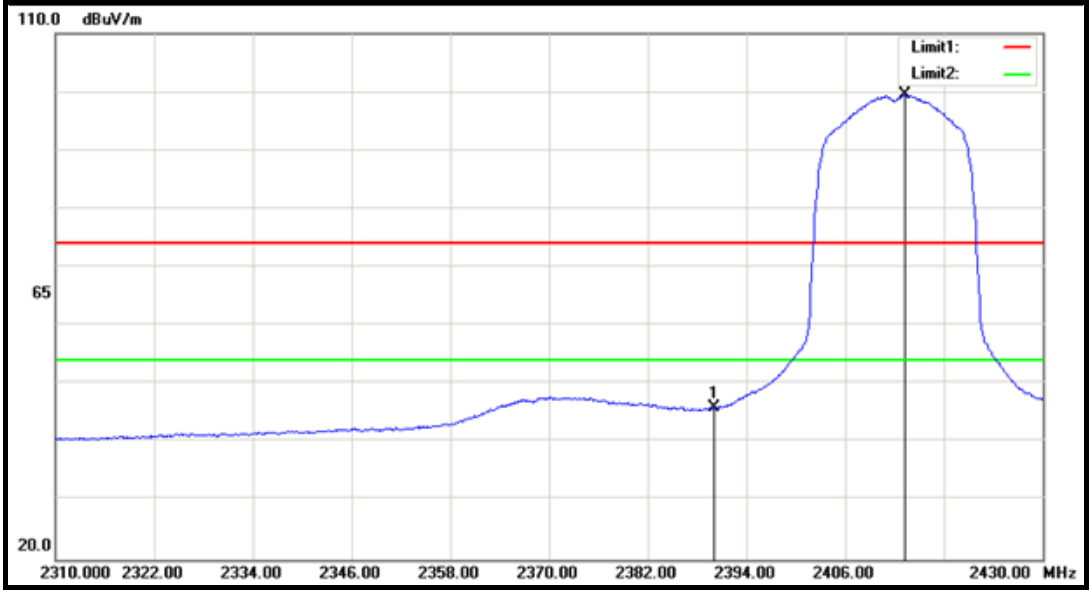
IEEE 802.11n HT20 MHz mode (Combine with Antenna 0 and Antenna 1)
Band Edges (CH Low)

Detector mode: Peak **Polarity: Vertical**



Detector mode: Average **Polarity: Vertical**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2410.320	113.30	-2.75	110.55	---	---	Peak	Vertical
2	2390.000	71.47	-2.86	68.61	74.00	-5.39	Peak	Vertical
1	2413.200	102.20	-2.74	99.46	---	---	Average	Vertical
2	2390.000	48.76	-2.86	45.90	74.00	-28.10	Average	Vertical

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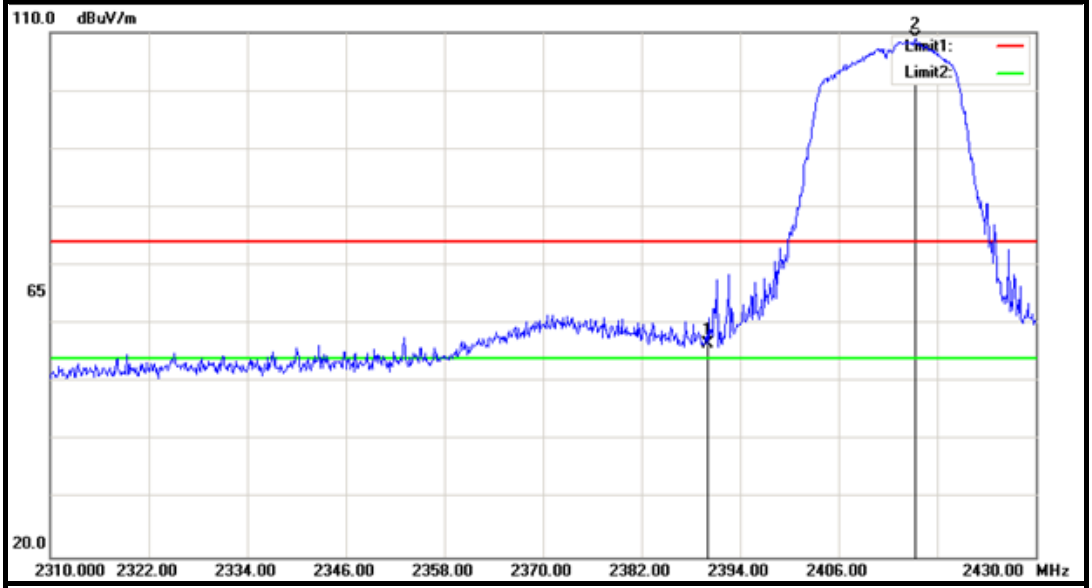
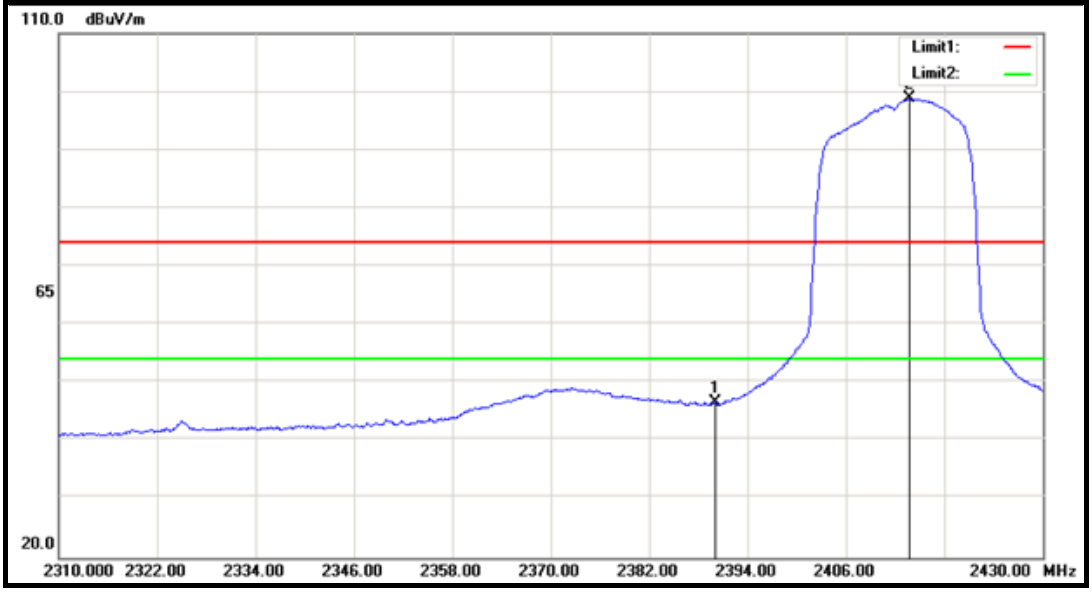
Detector mode: Peak **Polarity: Horizontal**



Detector mode: Average **Polarity: Horizontal**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2415.360	111.80	-2.72	109.08	---	---	Peak	Horizontal
2	2390.000	59.35	-2.86	56.49	74.00	-17.51	Peak	Horizontal
1	2413.800	101.55	-2.73	98.82	---	---	Average	Horizontal
2	2390.000	49.48	-2.86	46.62	54.00	-7.38	Average	Horizontal

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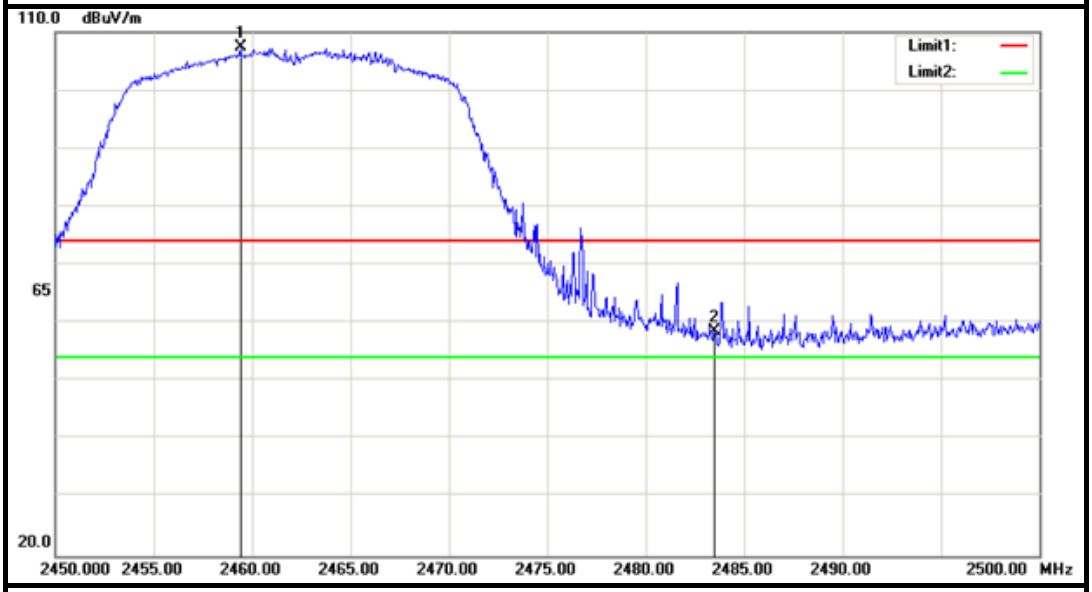
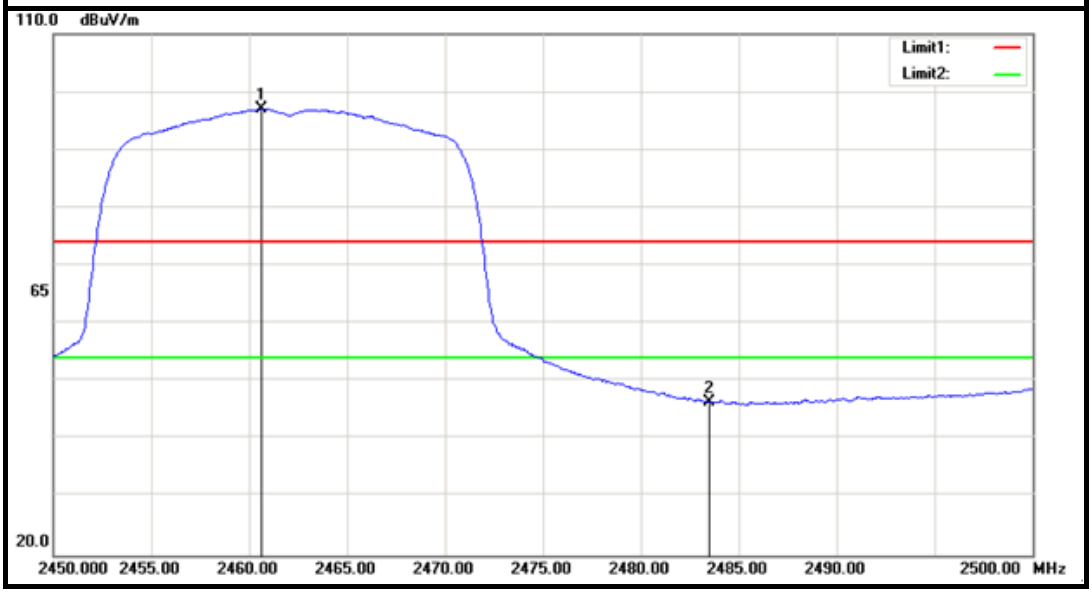
Band Edges (CH High)

Detector mode: Peak **Polarity: Vertical**



Detector mode: Average **Polarity: Vertical**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2459.400	109.80	-2.48	107.32	---	---	Peak	Vertical
2	2483.500	60.90	-2.35	58.55	74.00	-15.45	Peak	Vertical
1	2460.600	99.59	-2.48	97.11	---	---	Average	Vertical
2	2483.500	48.75	-2.35	46.40	54.00	-7.60	Average	Vertical

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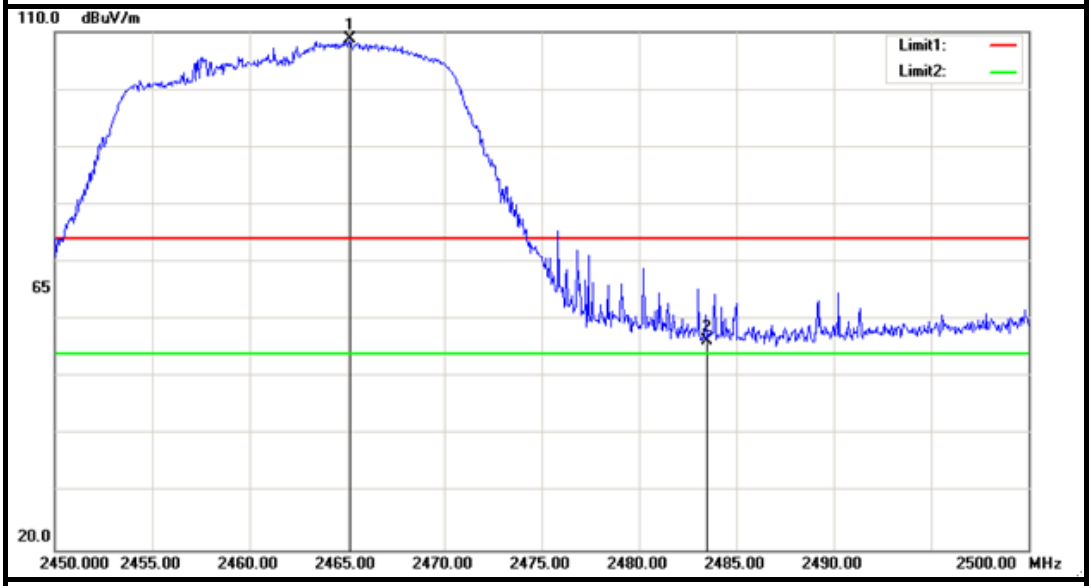
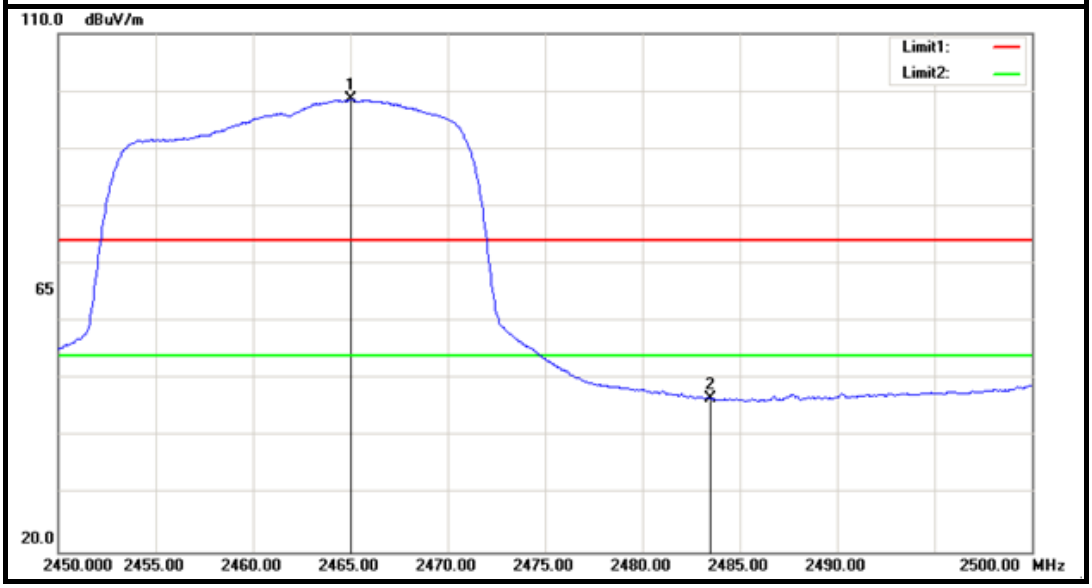
Detector mode: Peak **Polarity: Horizontal**



Detector mode: Average **Polarity: Horizontal**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2465.150	111.32	-2.45	108.87	---	---	Peak	Horizontal
2	2483.500	58.66	-2.35	56.31	74.00	-17.69	Peak	Horizontal
1	2465.050	101.07	-2.45	98.62	---	---	Average	Horizontal
2	2483.500	49.01	-2.35	46.66	54.00	-7.34	Average	Horizontal

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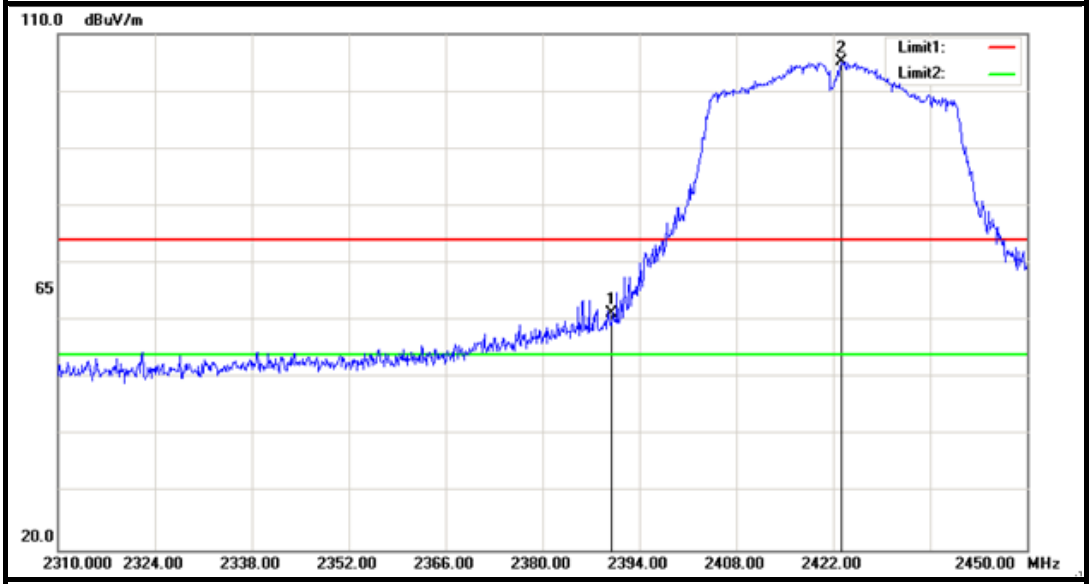
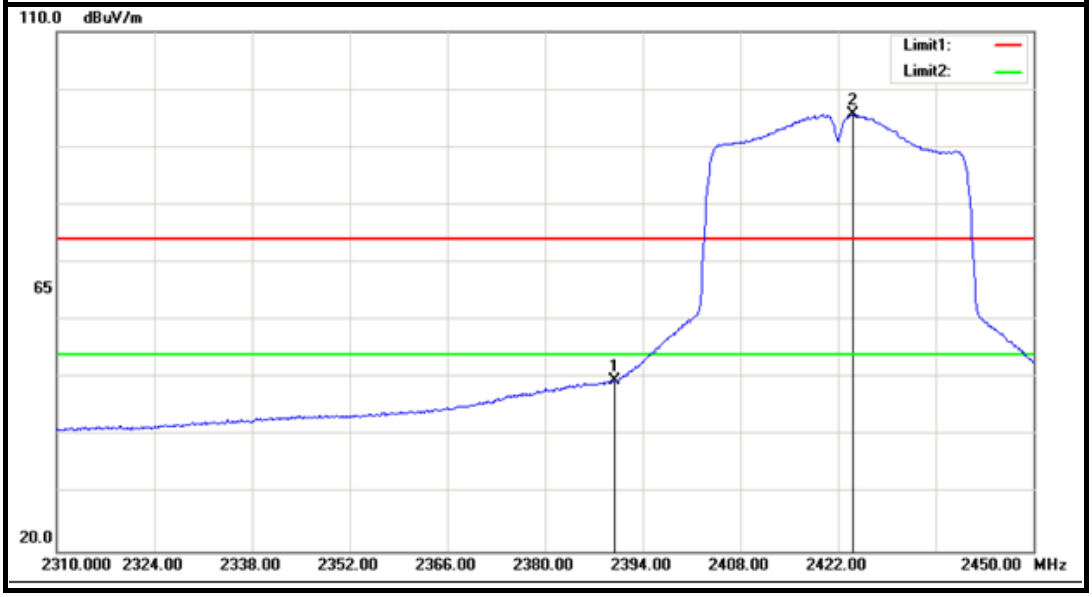
IEEE 802.11n HT40 MHz mode (Combine with Antenna 0 and Antenna 1)

Band Edges (CH Low)

Detector mode: Peak **Polarity: Vertical**



Detector mode: Average **Polarity: Vertical**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2423.260	107.94	-2.68	105.26	---	---	Peak	Vertical
2	2390.000	64.23	-2.86	61.37	74.00	-12.63	Peak	Vertical
1	2424.100	98.37	-2.68	95.69	---	---	Average	Vertical
2	2390.000	52.48	-2.86	49.62	54.00	-4.38	Average	Vertical

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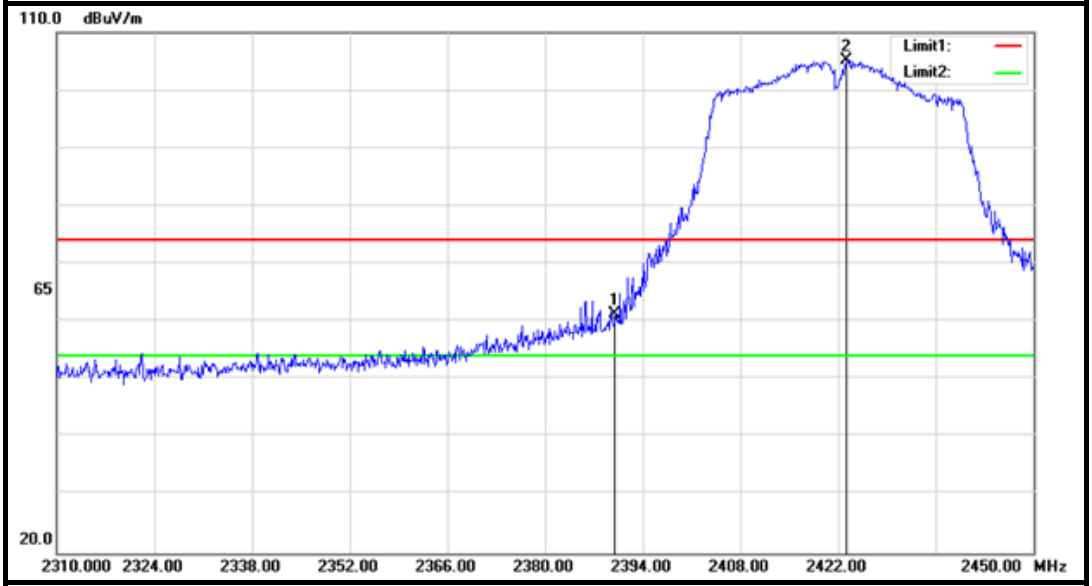
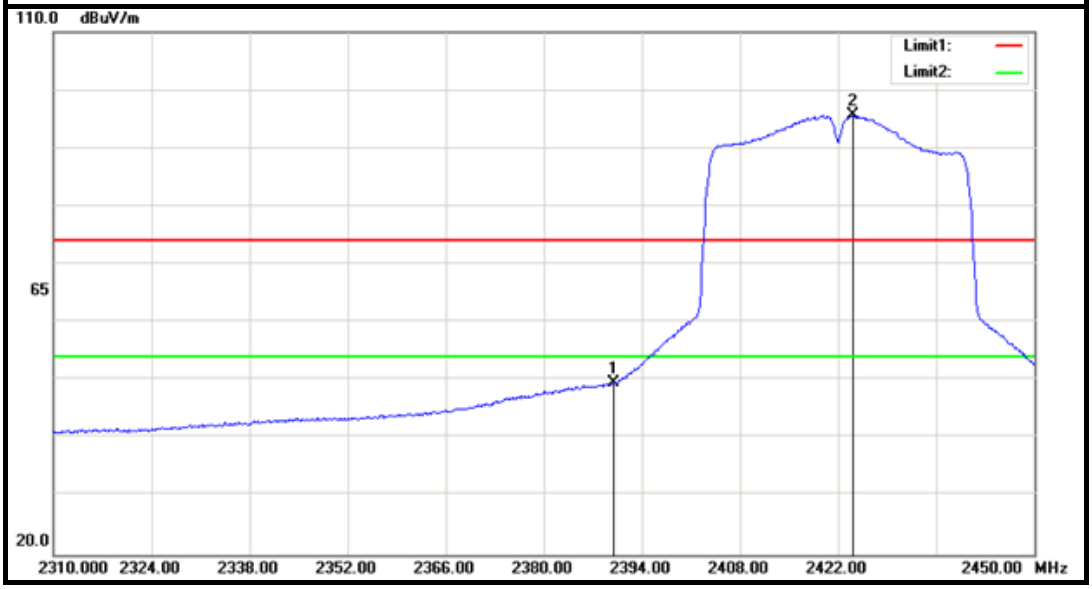
Detector mode: Peak **Polarity: Horizontal**



Detector mode: Average **Polarity: Horizontal**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2418.360	110.07	-2.71	107.36	---	---	Peak	Horizontal
2	2390.000	66.88	-2.86	64.02	74.00	-9.98	Peak	Horizontal
1	2419.620	99.15	-2.70	96.45	---	---	Average	Horizontal
2	2390.000	52.06	-2.86	49.20	54.00	-4.80	Average	Horizontal

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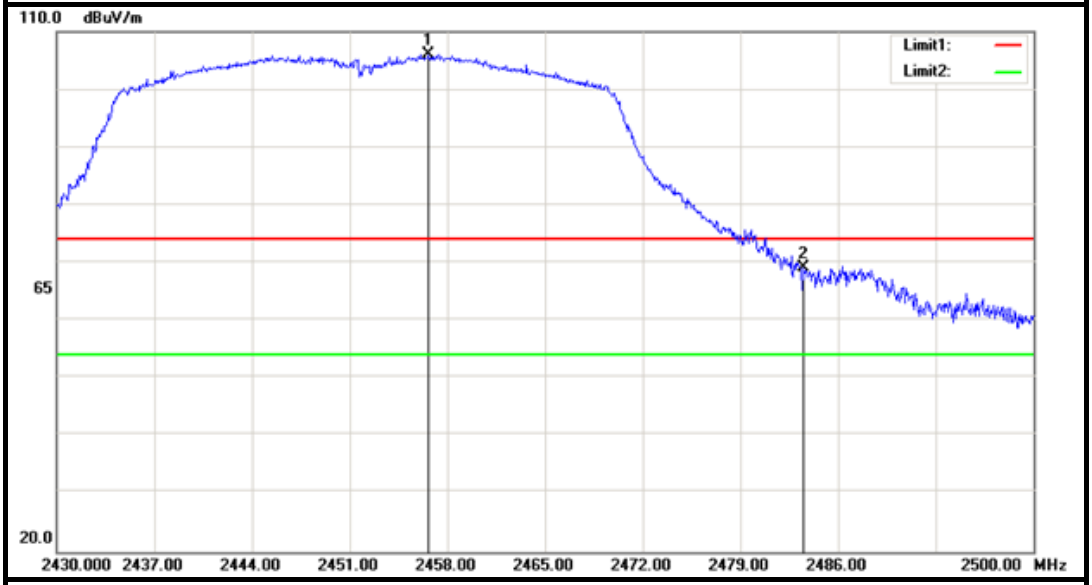
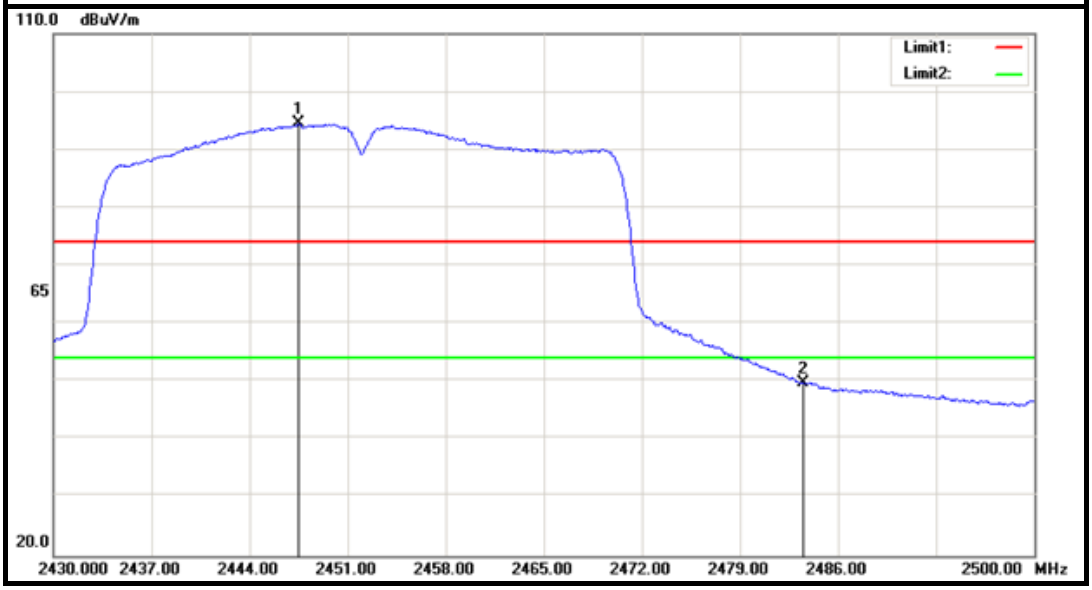
Band Edges (CH High)

Detector mode: Peak **Polarity: Vertical**



Detector mode: Average **Polarity: Vertical**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2456.670	108.61	-2.50	106.11	---	---	Peak	Vertical
2	2483.500	71.42	-2.35	69.07	74.00	-4.93	Peak	Vertical
1	2447.500	97.03	-2.55	94.48	---	---	Average	Vertical
2	2483.500	52.15	-2.35	49.80	74.00	-24.20	Average	Vertical

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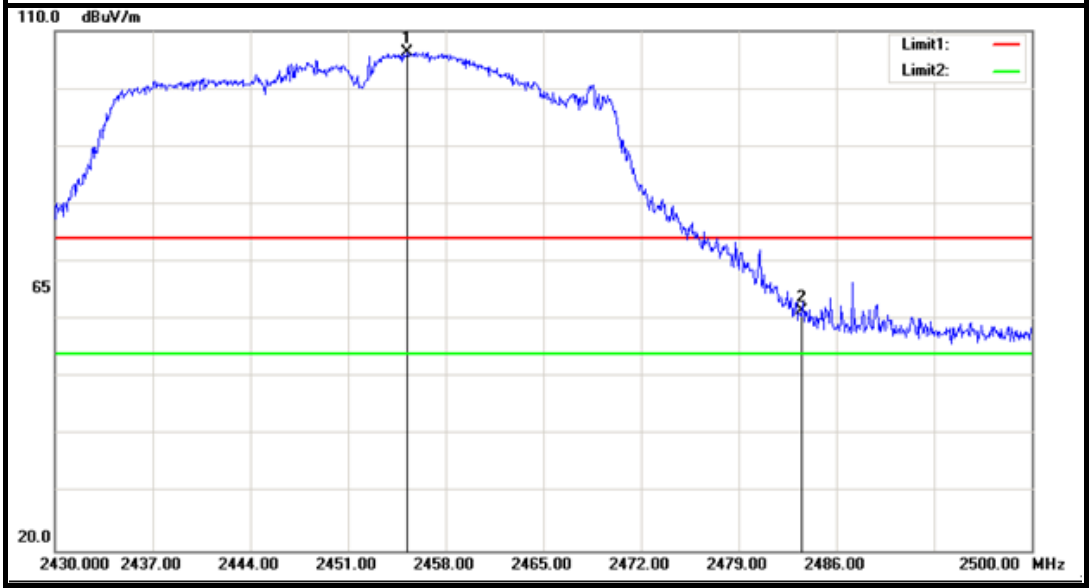
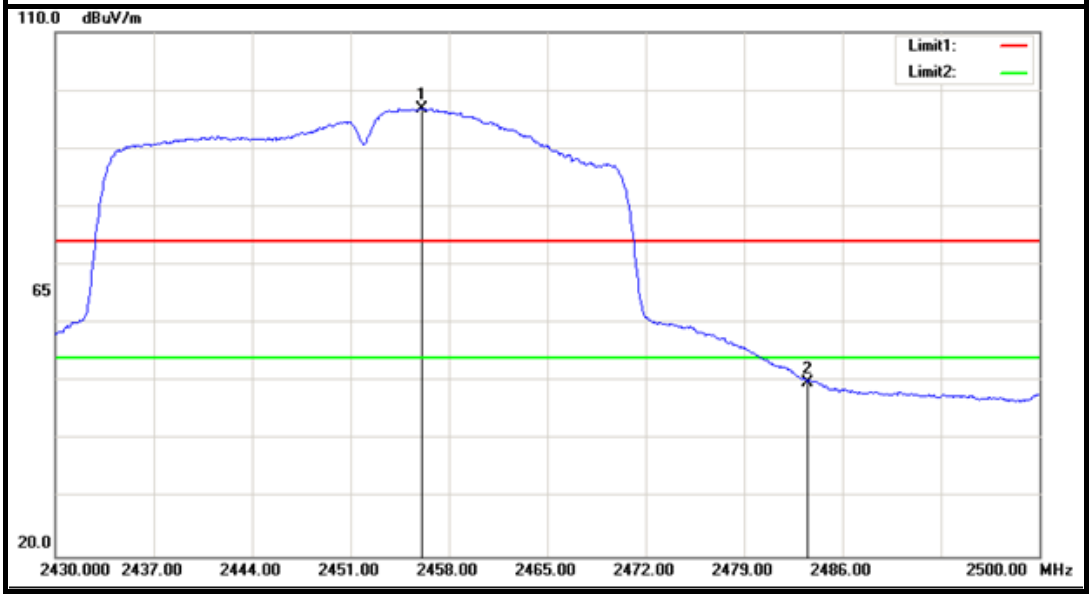
Detector mode: Peak **Polarity: Horizontal**



Detector mode: Average **Polarity: Horizontal**



No.	Frequency (MHz)	Reading (dB)	Factor (dB/m)	Result (dB/m)	Limit (dB/m)	Margin (dB)	Remark	Antenna Polar
1	2455.270	108.87	-2.51	106.36	---	---	Peak	Horizontal
2	2483.500	63.83	-2.35	61.48	74.00	-12.52	Peak	Horizontal
1	2456.040	99.37	-2.50	96.87	---	---	Average	Horizontal
2	2483.500	52.23	-2.35	49.88	54.00	-4.12	Average	Horizontal

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7.7. PEAK POWER SPECTRAL DENSITY MEASUREMENT

7.7.1. LIMITS

According to §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

According to §15.247(f), the digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

7.7.2. TEST INSTRUMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Calibration Due
Spectrum Analyzer	Agilent	N9010A	MY52221469	02/21/2017	02/20/2018

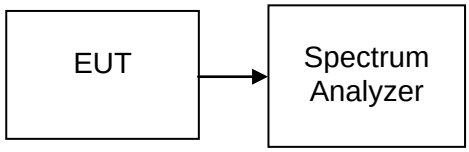
7.7.3. TEST PROCEDURES (please refer to measurement standard)

§15.247(e)specifies a conducted power spectral density (PSD) limit of 8 dBm in any 3 kHz band segment within the fundamental EBW during any time interval of continuous transmission. The same method as used to determine the conducted output power shall be used to determine the power spectral density (i.e.,if peak-detected fundamental power was measured then use the peak PSD procedure and if average fundamental power was measured then use the average PSD procedure).

10.2 Method PKPSD (peak PSD)

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

7.7.4. TEST SETUP



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7.7.5. TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b (Antenna 0)

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Test Result
Low	2412	-6.029	6	PASS
Mid	2437	-6.676		PASS
High	2462	-5.928		PASS

Test mode: IEEE 802.11b (Antenna 1)

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Test Result
Low	2412	-6.276	6	PASS
Mid	2437	-7.981		PASS
High	2462	-7.566		PASS

Test mode: IEEE 802.11g (Antenna 0)

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Test Result
Low	2412	-9.388	6	PASS
Mid	2437	-8.995		PASS
High	2462	-9.315		PASS

Test mode: IEEE 802.11g (Antenna 1)

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Test Result
Low	2412	-8.671	6	PASS
Mid	2437	-8.528		PASS
High	2462	-9.339		PASS

Remark: Limit=8–(Gain-6)

The beamforming gain=10log(N)=3, Antenna Gain=5+3

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Test mode: IEEE 802.11n HT20 MHz (Combine with Antenna 0 and Antenna 1)

Channel	Frequency (MHz)	PPSD (dBm)			Limit (dBm)	Test Result
		Antenna 0	Antenna 1	Total		
Low	2412	-7.764	-10.093	-5.764	6	PASS
Mid	2437	-10.373	-9.328	-6.809		PASS
High	2462	-10.114	-10.825	-7.445		PASS

Test mode: IEEE 802.11n HT40 MHz (Combine with Antenna 0 and Antenna 1)

Channel	Frequency (MHz)	PPSD (dBm)			Limit (dBm)	Test Result
		Antenna 0	Antenna 1	Total		
Low	2422	-11.982	-12.509	-9.227	6	PASS
Mid	2437	-10.867	-13.949	-9.130		PASS
High	2452	-12.886	-12.910	-9.888		PASS

Remark: Limit=8–(Gain-6)

The beamforming gain=10log(N)=3, Antenna Gain=5+3

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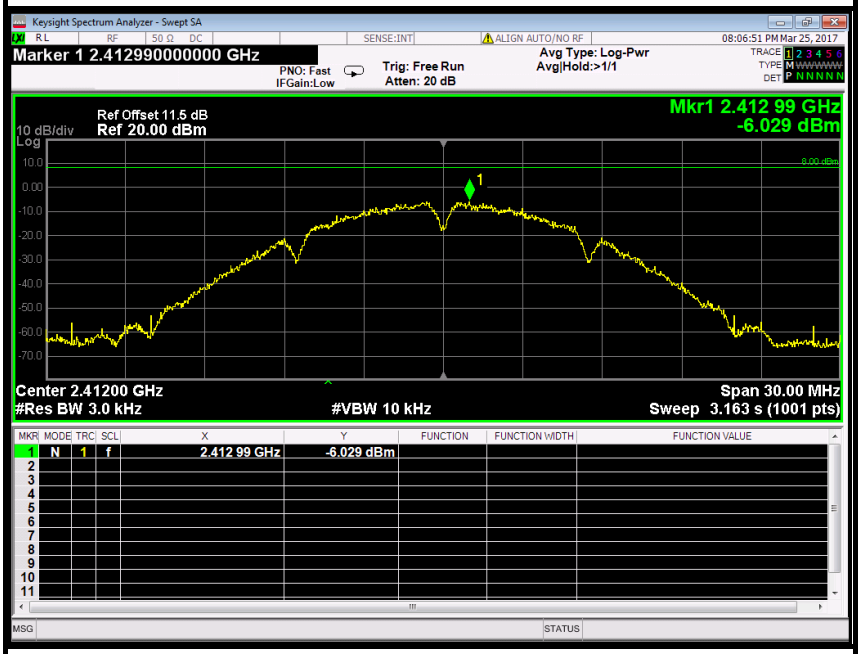
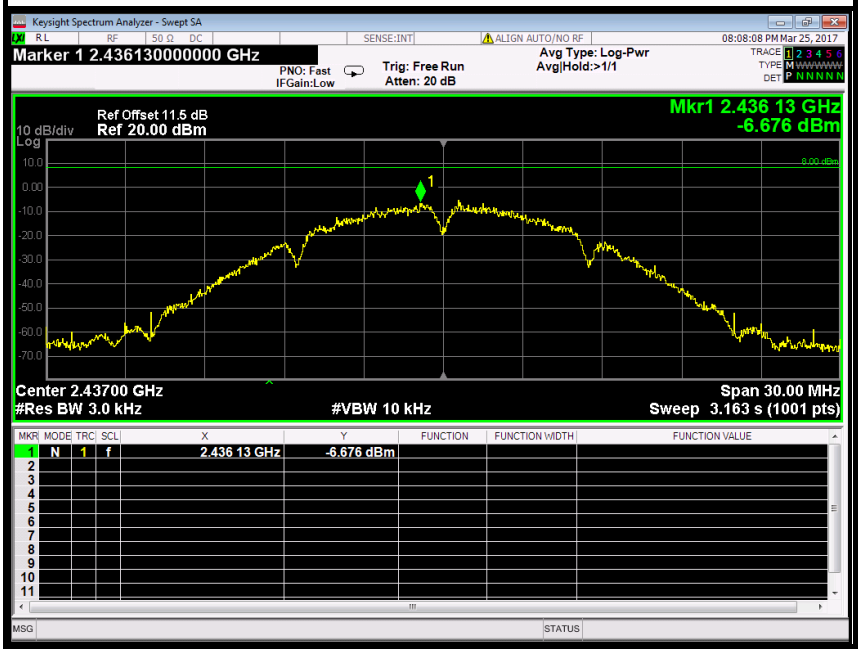
Test Plot

IEEE 802.11b mode (Antenna 0)

PPSD (CH Low)



PPSD (CH Mid)



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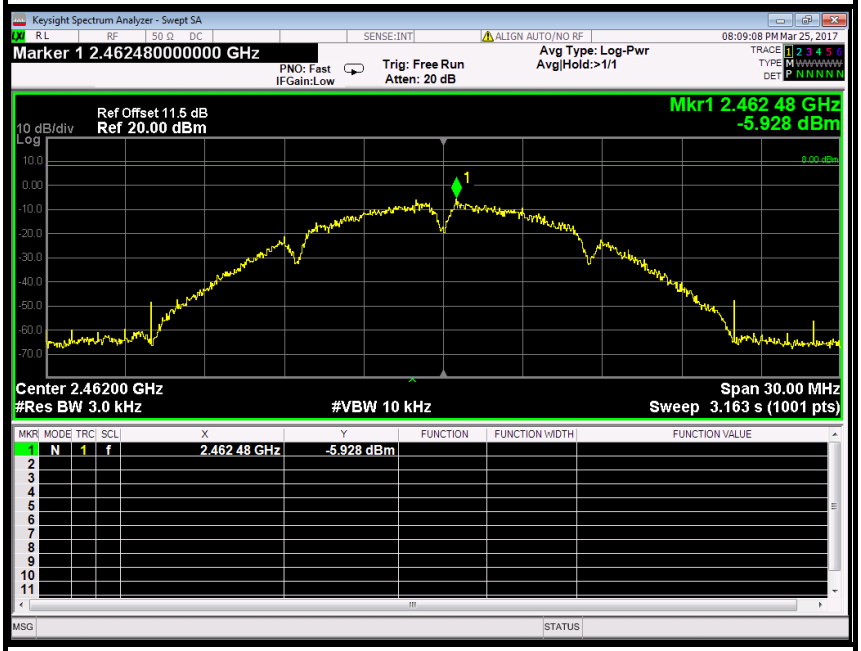
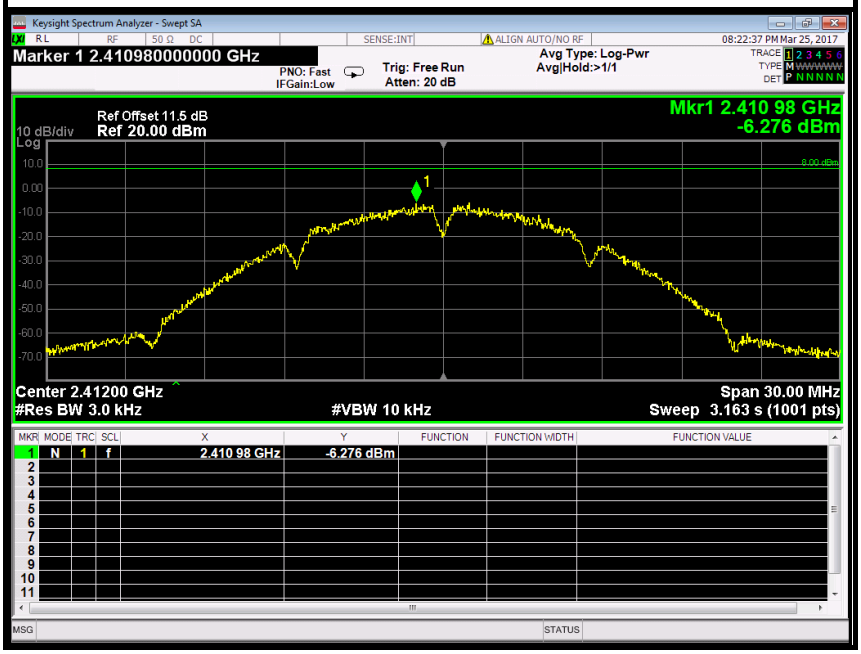
PPSD (CH High)



IEEE 802.11b mode (Antenna 1)

PPSD (CH Low)



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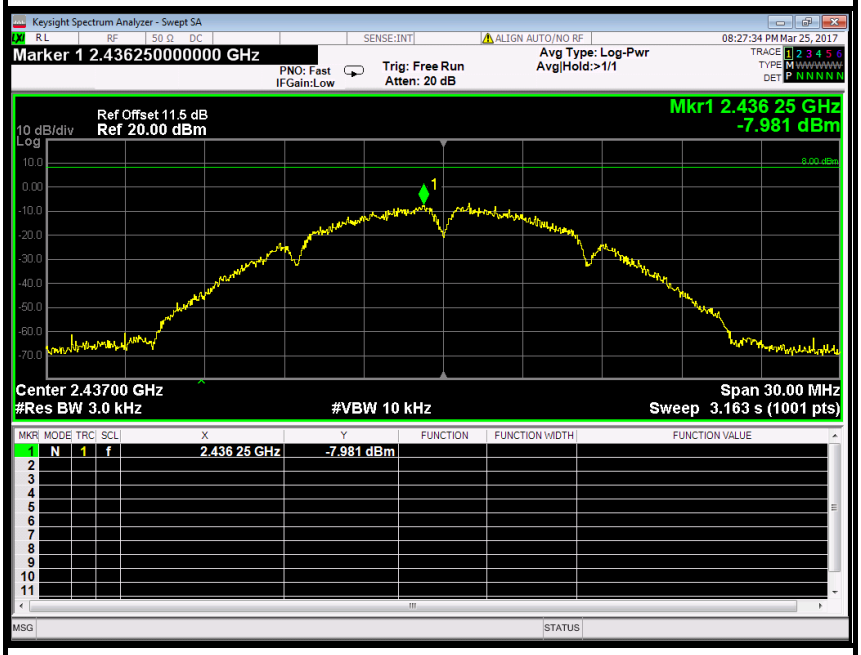
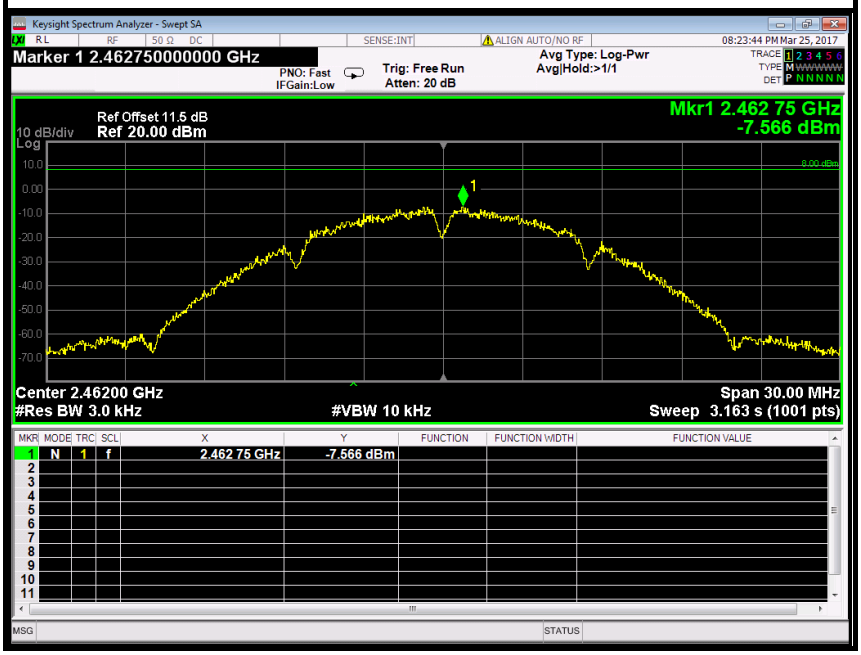
PPSD (CH Mid)



PPSD (CH High)



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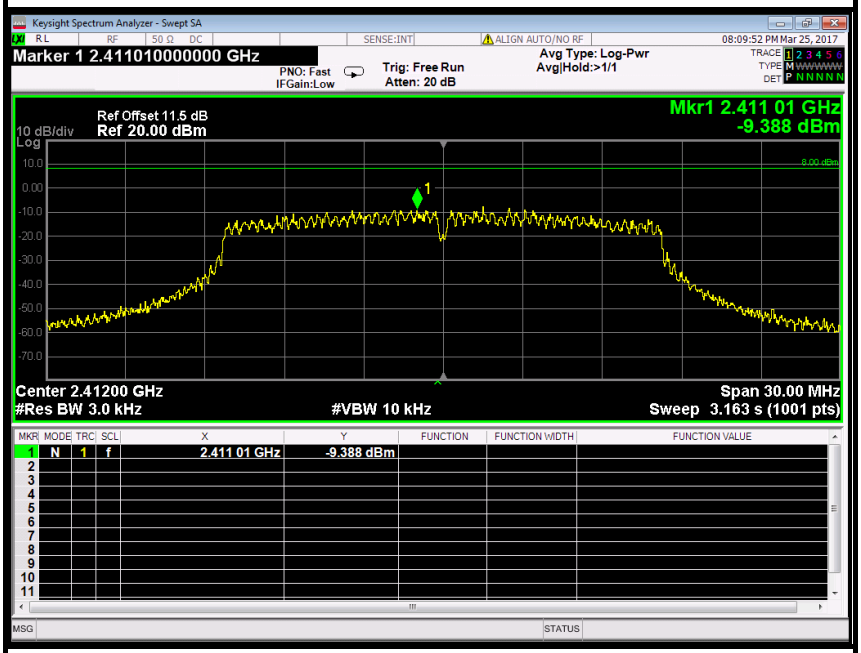
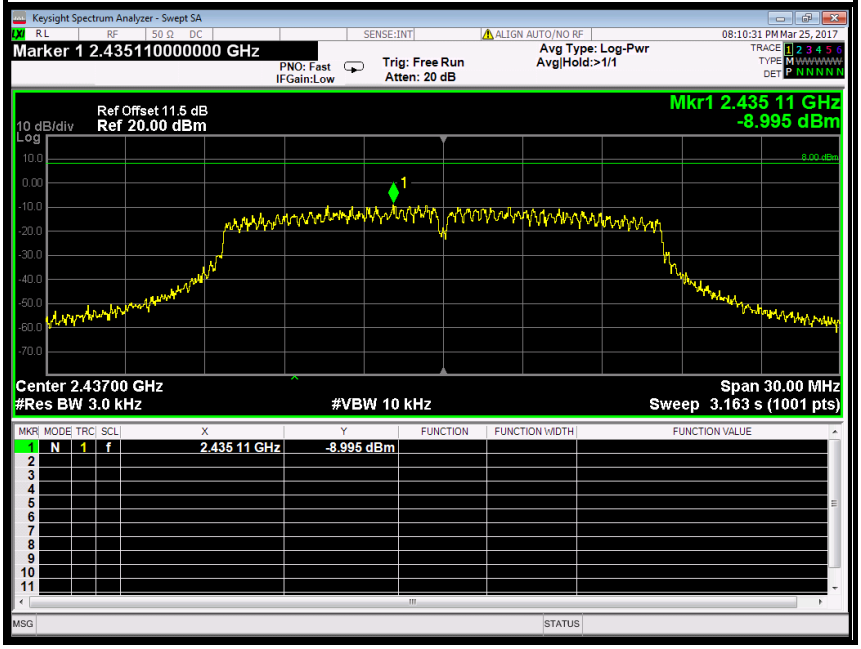
IEEE 802.11g mode (Antenna 0)

PPSD (CH Low)



PPSD (CH Mid)



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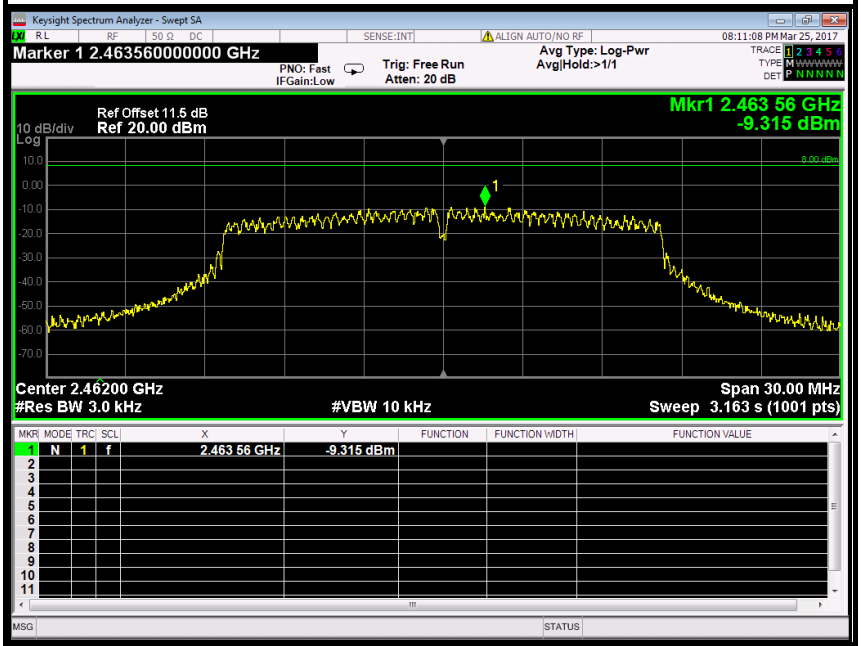
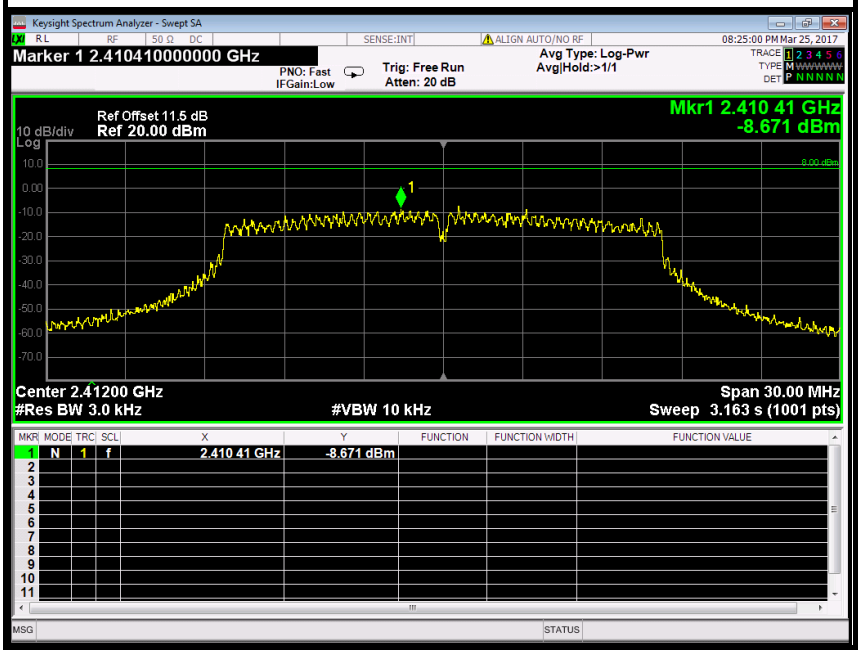
PPSD (CH High)



IEEE 802.11g mode (Antenna 1)

PPSD (CH Low)



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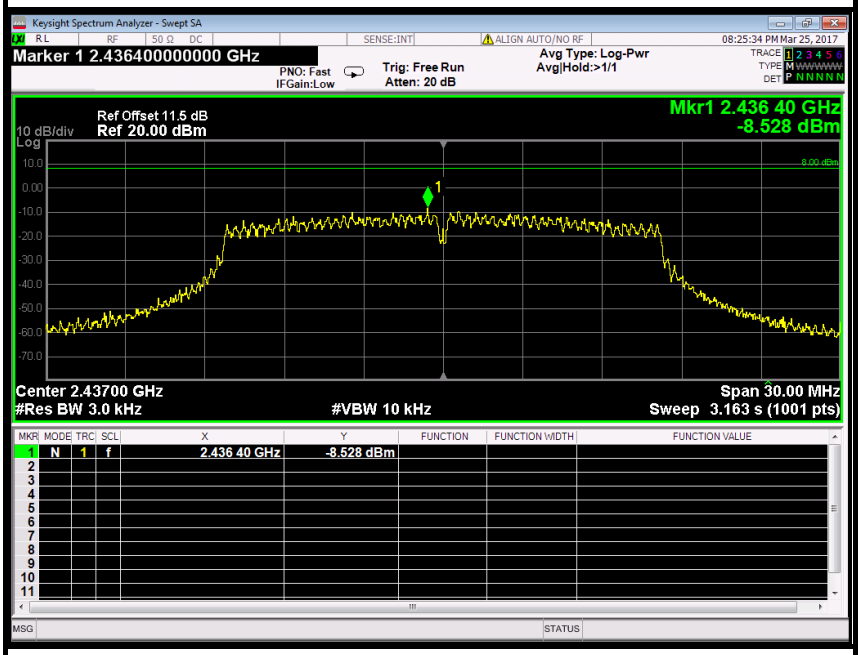
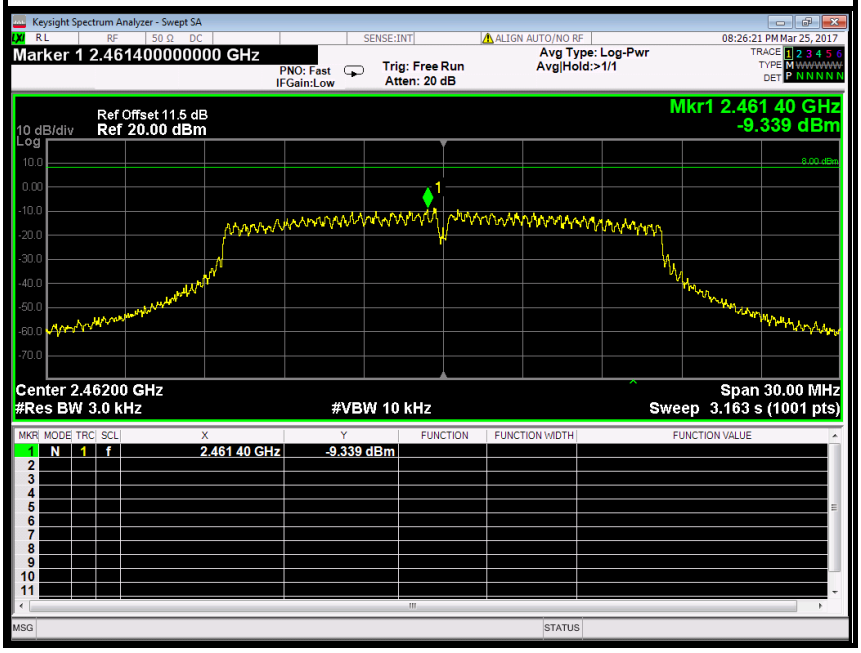
PPSD (CH Mid)



PPSD (CH High)



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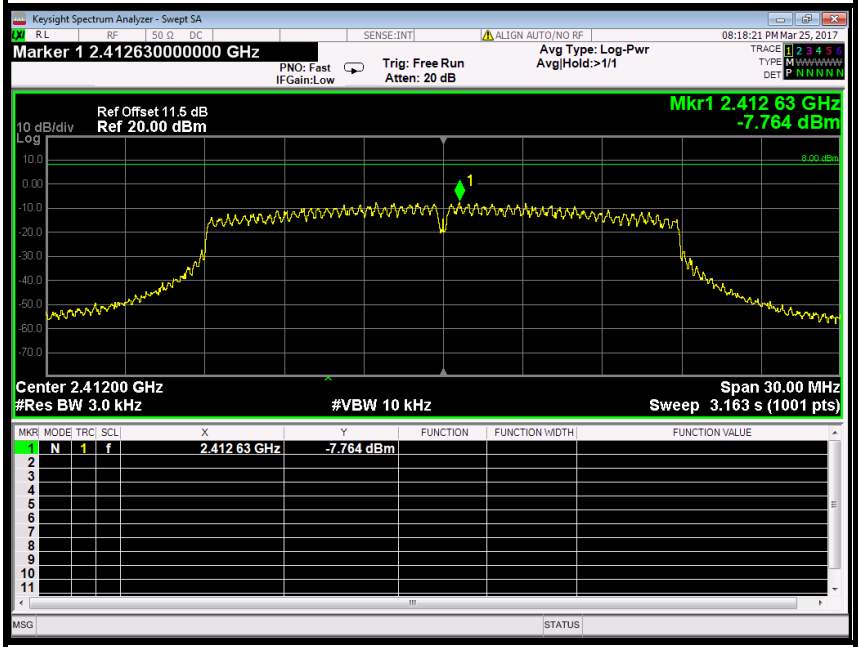
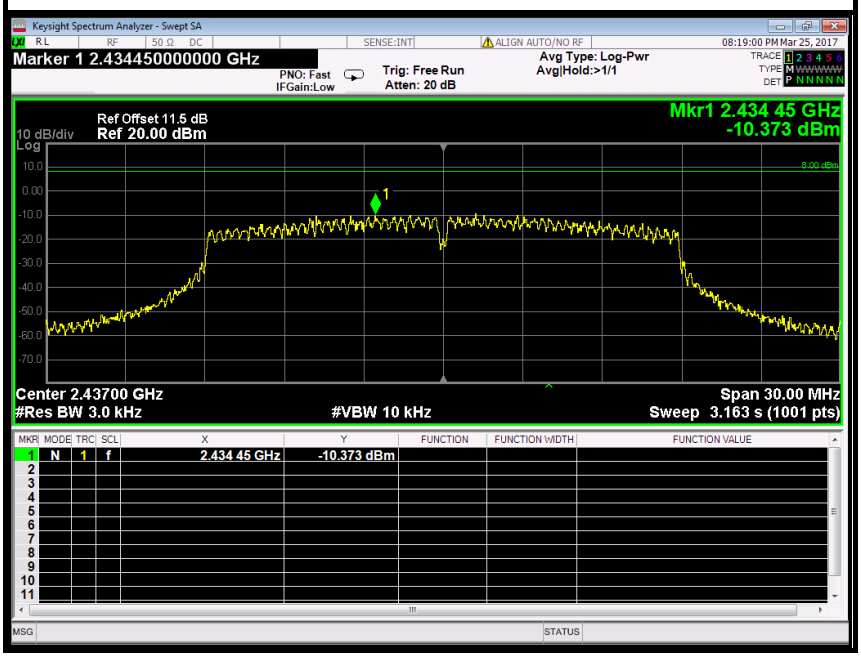
IEEE 802.11n HT20 MHz mode (Antenna 0)

PPSD (CH Low)



PPSD (CH Mid)



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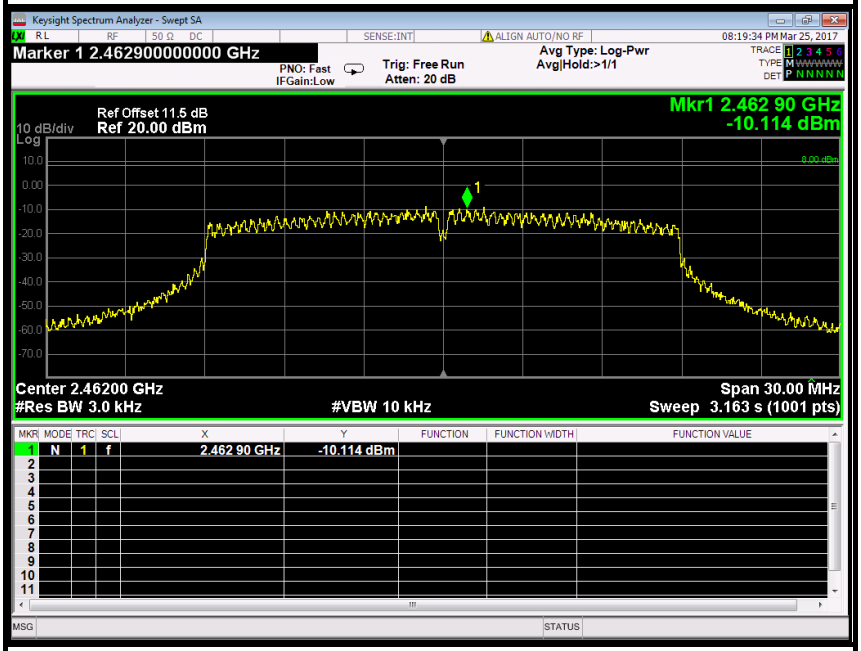
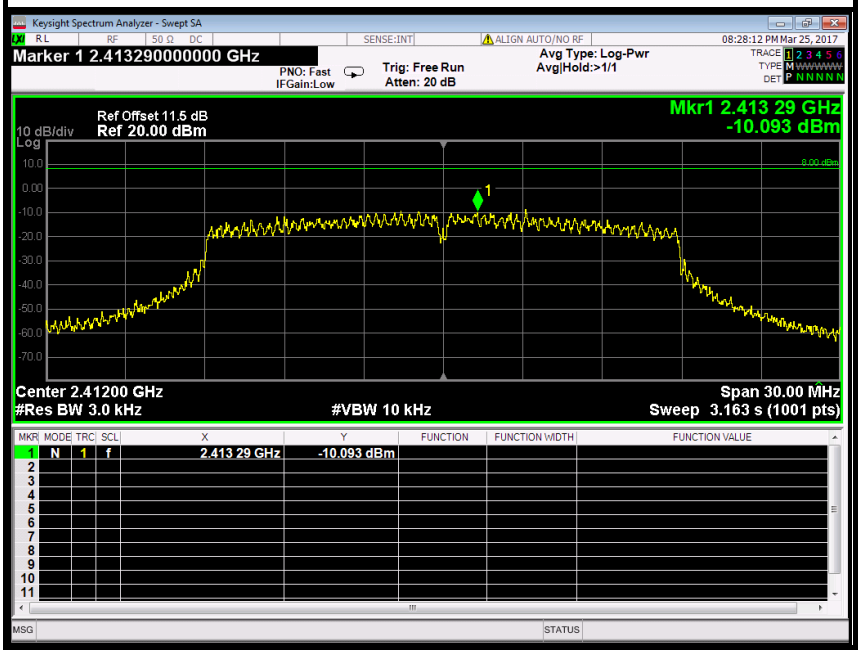
PPSD (CH High)



IEEE 802.11n HT20 MHz mode (Antenna 1)

PPSD (CH Low)



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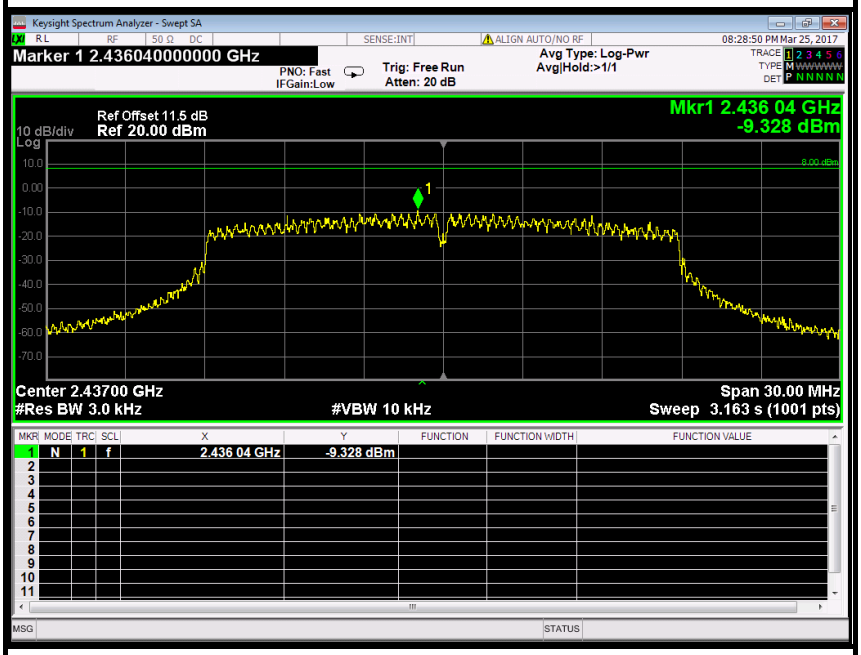
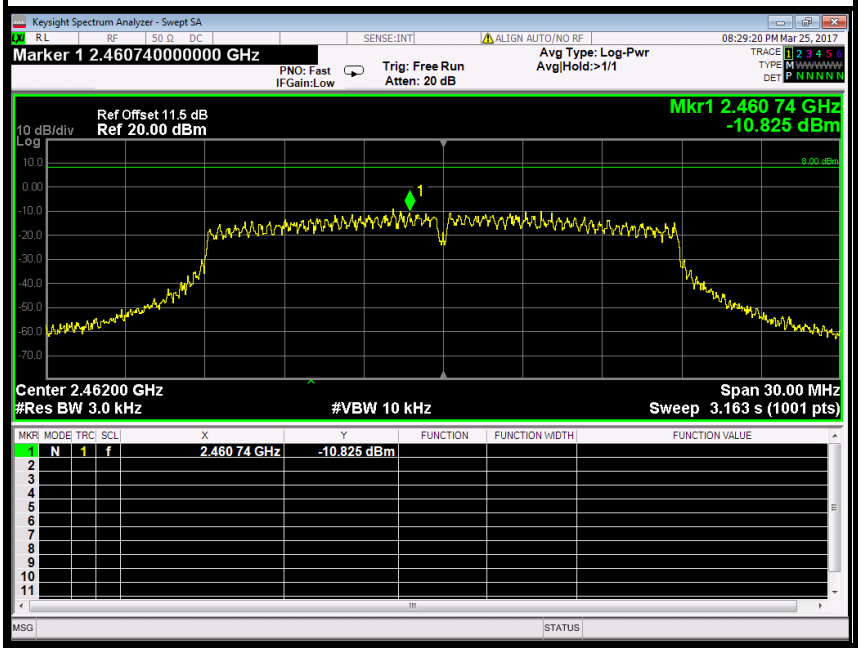
PPSD (CH Mid)



PPSD (CH High)



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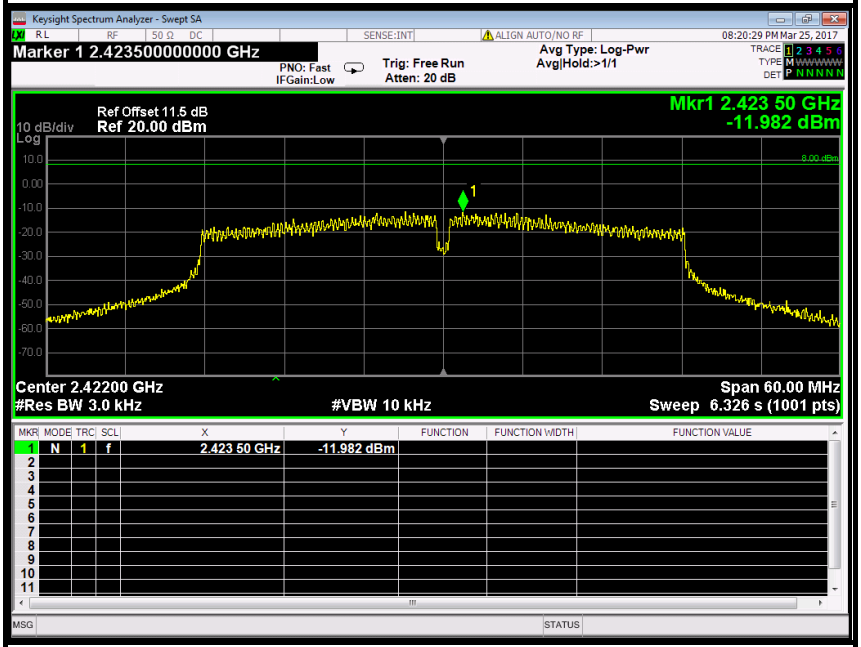
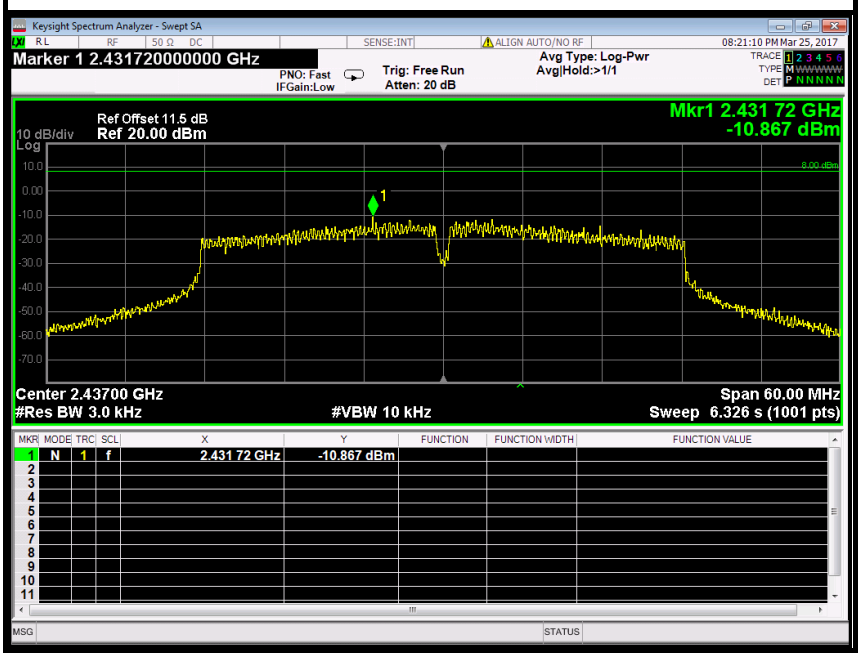
IEEE 802.11n HT40 MHz mode (Antenna 0)

PPSD (CH Low)



PPSD (CH Mid)



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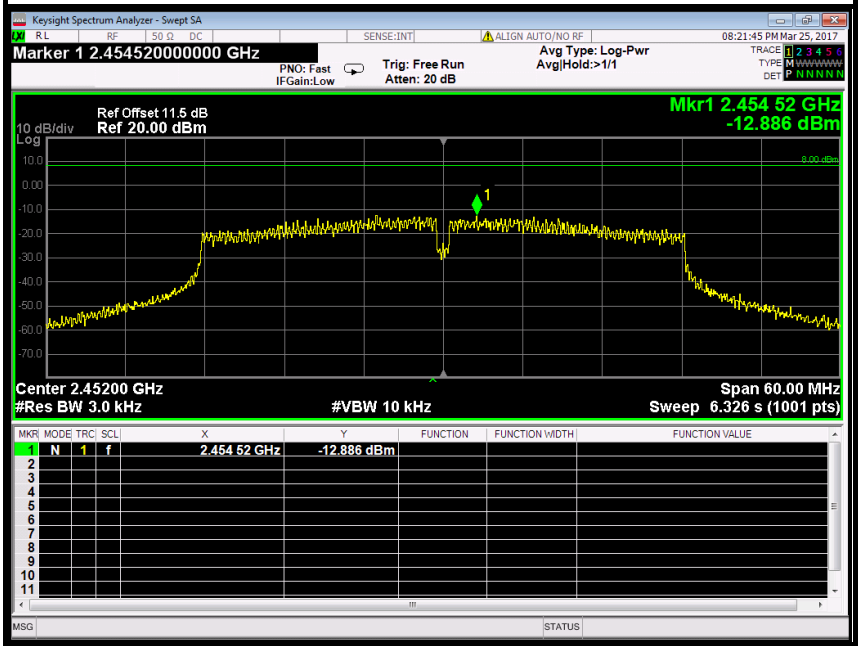
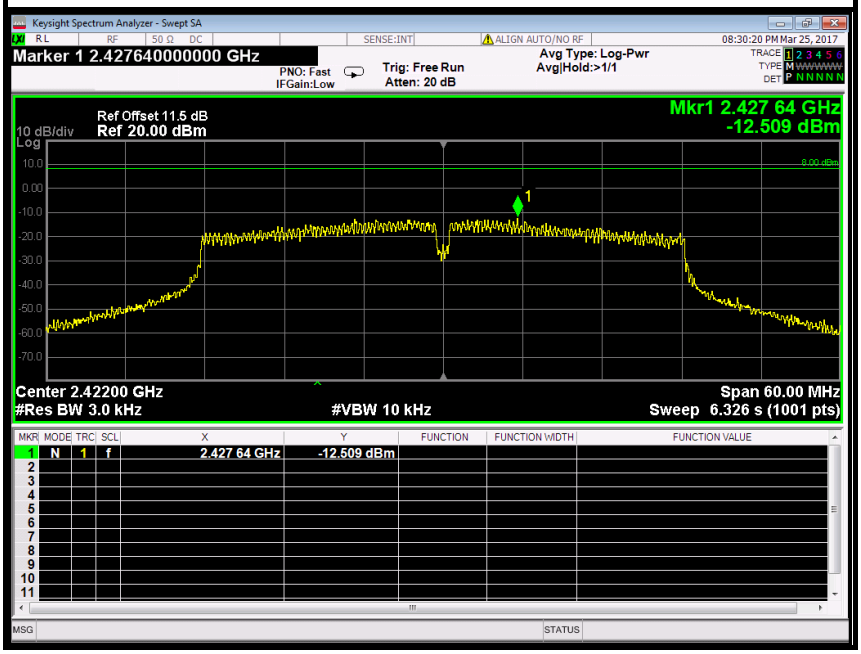
PPSD (CH High)



IEEE 802.11n HT40 MHz mode (Antenna 1)

PPSD (CH Low)



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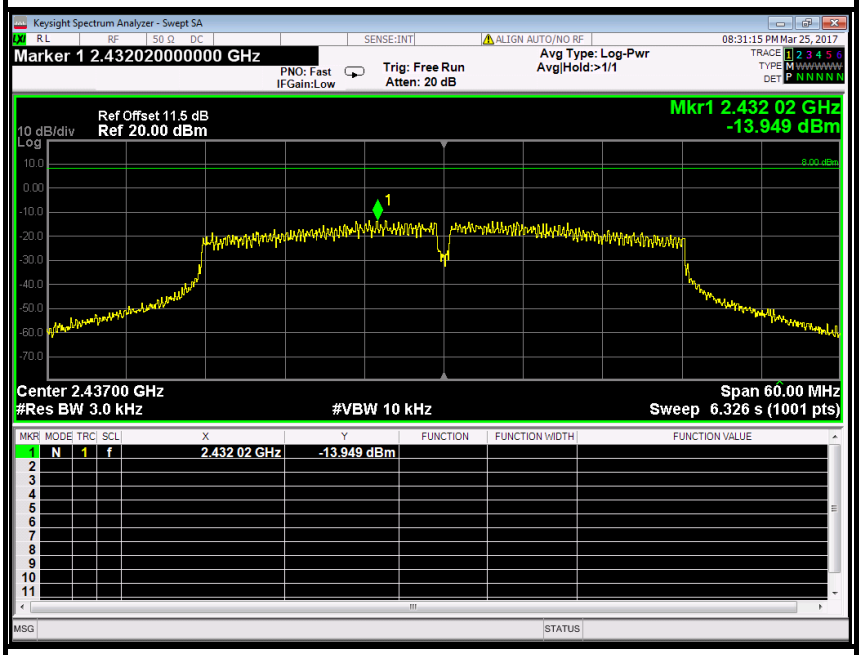
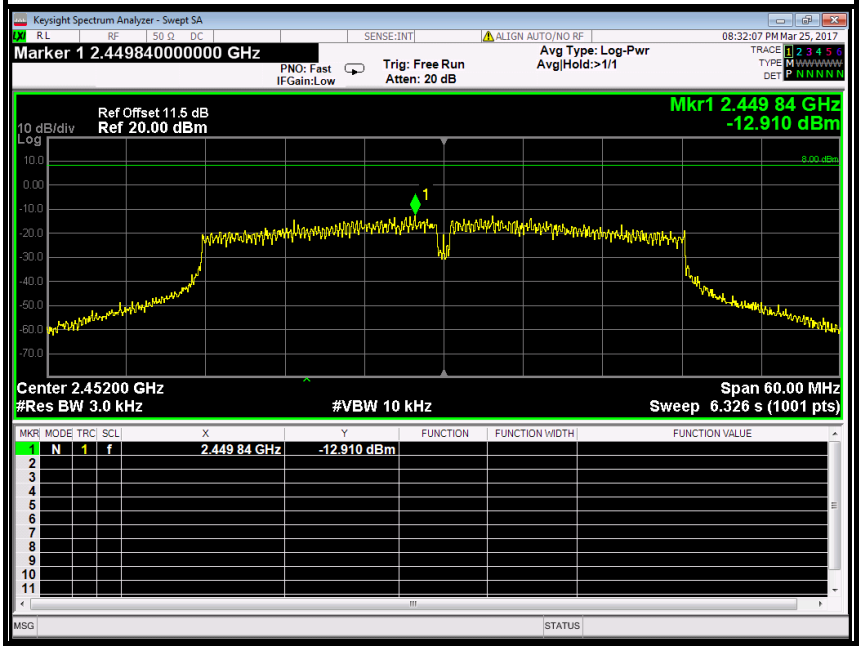
PPSD (CH Mid)



PPSD (CH High)



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