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TEST REPORT

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PAGES
58

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Radio Spectrum
TEST REPORT

Applicant:	**DiCon Fiberoptics, Inc.** **1689 Regatta Blvd. Richmond, CA 94804**
Product:	**LED Aquarium Lighting**
Model No.:	**AP9X**
Brand Name:	**Kessil**
FCC ID:	**2ASL8-AP9X**
Test Method/ Standard:	**47 CFR FCC Part 15.247 & ANSI C63.10 2013** **KDB 558074 D01 v05r02**
Test By:	**Intertek Testing Services Taiwan Ltd.,** **Hsinchu Laboratory** **No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li,** **Shiang-Shan District, Hsinchu City, Taiwan**

Testing Laboratory
0597

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Revision History

Report No.	Issue Date	Revision Summary
200300080TWN-001	Apr. 17, 2020	Original report

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Summary of Test Data

Test Requirement	Applicable Rule (Section 15.247)	Result
Minimum 6 dB Bandwidth	15.247(a)(2)	Pass
Maximum Peak Conducted Output Power	15.247(b)(3)	Pass
Power Spectral Density	15.247(e)	Pass
Emissions In Non-Restricted Frequency Bands	15.247(d)	Pass
Emissions In Restricted Frequency Bands (Radiated emission measurements)	15.247(d), 15.205, 15.209	Pass
Emission On The Band Edge	15.247(d), 15.205	Pass
AC Power Line Conducted Emission	15.207	Pass
Antenna Requirement	15.203	Pass

Note: Please note that the test results with statement of conformity, the decision rules which are based on: Safety Testing: the specification, standard or IEC Guide 115.
Other Testing: the specification, standard and not taking into account the measurement uncertainty.

1. General Information

1.1 Identification of the EUT

Product:	LED Aquarium Lighting
Model No.:	AP9X
Operating Frequency:	2412 MHz ~ 2462 MHz for 802.11b, 802.11g, 802.11n HT20 2422 MHz ~ 2452 MHz for 802.11n HT40
Channel Number:	11 channels for 2412 MHz ~ 2462 MHz 7 channels for 2422 MHz ~ 2452 MHz
Frequency of Each Channel:	2412+5 k, k＝0 ~ 10 for 802.11b, 802.11g, 802.11n HT20 2422+5 k, k＝0 ~ 6 for 802.11n HT40
Access scheme:	DSSS, OFDM
Rated Power:	DC 48V from adapter
Power Cord:	N/A
Sample receiving date:	Mar. 05, 2020
Sample condition:	Workable
Test Date(s):	Mar. 10, 2020~ Mar. 25, 2020

1.2 Antenna description

Antenna Gain : 4.4 dBi
Antenna Type : PCB antenna
Connector Type : I-Pex

1.3 Adapter information

The EUT will be supplied with a power supply from below list:

No.	Model no.	Specification
Adapter	HLG-185H-48	I/P: 100-240 Vac, 2.1 A, 50/60 Hz 277 Vac, 0.8 A, 50/60 Hz O/P: 48Vdc, 3.9 A, 187.2W

1.4 Operation mode

Test Voltage: 120 Vac, 60Hz
Connected to Notebook via USB Cable, executing “Tera Term” and setting COM port and Baud rate to enter test mode. selecting different frequency and modulation for the test.

With individual verifying, the maximum output power was found out 1 Mbps data rate for 802.11b mode, 6 Mbps data rate for 802.11g mode, 6.5 Mbps data rate for 802.11n(HT20) mode, 13.5 Mbps data rate for 802.11n(HT40) mode the final tests were executed under these conditions recorded in this report individually.

Modulation mode	Transmit path
	Chain 0 / Main
802.11b	V
802.11g	V
802.11 n (HT20)	V
802.11 n (HT40)	V

1.5 Peripherals equipment

Peripherals	Brand	Model No.	Serial No.	Data cable
Notebook PC	Dell	Latitude E5420	N/A	1. RJ-45 Cable 1 meter × 1 2. Non-shielded USB to Type-C cable 0.8 meter × 1

2. Minimum 6 dB Bandwidth

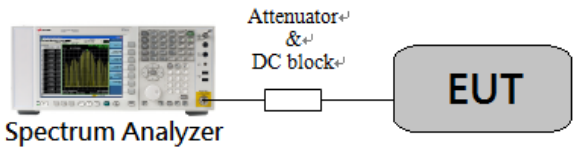
2.1 Instrument Setting

Spectrum Parameter	Setting
Detector	Peak
RBW	100kHz
VBW	≧3 x RBW
Sweep	Auto couple
Trace	Allow the trace to stabilize.
Span	Between two times and five times the occupied bandwidth
Attenuation	Auto

2.2 Test Procedure

Step 1	The transmitter output was connected to the spectrum analyzer.
Step 2	Test was performed accordance with ANSI C63.10.
Step 3	Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

2.3 Test Diagram



2.4 Limit

The minimum 6 dB bandwidth shall be at least 500 kHz.

2.5 Operating Environment Condition

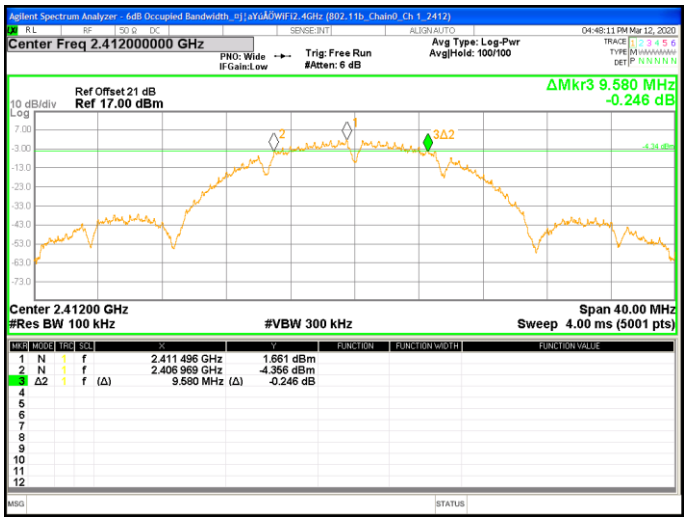
Temperature (℃) :	20
Relative Humidity (%) :	57

2.6 Test Results

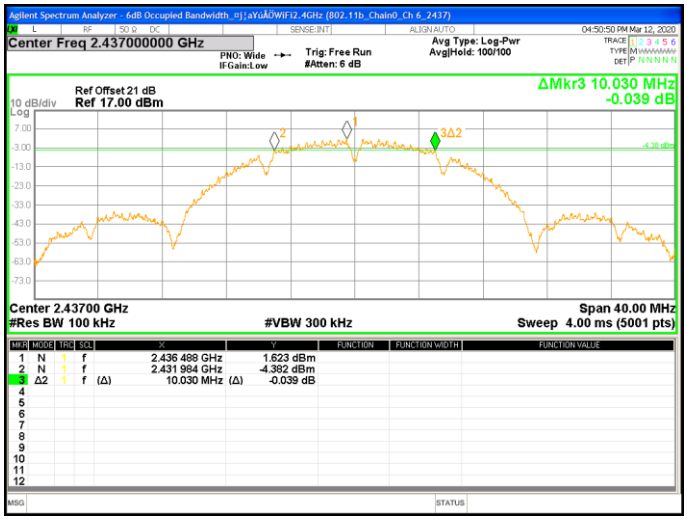
Chain 0

Mode	Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
802.11b	1	2412	9.58	>0.5	Pass
	6	2437	10.03	>0.5	Pass
	11	2462	9.56	>0.5	Pass
802.11g	1	2412	13.15	>0.5	Pass
	6	2437	15.04	>0.5	Pass
	11	2462	13.81	>0.5	Pass
802.11n(HT20)	1	2412	15.36	>0.5	Pass
	6	2437	12.78	>0.5	Pass
	11	2462	15.08	>0.5	Pass
802.11n(HT40)	3	2422	35.10	>0.5	Pass
	6	2437	33.89	>0.5	Pass
	9	2452	35.10	>0.5	Pass

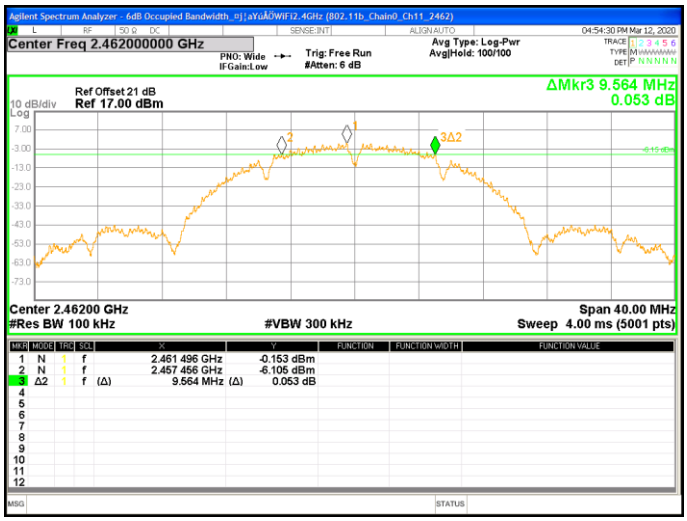
Chain0 : 6dB Bandwidth @ 802.11b Mode Ch 1



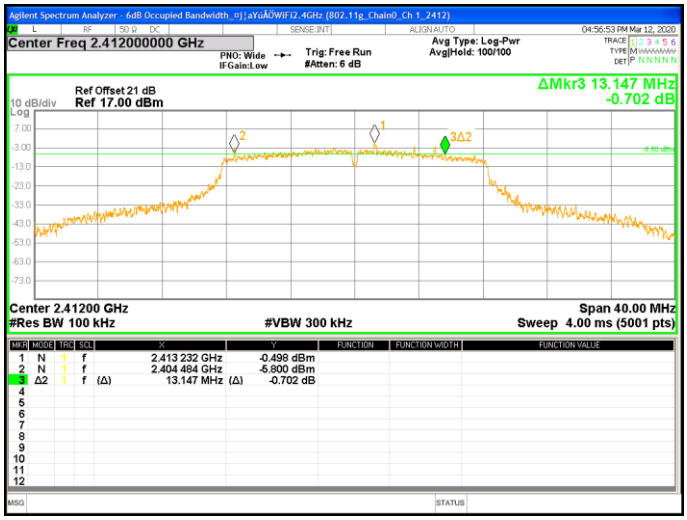
Chain0 : 6dB Bandwidth @ 802.11b Mode Ch 6



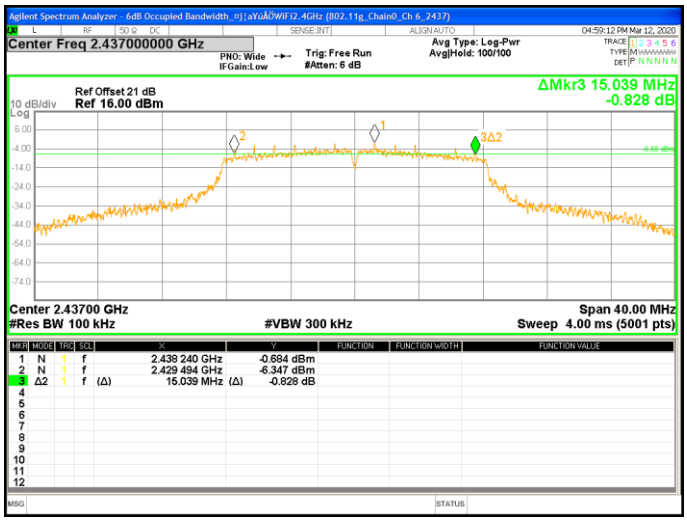
Chain0 : 6dB Bandwidth @ 802.11b Mode Ch11



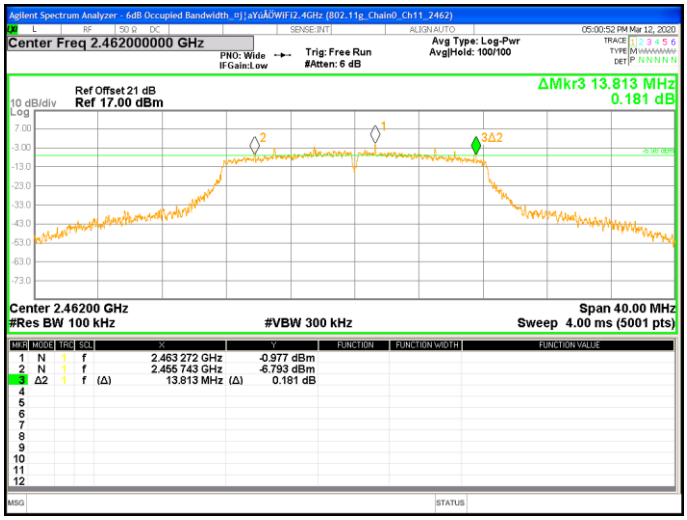
Chain0 : 6dB Bandwidth @ 802.11g Mode Ch 1



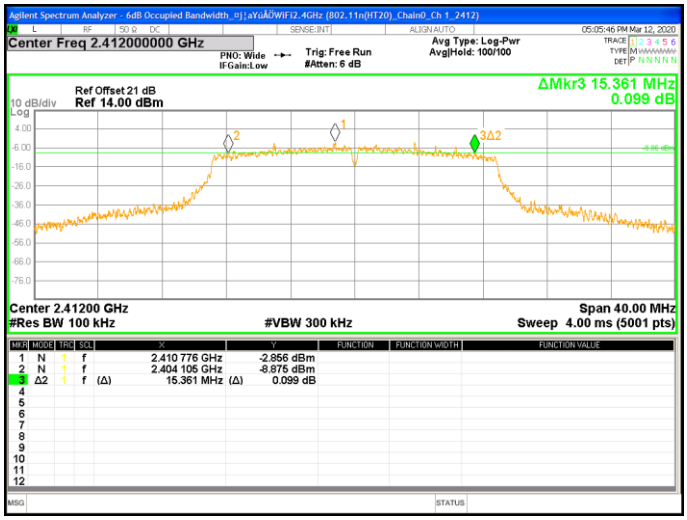
Chain0 : 6dB Bandwidth @ 802.11g Mode Ch 6



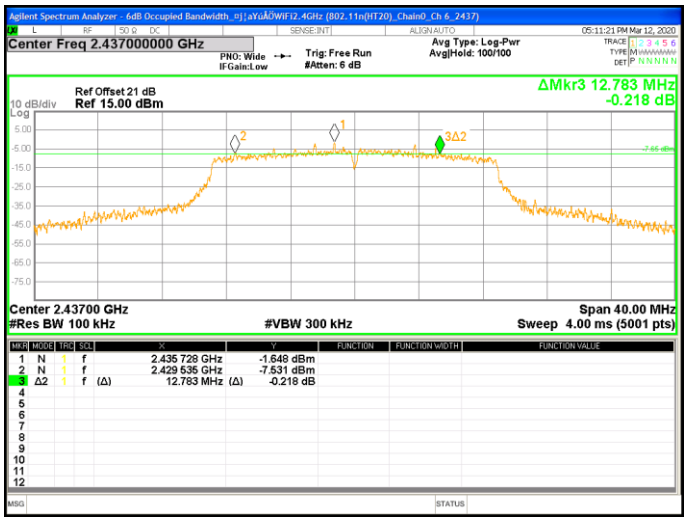
Chain0 : 6dB Bandwidth @ 802.11g Mode Ch11



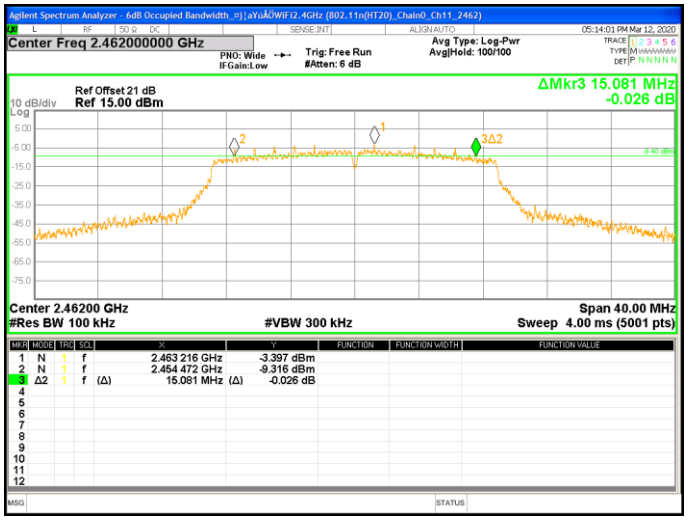
Chain0 : 6dB Bandwidth @ 802.11n(HT20) Mode Ch 1



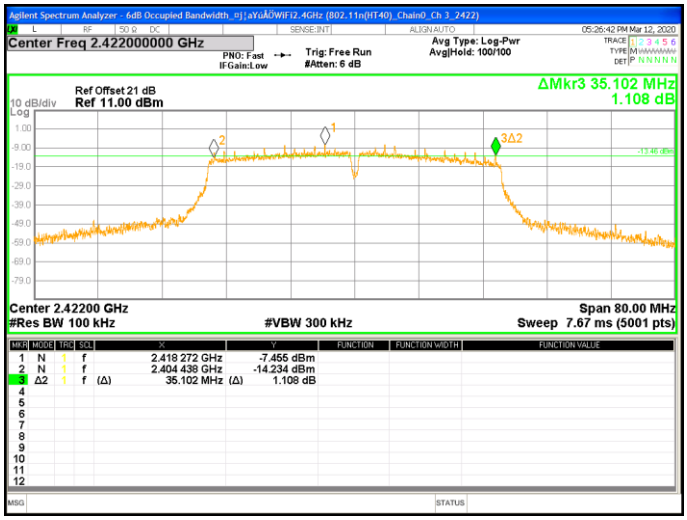
Chain0 : 6dB Bandwidth @ 802.11n(HT20) Mode Ch 6



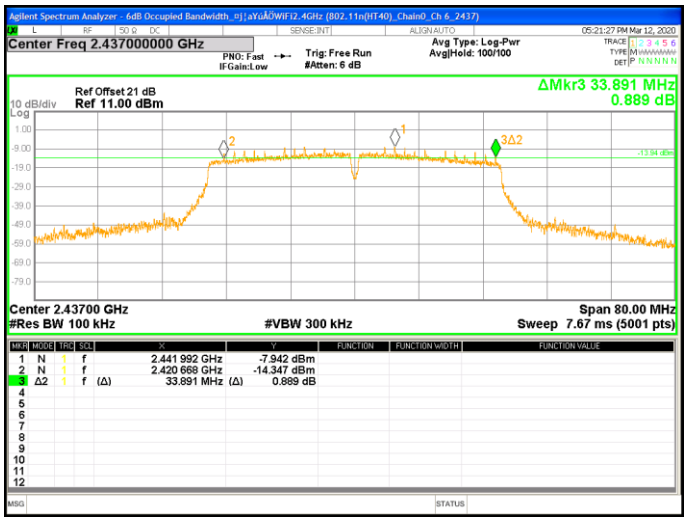
Chain0 : 6dB Bandwidth @ 802.11n(HT20) Mode Ch11



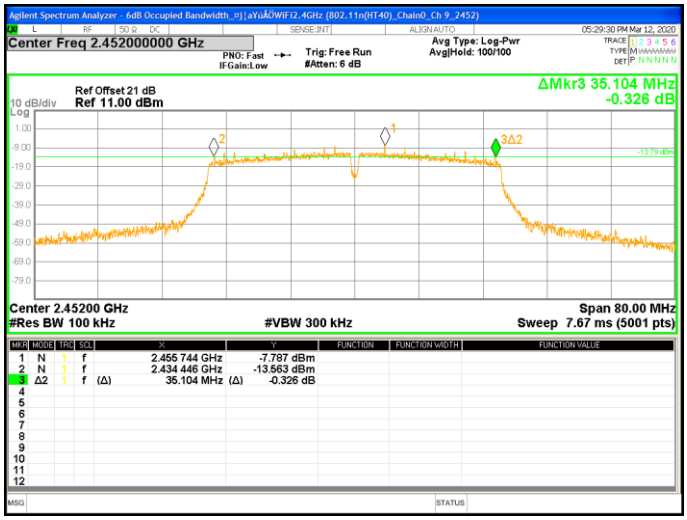
Chain0 : 6dB Bandwidth @ 802.11n(HT40) Mode Ch 3



Chain0 : 6dB Bandwidth @ 802.11n(HT40) Mode Ch 6



Chain0 : 6dB Bandwidth @ 802.11n(HT40) Mode Ch 9



3. Maximum Peak Conducted Output Power

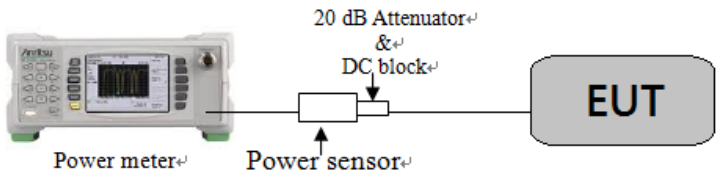
3.1 Instrument Setting

Power Meter Parameter	Setting
Bandwidth	65MHz bandwidth is greater than the EUT emission bandwidth
Detector	Peak & Average

3.2Test Procedure

The preferred methodology is to use integrated average power measurements, as described in 11.9.2 and 11.13.3 of ANSI C63.10. The peak integrated band power methods of 11.9.1.2 and 11.13.3.2 of ANSI C63.10 are not applicable for FCC compliance testing purposes.

3.3 Test Diagram



3.4 Limit

For systems using digital modulation in the 2400-2483.5 MHz: 1 Watt (30dBm)

3.5 Operating Environment Condition

Temperature (℃) :	20
Relative Humidity (%) :	57

3.6 Test Results

Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Output Power (AV) (dBm)	Total Power (AV) (mW)	Maximum power (PK) (dBm)	Maximum power (PK) (mW)	Limit (dBm)	Margin (dB)
802.11b	1	2412	1	13.94	24.77	15.79	37.93	30.00	-14.21
	6	2437		14.03	25.29	15.82	38.19	30.00	-14.18
	11	2462		12.06	16.07	13.84	24.21	30.00	-16.16
802.11g	1	2412	6	12.16	16.44	18.60	72.44	30.00	-11.40
	6	2437		12.22	16.67	18.79	75.68	30.00	-11.21
	11	2462		11.49	14.09	18.38	68.87	30.00	-11.62
802.11n (HT20)	1	2412	6.5	11.20	13.18	18.55	71.61	30.00	-11.45
	6	2437		10.97	12.50	18.64	73.11	30.00	-11.36
	11	2462		10.26	10.62	18.27	67.14	30.00	-11.73
802.11n (HT40)	3	2422	13.5	8.63	7.29	15.83	38.28	30.00	-14.17
	6	2437		8.42	6.95	15.97	39.54	30.00	-14.03
	9	2452		8.23	6.65	16.41	43.75	30.00	-13.59

4. Power Spectral Density

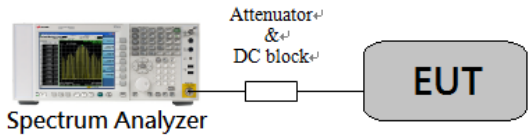
4.1 Instrument Setting

Spectrum Function	Setting
Detector	Peak
RBW	≧3 kHz
VBW	≧3 x RBW
Sweep	Auto couple
Trace	Max hold
Span	1.5 times x 6dB bandwidth
Attenuation	Auto

4.2 Test Procedure

Step 1	Test procedure refer to subclause 11.10 of ANSI C63.10.
Step 2	Using the maximum conducted output power in the fundamental emission demonstrates compliance. The EUT must be configured to transmit continuously at full power over the measurement duration.
Step 3	Use the peak marker function to determine the maximum amplitude level within the RBW.

4.3 Test Diagram



4.4 Limit

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

4.5 Operating Environment Condition

Temperature (℃) :	20
Relative Humidity (%) :	57

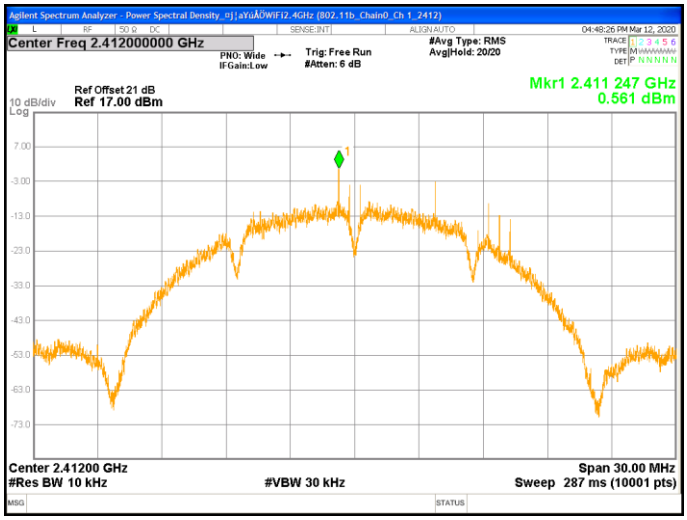
4.6 Test Results

Mode	Channel	Frequency (MHz)	RBW factor	PSD in 10kHz	PSD in 3kHz		Limit (dBm)	Margin (dB)
					(dBm)	(mW)		
802.11b	1	2412	5.23	0.56	-4.67	0.34	8	-12.67
	6	2437	5.23	-1.65	-6.88	0.21	8	-14.88
	11	2462	5.23	-4.73	-9.96	0.10	8	-17.96
802.11g	1	2412	5.23	-11.02	-16.24	0.02	8	-24.24
	6	2437	5.23	-10.02	-15.25	0.03	8	-23.25
	11	2462	5.23	-9.24	-14.47	0.04	8	-22.47
802.11n (HT20)	1	2412	5.23	-11.19	-16.42	0.02	8	-24.42
	6	2437	5.23	-11.44	-16.67	0.02	8	-24.67
	11	2462	5.23	-12.48	-17.70	0.02	8	-25.70
802.11n (HT40)	3	2422	5.23	-17.49	-22.72	0.01	8	-30.72
	6	2437	5.23	-18.15	-23.37	0.00	8	-31.37
	9	2452	5.23	-17.61	-22.84	0.01	8	-30.84

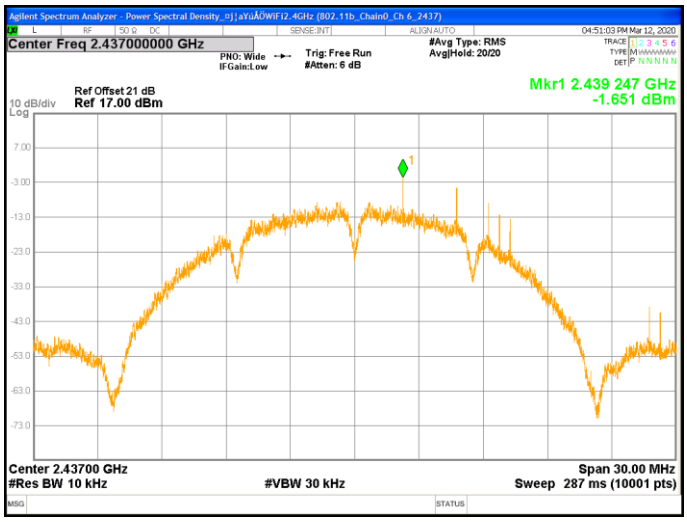
Note: MIMO Correction: 10log(Nant)= 10log(2) = 3

Correction Factor =10log(10kHz/3kHz)

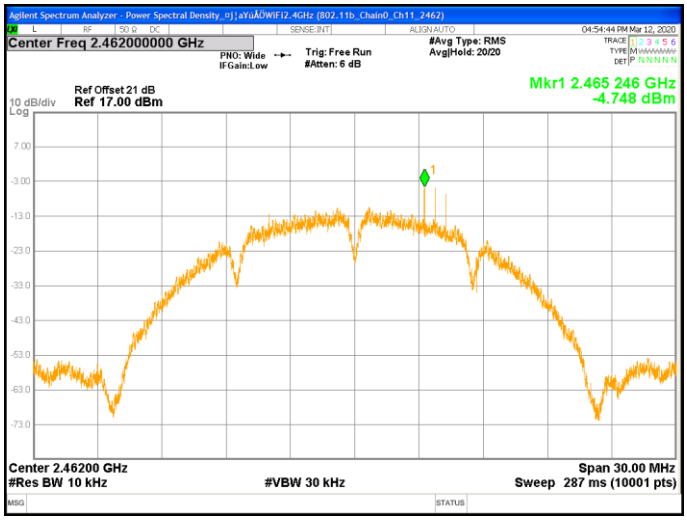
Chain0 : Power Spectral Density @ 802.11b Mode Ch 1



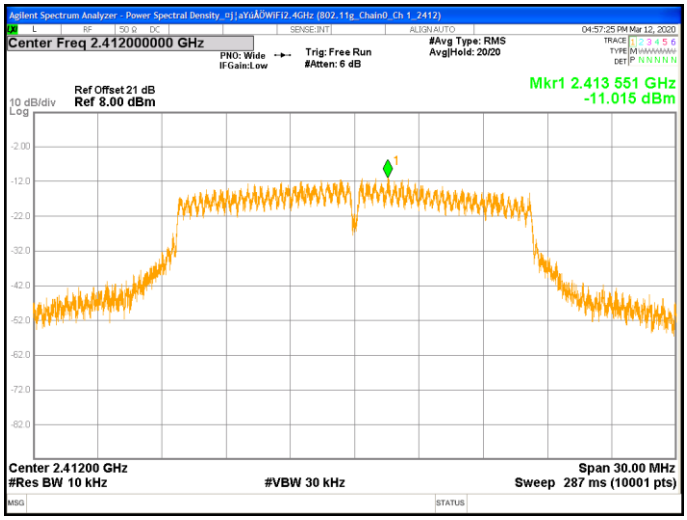
Chain0 : Power Spectral Density @ 802.11b Mode Ch 6



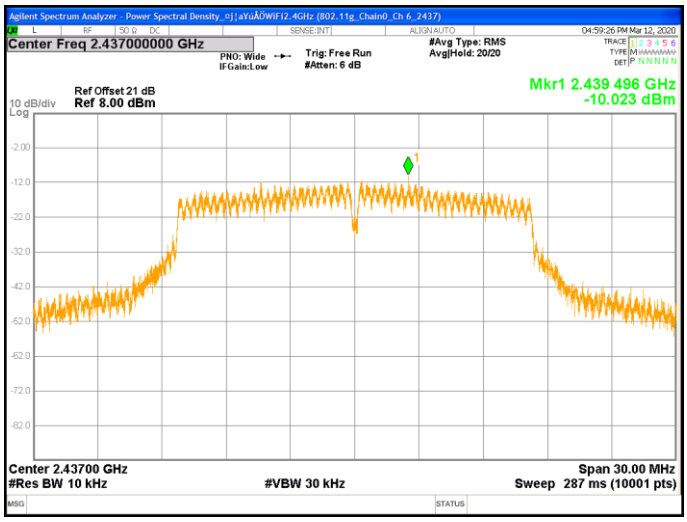
Chain0 : Power Spectral Density @ 802.11b Mode Ch11



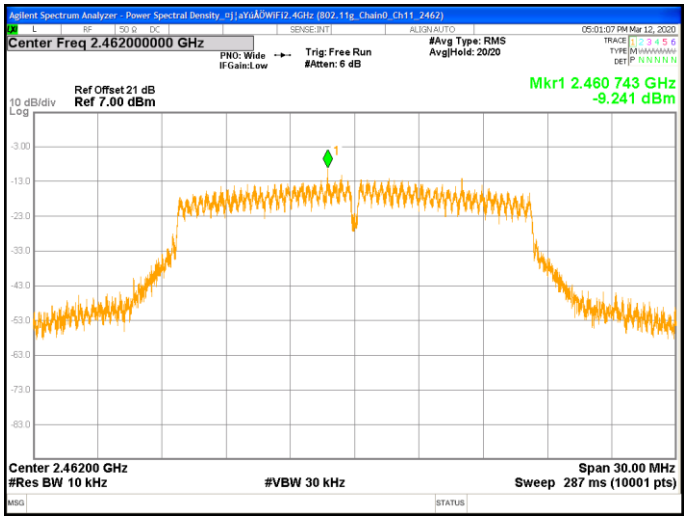
Chain0 : Power Spectral Density @ 802.11g Mode Ch 1



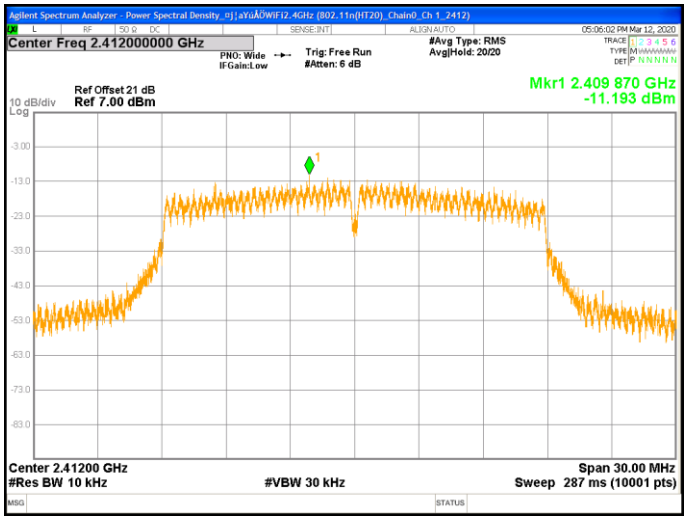
Chain0 : Power Spectral Density @ 802.11g Mode Ch 6



Chain0 : Power Spectral Density @ 802.11g Mode Ch11



Chain0 : Power Spectral Density @ 802.11n(HT20) Mode Ch 1



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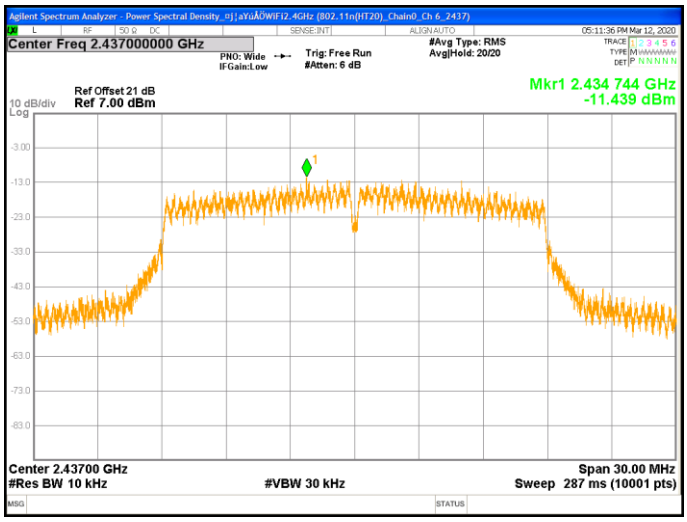
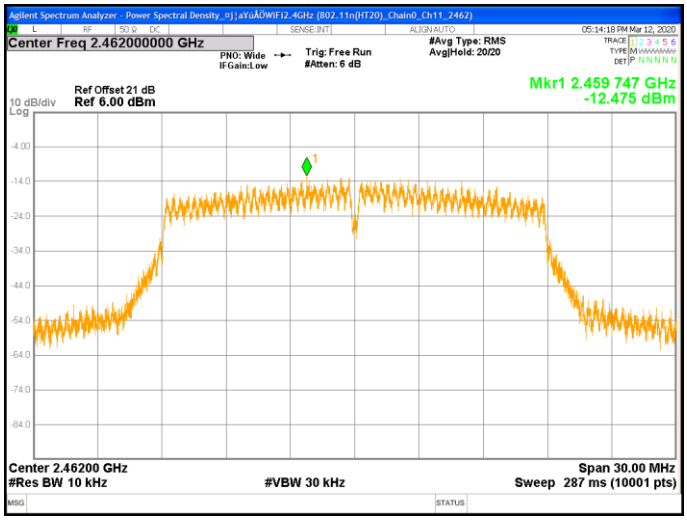
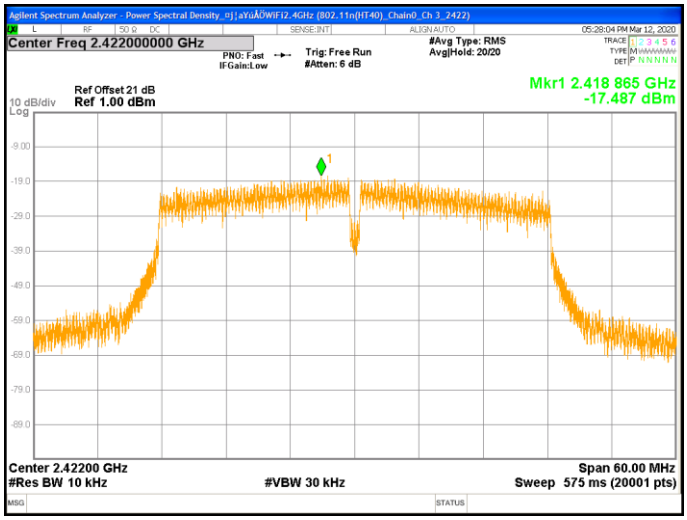


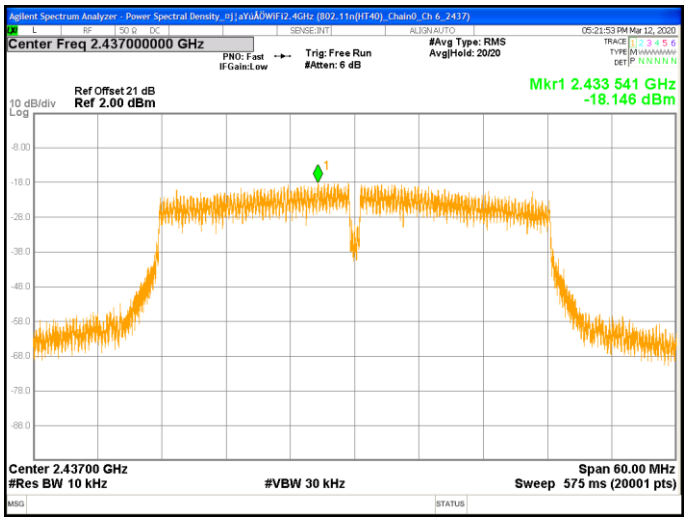
Chain0 : Power Spectral Density @ 802.11n(HT20) Mode Ch11



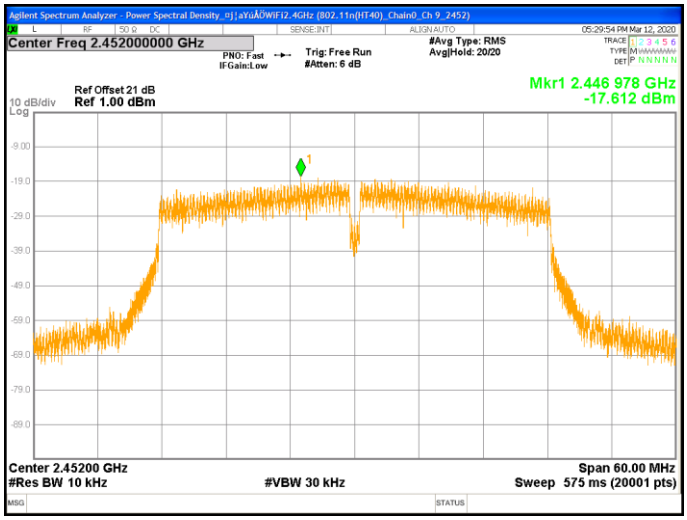
Chain0 : Power Spectral Density @ 802.11n(HT40) Mode Ch 3



Chain0 : Power Spectral Density @ 802.11n(HT40) Mode Ch 6



Chain0 : Power Spectral Density @ 802.11n(HT40) Mode Ch 9



5. Emissions in Non-Restricted Frequency Bands

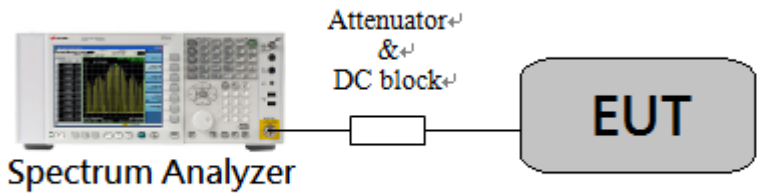
5.1 Instruments Setting

Spectrum Function	Setting (Reference Level)	Setting (Emission Level)
Detector	Peak	Peak
RBW	≧100 kHz	≧100 kHz
VBW	≧3 x RBW	≧3 x RBW
Sweep	Auto couple	Auto couple
Trace	Max hold	Max hold
Span	≧1.5 time 6dB bandwidth	
Attenuation	Auto	Auto

5.2 Test Procedure

Step 1 The procedure was used in antenna-port conducted and connected to the spectrum analyzer.
Step 2 Set instrument center frequency to center frequency.
Step 3 Use the parameter configured in subclause 11.11 of ANSI C63.10 to measure.
Step 4 Use the peak marker function to determine the maximum amplitude level.

5.3 Test Diagram



5.4 Limit

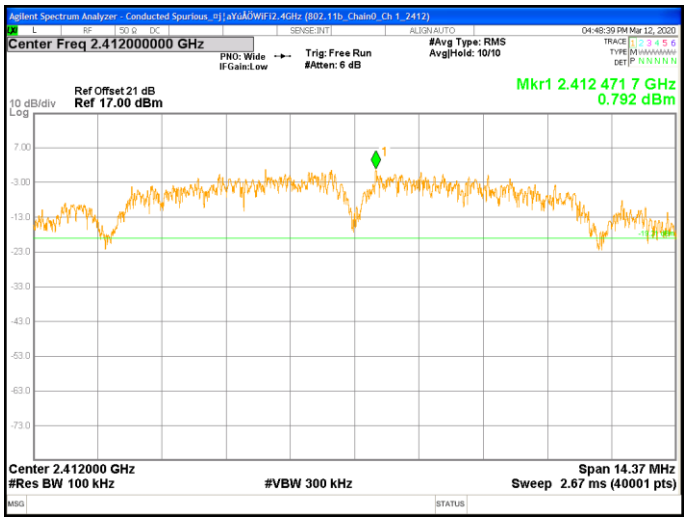
The peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz

5.5 Operating Environment Condition

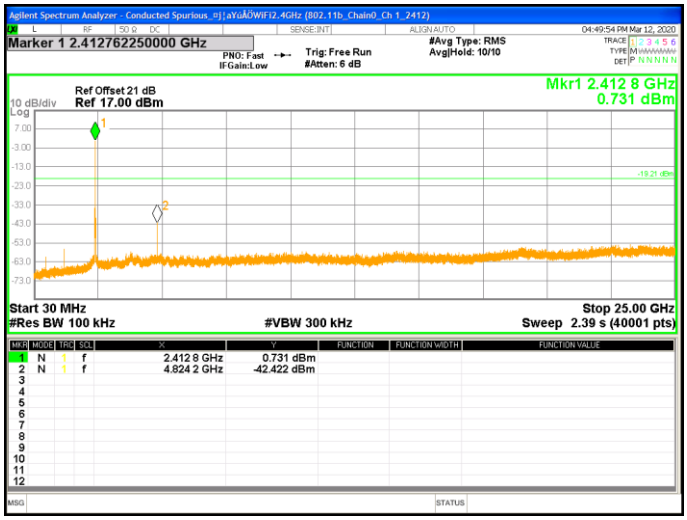
Temperature (℃) :	20
Relative Humidity (%) :	57

5.6 Test Results

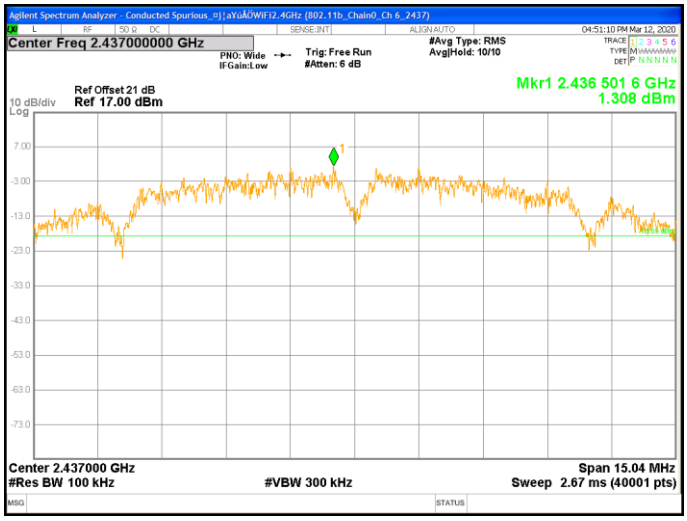
Chain0 : Conducted Spurious @ 802.11b Mode Ch 1



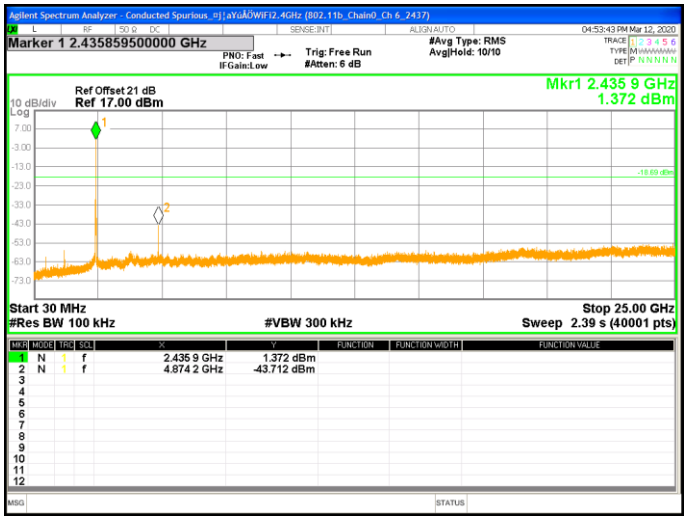
Chain0 : Conducted Spurious @ 802.11b Mode Ch 1



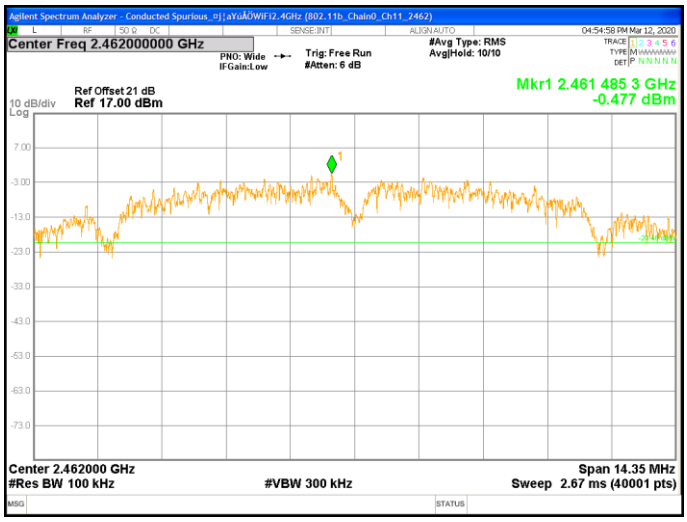
Chain0 : Conducted Spurious @ 802.11b Mode Ch 6



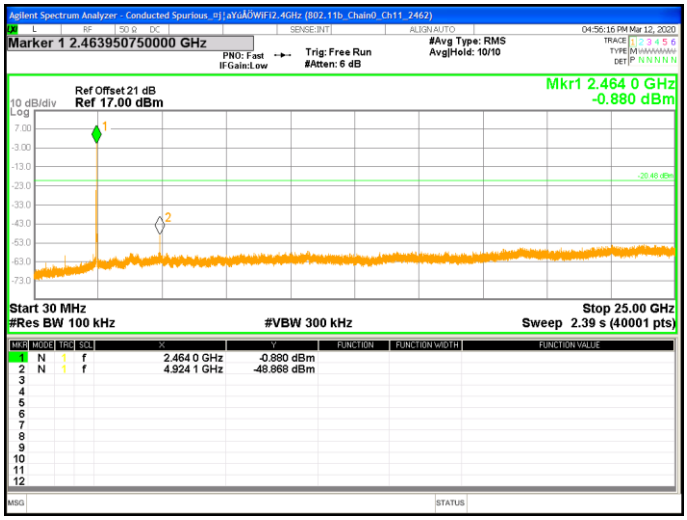
Chain0 : Conducted Spurious @ 802.11b Mode Ch 6



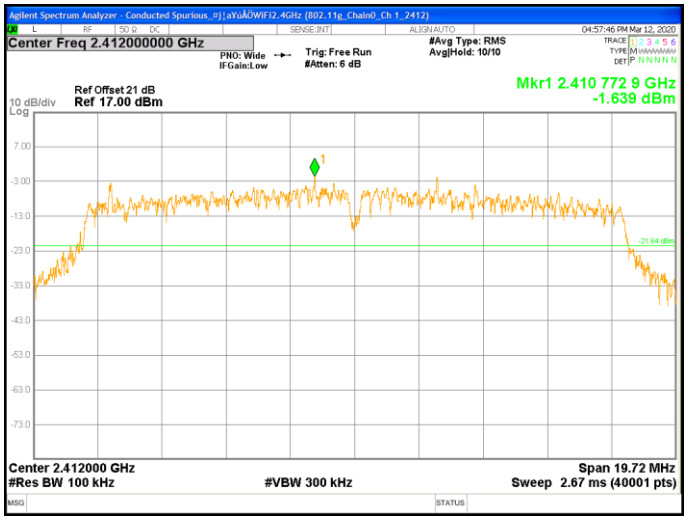
Chain0 : Conducted Spurious @ 802.11b Mode Ch11



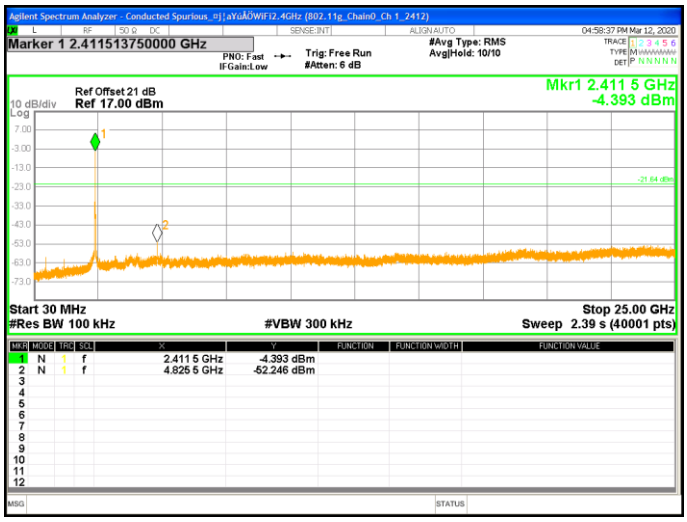
Chain0 : Conducted Spurious @ 802.11b Mode Ch11



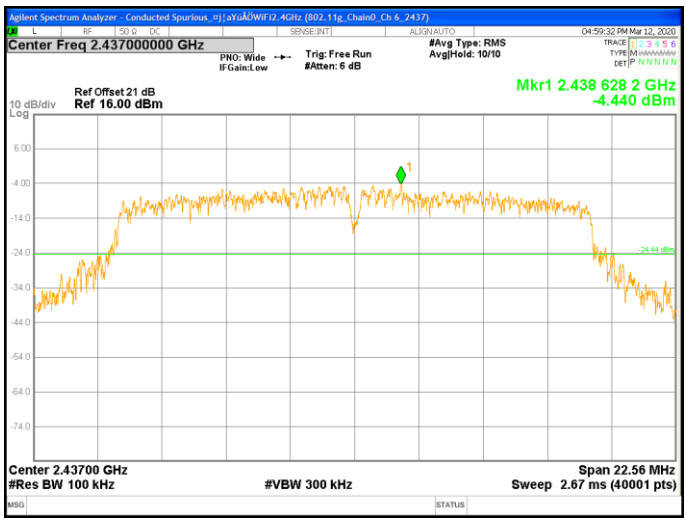
Chain0 : Conducted Spurious @ 802.11g Mode Ch 1



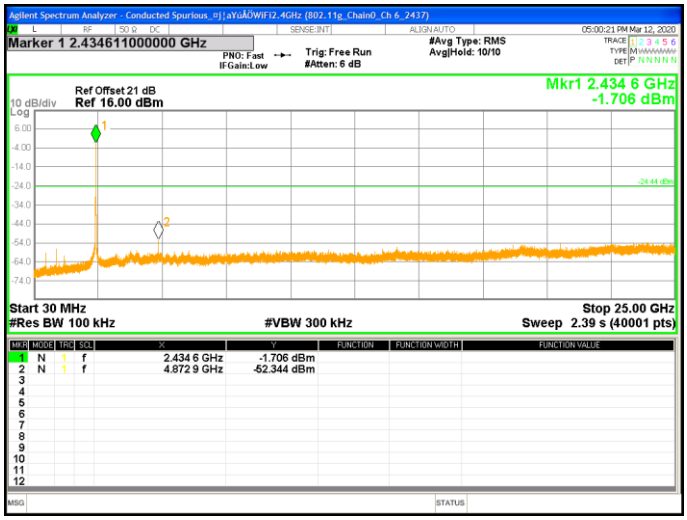
Chain0 : Conducted Spurious @ 802.11g Mode Ch 1



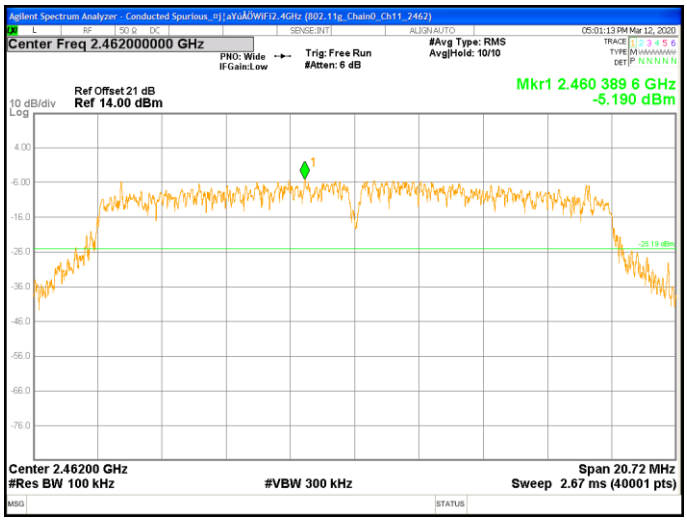
Chain0 : Conducted Spurious @ 802.11g Mode Ch 6



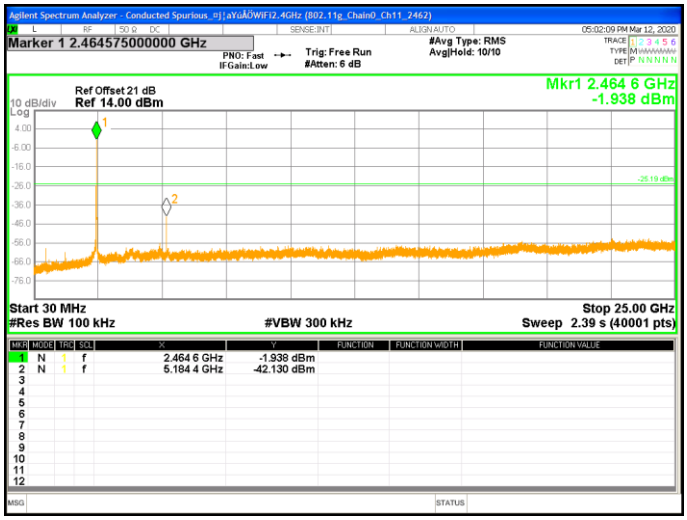
Chain0 : Conducted Spurious @ 802.11g Mode Ch 6



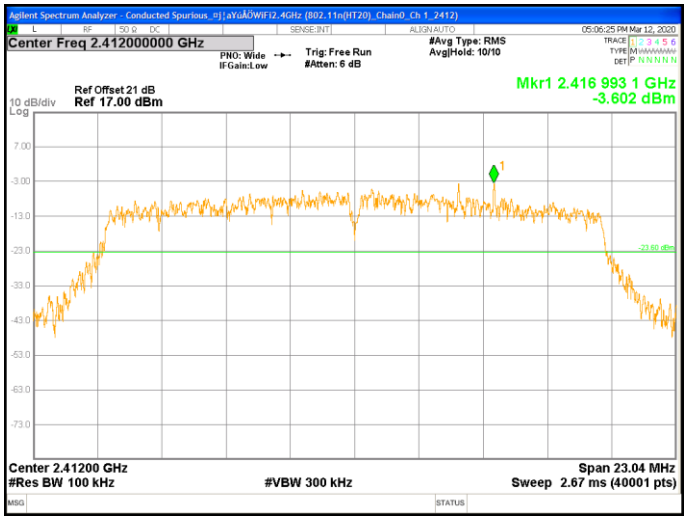
Chain0 : Conducted Spurious @ 802.11g Mode Ch11



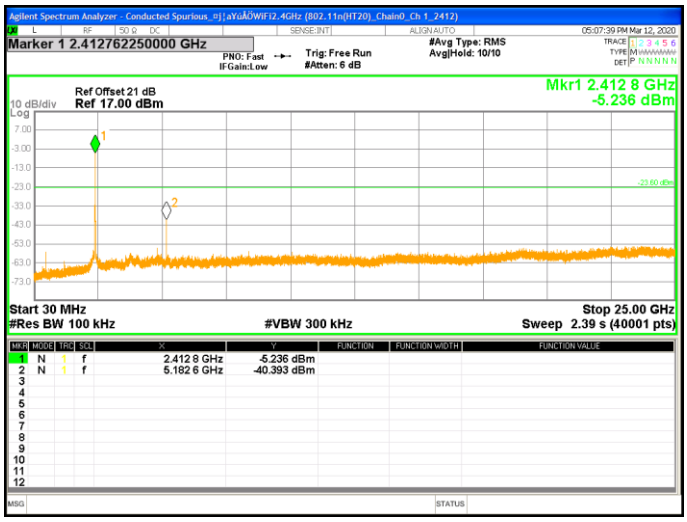
Chain0 : Conducted Spurious @ 802.11g Mode Ch11



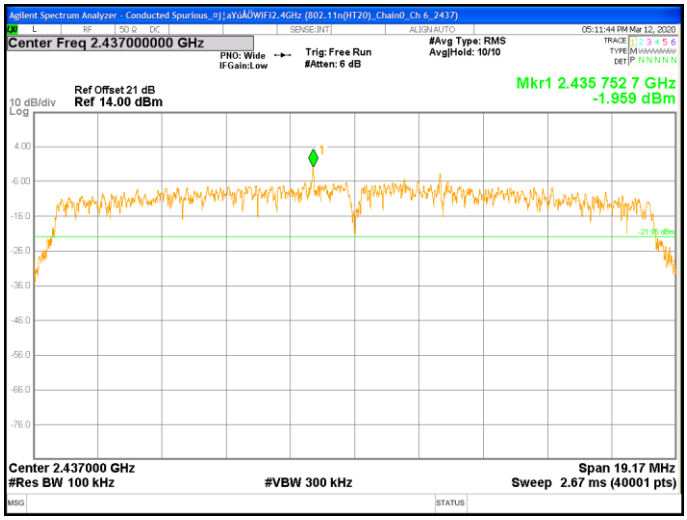
Chain0 : Conducted Spurious @ 802.11n(HT20) Mode Ch 1



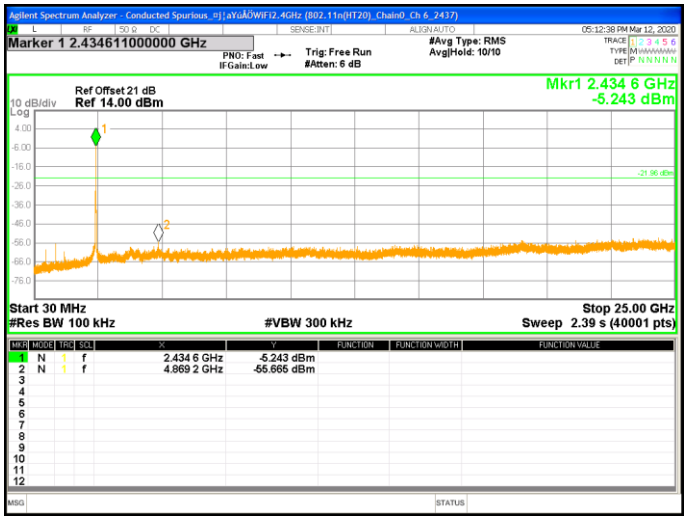
Chain0 : Conducted Spurious @ 802.11n(HT20) Mode Ch 1



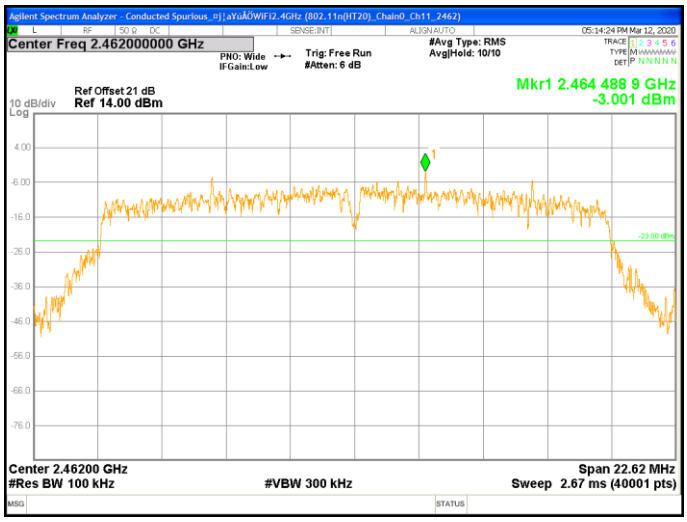
Chain0 : Conducted Spurious @ 802.11n(HT20) Mode Ch 6



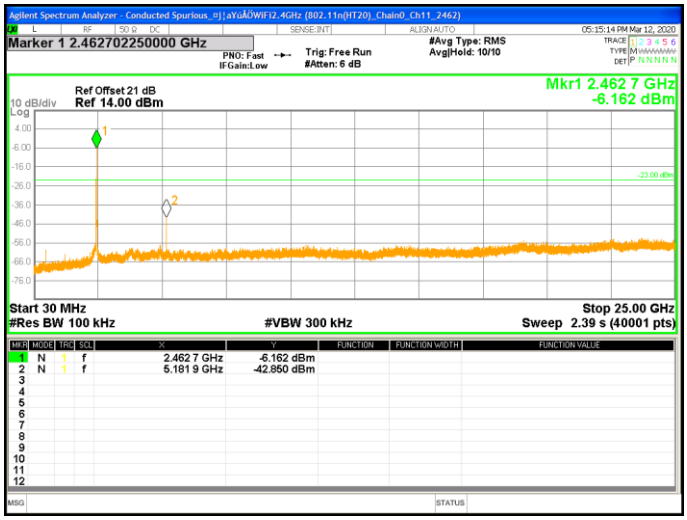
Chain0 : Conducted Spurious @ 802.11n(HT20) Mode Ch 6



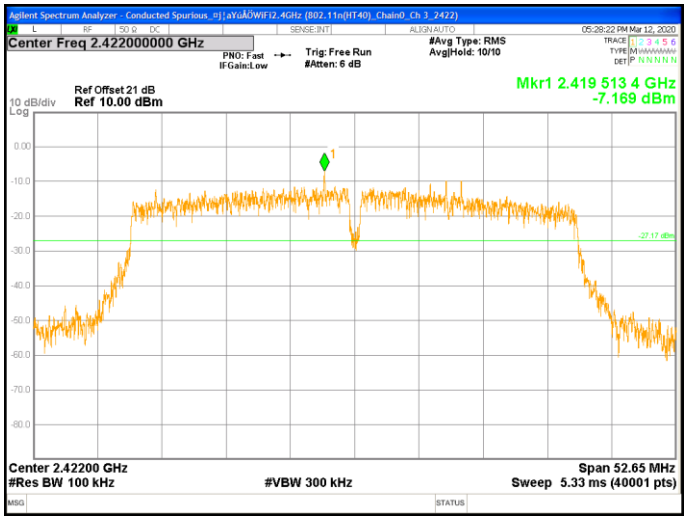
Chain0 : Conducted Spurious @ 802.11n(HT20) Mode Ch11



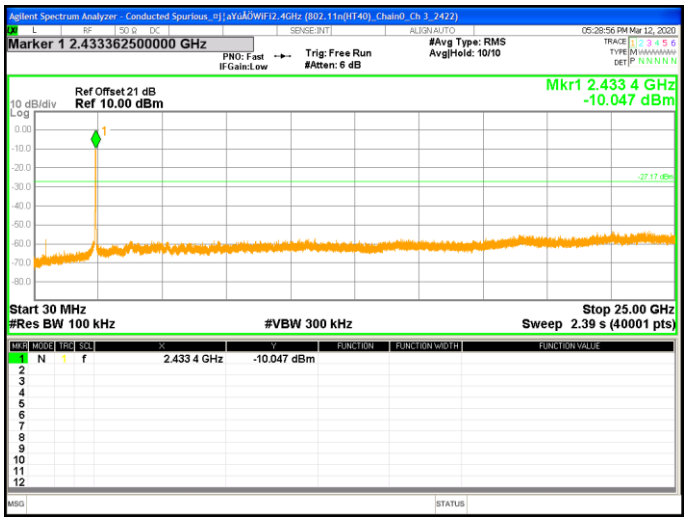
Chain0 : Conducted Spurious @ 802.11n(HT20) Mode Ch11



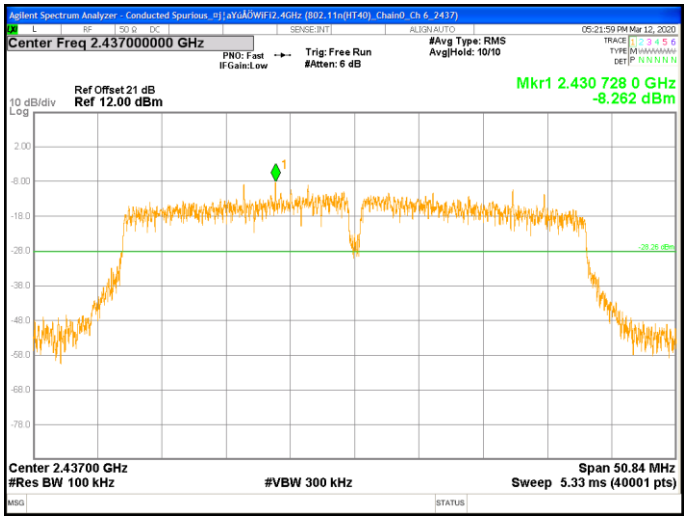
Chain0 : Conducted Spurious @ 802.11n(HT40) Mode Ch 3



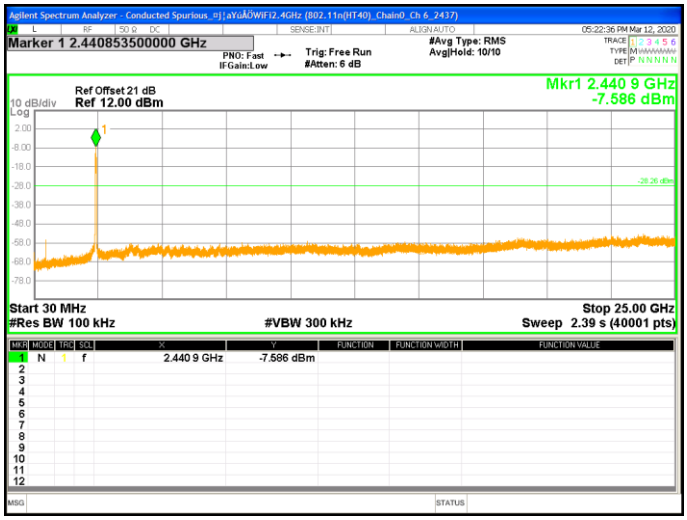
Chain0 : Conducted Spurious @ 802.11n(HT40) Mode Ch 3



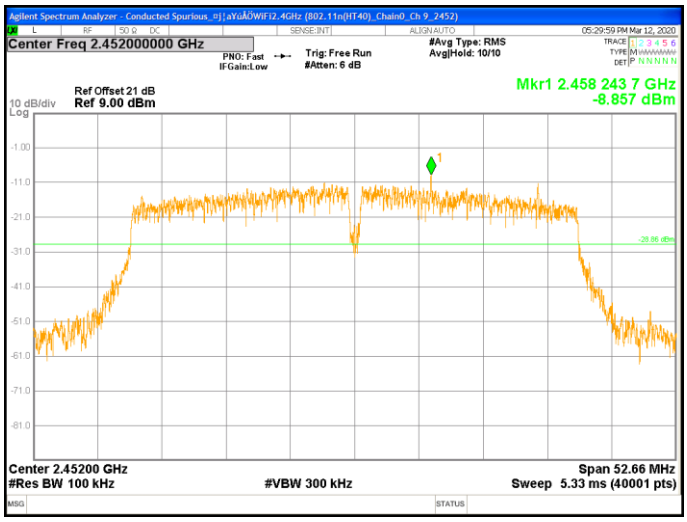
Chain0 : Conducted Spurious @ 802.11n(HT40) Mode Ch 6



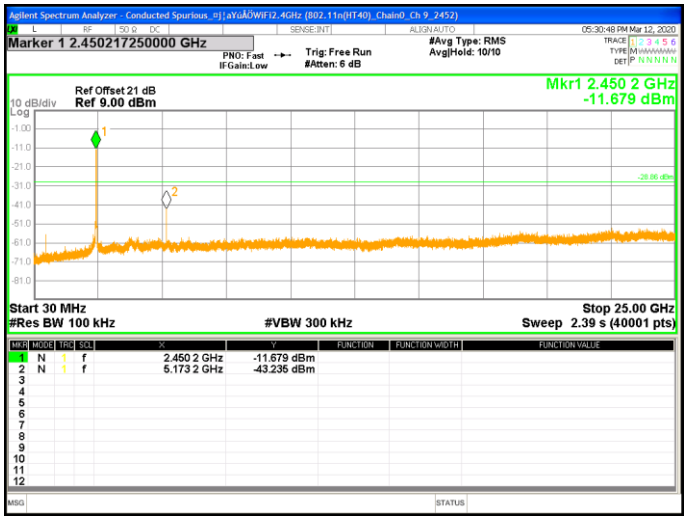
Chain0 : Conducted Spurious @ 802.11n(HT40) Mode Ch 6



Chain0 : Conducted Spurious @ 802.11n(HT40) Mode Ch 9



Chain0 : Conducted Spurious @ 802.11n(HT40) Mode Ch 9



6. Emissions in Restricted Frequency Bands (Radiated emission measurements)

6.1 Instrument Setting

Receiver Function	Setting (Below 1GHz)	Setting (Above 1GHz)
Detector	QP	Peak and Average
RBW	9-150 kHz ; 200-300 Hz 0.15-30 MHz; 9-10 kHz 30-1000 MHz; 100-120 kHz	1MHz
VBW	≧3 x RBW	3MHz
Sweep	Auto couple	Auto couple
Start Frequency	9 kHz	1GHz
Stop Frequency	1 GHz	Tenth harmonic
Attenuation	Auto	Auto

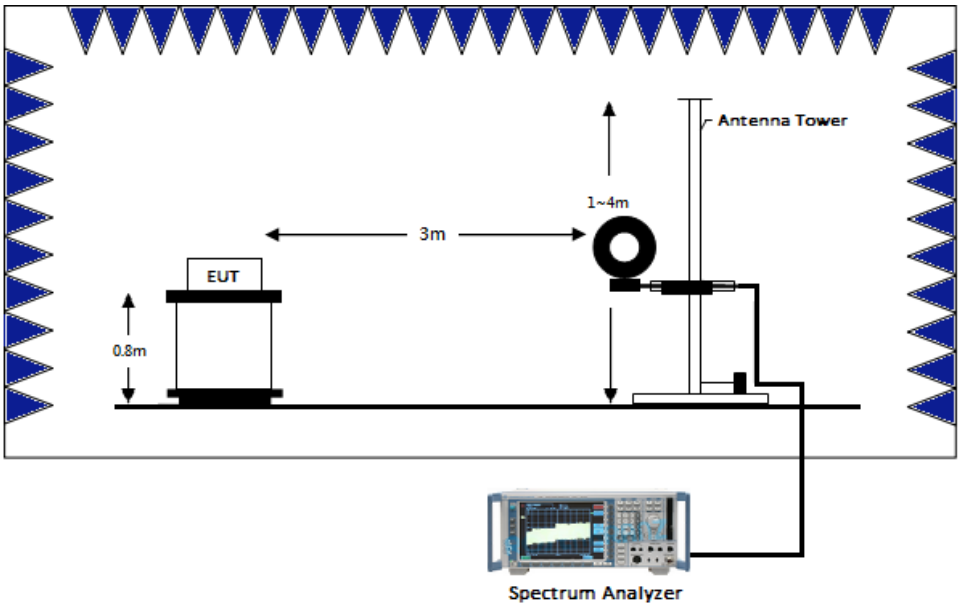
6.2 Test Procedure

Step 1	Configure the EUT according to ANSI C63.10:2013. The EUT was placed on the top of the turntable 0.8 meter (below 1GHz) and 1.5 meter (above 1GHz) above ground. The center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
Step 2	Power on the EUT and all the companion devices. The turntable was rotated by 360 degree to find the position of the maximum emission level.
Step 3	The height of the receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of the both horizontal and vertical polarization.
Step 4	If find the frequencies above the limit or below within 3dB, the antenna tower was scan (from 1m to 4m) and then the turntable was rotated to find the maximum reading.
Step 5	Set the test-receiver system to peak or CISPR quasi-peak detector with specified bandwidth under maximum hold mode.
Step 6	For emissions above 1GHz, use 1MHz VBW and 3MHz RBW for reading in spectrum analyzer. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response.
Step 7	If the emissions level of the EUT in peak mode was 3dB lower than the average limit specified then testing will be stopped and peak values of the EUT will be reported. Otherwise, the emissions which do not have 3dB margin will be measured using the quasi-peak method for below 1GHz.
Step 8	For testing above 1GHz, The emissions level of the EUT in peak mode was lower than average limit, then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured in average mode again and reported.

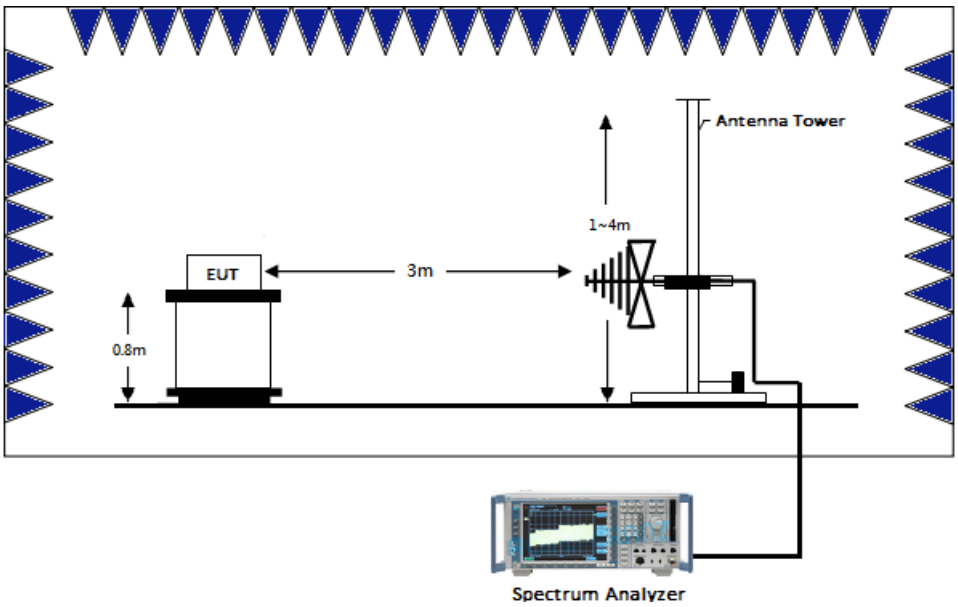
Step 9	In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be quasi-peak measured by receiver.

6.3 Test Diagram

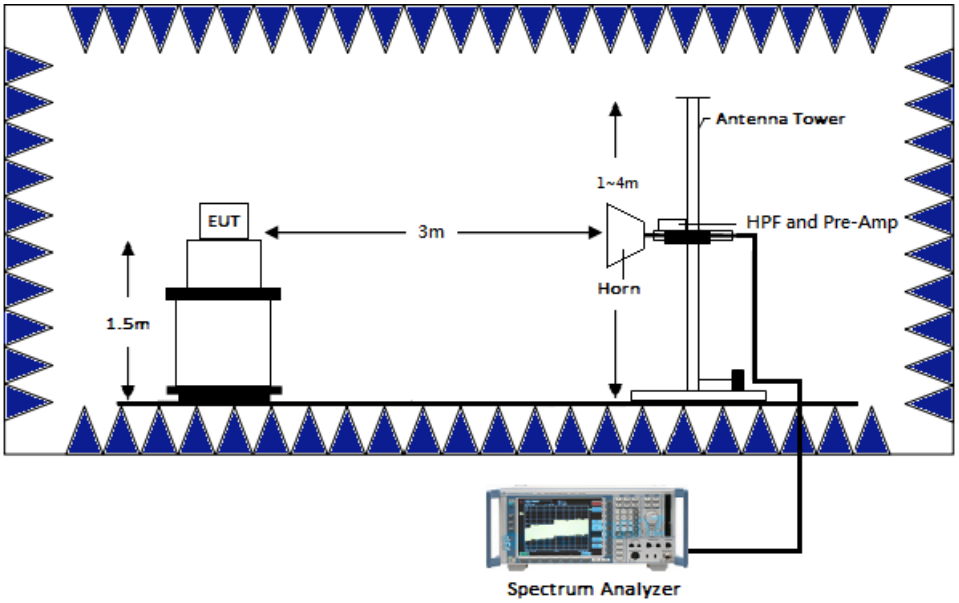
6.3.1 Radiated emission from 9kHz to 30MHz uses Loop Antenna:



6.3.2 Radiated emission below 1GHz using Bilog Antenna



6.3.3 Radiated emission above 1GHz using Horn Antenna



6.4 Limit

Frequency(MHz)	Field Strength(uV/m)	Measurement distance(m)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

6.5 Operating Environment Condition

Temperature (℃) :	21
Relative Humidity (%) :	54

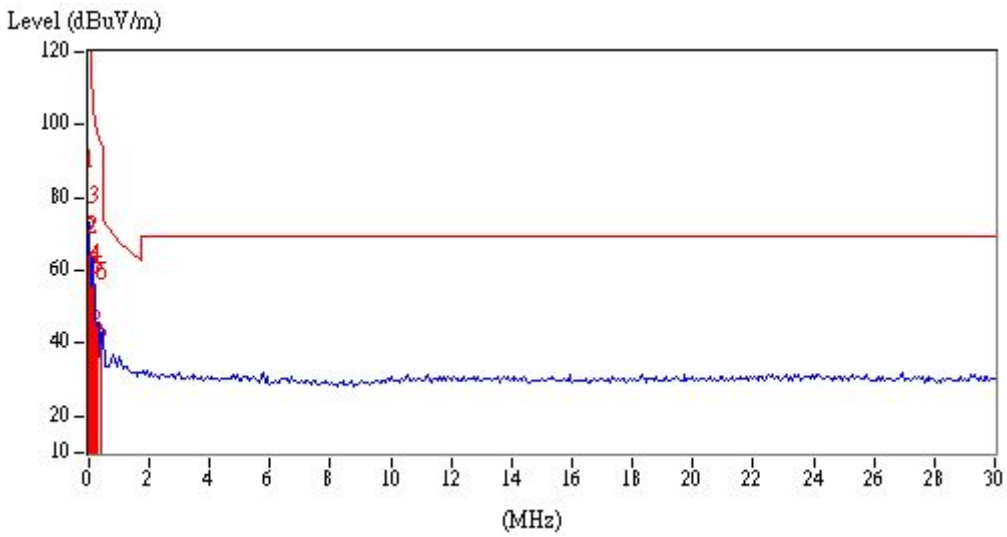
6.6 Test Result

6.6.1 Measurement results: frequencies 9kHz to 30MHz

The test was performed on EUT under 802.11b/g/n continuously transmitting mode. The worst case occurred at 802.11g Channel 6.

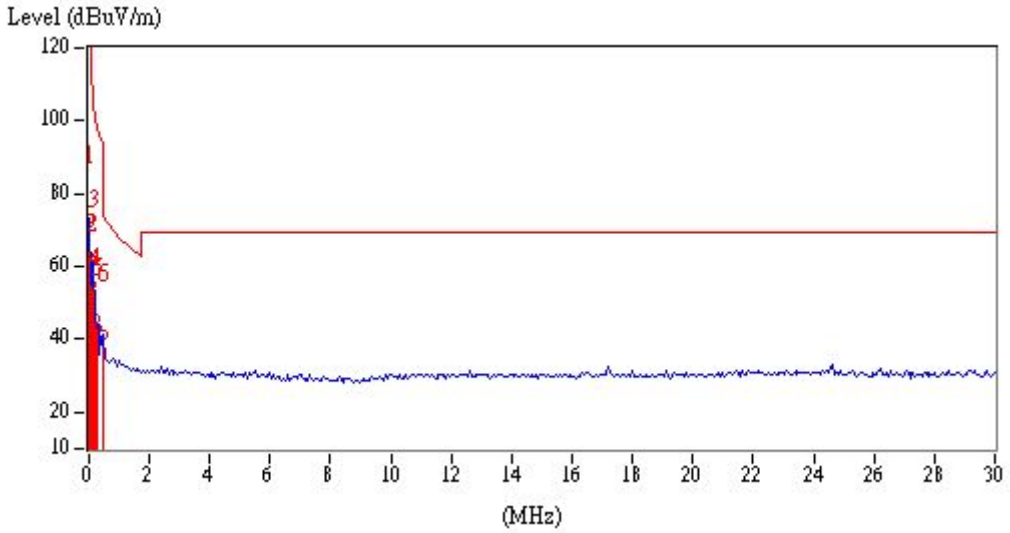
Ant Polarity	Frequency (MHz)	Detector	Factor (dB/m)	Reading (dBµV)	Corrected Reading (dBµV/m)	Limit @ 3m (dBµV/m)	Margin (dB)
Perpendicular	0.01	AV	18.38	55.10	73.48	127.60	-54.12
Perpendicular	0.07	AV	18.55	37.32	55.87	110.70	-54.83
Perpendicular	0.13	AV	18.33	45.68	64.01	105.33	-41.32
Perpendicular	0.19	AV	18.36	29.37	47.73	102.03	-54.30
Perpendicular	0.25	AV	18.39	26.23	44.62	99.65	-55.03
Perpendicular	0.43	AV	18.49	24.47	42.96	94.93	-51.97

Remark: Corr. Factor = Antenna Factor + Cable Loss



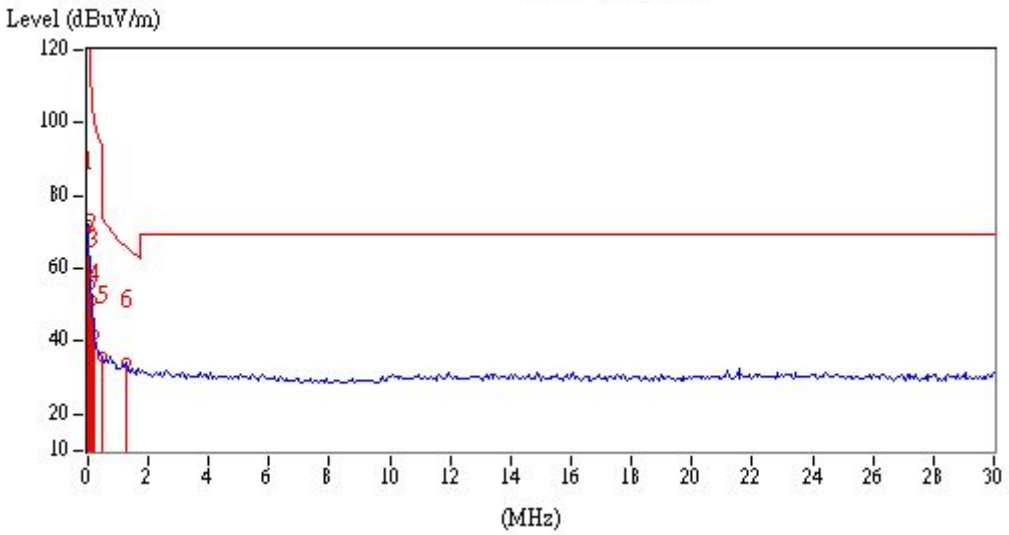
Ant Polarity	Frequency (MHz)	Detector	Factor (dB/m)	Reading (dBµV)	Corrected Reading (dBµV/m)	Limit @ 3m (dBµV/m)	Margin (dB)
Parallel	0.01	AV	18.38	55.12	73.50	127.60	-54.10
Parallel	0.07	AV	18.55	36.45	55.00	110.70	-55.70
Parallel	0.13	AV	18.33	43.15	61.48	105.33	-43.85
Parallel	0.19	AV	18.36	27.50	45.86	102.03	-56.17
Parallel	0.25	AV	18.39	24.65	43.04	99.65	-56.61
Parallel	0.49	AV	18.52	22.86	41.38	93.80	-52.42

Remark: Corr. Factor = Antenna Factor + Cable Loss



Ant Polarity	Frequency (MHz)	Detector	Factor (dB/m)	Reading (dBµV)	Corrected Reading (dBµV/m)	Limit @ 3m (dBµV/m)	Margin (dB)
Ground-parallel	0.01	AV	18.38	54.04	72.42	127.60	-55.18
Ground-parallel	0.07	AV	18.55	37.32	55.87	110.70	-54.83
Ground-parallel	0.13	AV	18.33	32.98	51.31	105.33	-54.02
Ground-parallel	0.19	AV	18.36	23.28	41.64	102.03	-60.39
Ground-parallel	0.49	AV	18.52	17.44	35.96	93.80	-57.84
Ground-parallel	1.27	QP	18.88	15.55	34.43	65.53	-31.10

Remark: Corr. Factor = Antenna Factor + Cable Loss

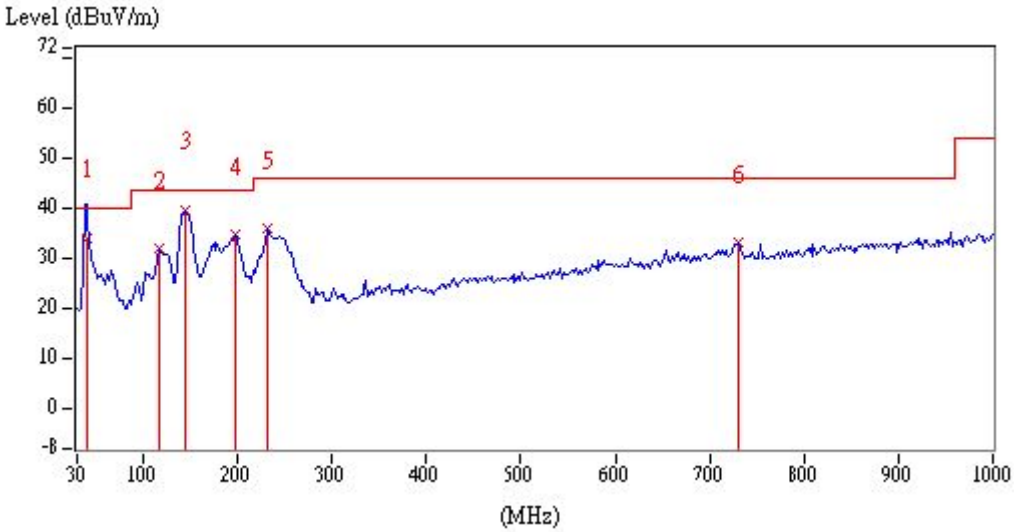


6.6.1 Measurement results: frequencies below 1 GHz

The test was performed on EUT under 802.11b/g/n continuously transmitting mode. The worst case occurred at 802.11g Channel 6.

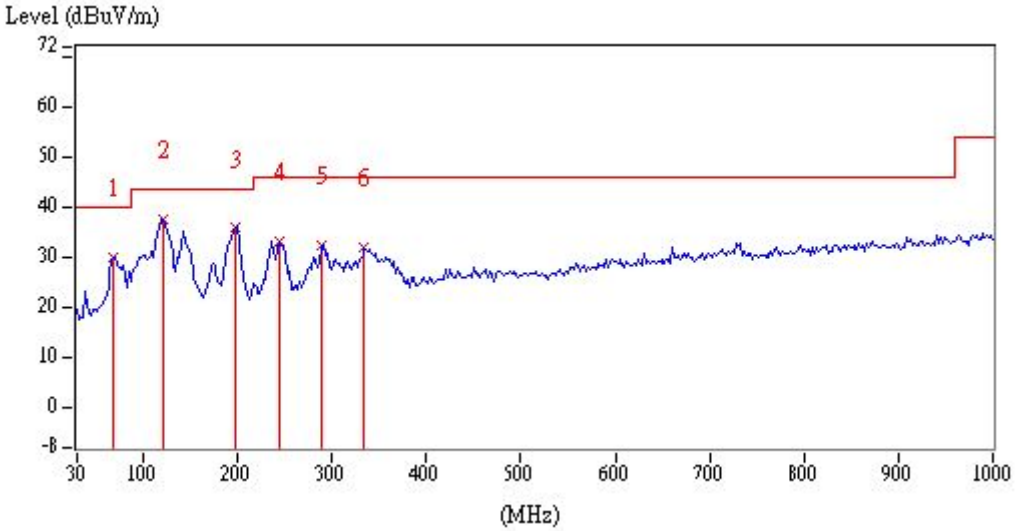
EUT: AP9X

Ant Polarity	Frequency (MHz)	Detector	Factor (dB/m)	Reading (dBµV)	Corrected Reading (dBµV/m)	Limit @ 3m (dBµV/m)	Margin (dB)
Vertical	39.70	QP	19.78	14.42	34.20	40.00	-5.80
Vertical	117.30	QP	17.59	14.23	31.82	43.50	-11.68
Vertical	144.46	QP	20.19	19.55	39.74	43.50	-3.76
Vertical	196.84	QP	17.95	16.71	34.66	43.50	-8.84
Vertical	231.76	QP	19.76	16.23	35.99	46.00	-10.01
Vertical	730.34	QP	30.48	2.72	33.20	46.00	-12.80



Ant Polarity	Frequency (MHz)	Detector	Factor (dB/m)	Reading (dBµV)	Corrected Reading (dBµV/m)	Limit @ 3m (dBµV/m)	Margin (dB)
Horizontal	68.80	QP	18.52	11.62	30.14	40.00	-9.86
Horizontal	121.18	QP	17.91	19.80	37.71	43.50	-5.79
Horizontal	196.84	QP	17.95	18.02	35.97	43.50	-7.53
Horizontal	243.40	QP	20.50	12.80	33.30	46.00	-12.70
Horizontal	289.96	QP	21.48	11.09	32.57	46.00	-13.43
Horizontal	334.58	QP	22.56	9.50	32.06	46.00	-13.94

Remark: Corr. Factor = Antenna Factor + Cable Loss



6.6.2 Measurement results: frequency above 1GHz to 25GHz

EUT: AP9X

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBµV)	Corrected Reading (dBµV/m)	Limit @ 3 m (dBµV/m)	Margin (dB)
802.11b_Ch1	4824	PK	V	8.87	44.48	53.35	74.00	-20.65
	4824	AV	V	8.87	43.48	52.35	54.00	-1.65
	7236	PK	V	14.38	31.98	46.36	74.00	-27.64
	4824	PK	H	8.87	42.22	51.09	74.00	-22.91
	4824	AV	H	8.87	41.59	50.46	54.00	-3.54
	7236	PK	H	14.38	29.80	44.18	74.00	-29.82
802.11b_Ch6	4874	PK	V	8.98	44.09	53.07	74.00	-20.93
	4874	AV	V	8.98	42.47	51.45	54.00	-2.55
	7311	PK	V	14.63	35.56	50.19	74.00	-23.81
	4874	PK	H	8.98	43.67	52.65	74.00	-21.35
	4874	AV	H	8.98	42.07	51.05	54.00	-2.95
	7236	PK	H	14.38	30.20	44.58	74.00	-29.42
802.11b_Ch11	4924	PK	V	9.08	45.13	54.21	74.00	-19.79
	4924	AV	V	9.08	42.93	52.01	54.00	-1.99
	7236	PK	V	14.38	29.72	44.10	74.00	-29.90
	4924	PK	H	9.08	44.84	53.92	74.00	-20.08
	4924	AV	H	9.08	42.82	51.90	54.00	-2.10
	7386	PK	H	14.87	29.61	44.48	74.00	-29.52
802.11g_Ch1	4824	PK	V	8.87	42.18	51.05	74.00	-22.95
	7236	PK	V	14.38	31.19	45.57	74.00	-28.43
	4824	PK	H	8.87	39.91	48.78	74.00	-25.22
	7236	PK	H	14.38	30.97	45.35	74.00	-28.65
802.11g_Ch6	4874	PK	V	8.98	39.87	48.85	74.00	-25.15
	7311	PK	V	14.63	31.69	46.32	74.00	-27.68
	4874	PK	H	8.98	41.84	50.82	74.00	-23.18
	7311	PK	H	14.63	29.84	44.47	74.00	-29.53
802.11g_Ch11	4924	PK	V	9.08	43.63	52.71	74.00	-21.29
	4924	AV	V	9.08	32.35	41.43	54.00	-12.57
	7386	PK	V	14.87	29.48	44.35	74.00	-29.65
	4924	PK	H	9.08	43.69	52.77	74.00	-21.23
	4924	AV	H	9.08	31.73	40.81	54.00	-13.19
	7386	PK	H	14.87	29.27	44.14	74.00	-29.86

Remark: Correction Factor = Antenna Factor + Cable Loss + High Pass Filter Loss - Pre_Amplifier Gain

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBµV)	Corrected Reading (dBµV/m)	Limit @ 3 m (dBµV/m)	Margin (dB)
802.11n(HT20)_Ch1	4824	PK	V	8.87	38.20	47.07	74.00	-26.93
	7236	PK	V	14.38	30.99	45.37	74.00	-28.63
	4824	PK	H	8.87	36.99	45.86	74.00	-28.14
	7236	PK	H	14.38	31.13	45.51	74.00	-28.49
802.11n(HT20)_Ch6	4874	PK	V	8.98	41.38	50.36	74.00	-23.64
	7311	PK	V	14.63	30.57	45.20	74.00	-28.80
	4874	PK	H	8.98	38.69	47.67	74.00	-26.33
	7311	PK	H	14.63	30.41	45.04	74.00	-28.96
802.11n(HT20)_Ch11	4924	PK	V	9.08	41.18	50.26	74.00	-23.74
	7386	PK	V	14.87	31.58	46.45	74.00	-27.55
	4924	PK	H	9.08	44.13	53.21	74.00	-20.79
	4924	AV	H	9.08	29.23	38.31	54.00	-15.69
	7386	PK	H	14.87	30.18	45.05	74.00	-28.95
802.11n(HT40)_Ch3	4824	PK	V	8.87	34.86	43.73	74.00	-30.27
	7236	PK	V	14.38	32.15	46.53	74.00	-27.47
	4824	PK	H	8.87	34.15	43.02	74.00	-30.98
	7236	PK	H	14.38	30.20	44.58	74.00	-29.42
802.11n(HT40)_Ch6	4874	PK	V	8.98	33.47	42.45	74.00	-31.55
	7311	PK	V	14.63	29.55	44.18	74.00	-29.82
	4874	PK	H	8.98	34.92	43.90	74.00	-30.10
	7311	PK	H	14.63	31.12	45.75	74.00	-28.25
802.11n(HT40)_Ch9	4904	PK	V	7.60	34.89	42.49	74.00	-31.51
	7356	PK	V	14.55	30.98	45.53	74.00	-28.47
	4904	PK	H	7.60	35.26	42.86	74.00	-31.14
	7356	PK	H	14.55	30.17	44.72	74.00	-29.28

Remark: Correction Factor = Antenna Factor + Cable Loss + High Pass Filter Loss - Pre_Amplifier Gain

7. Emission on Band Edge

7.1 Instrument Setting

Spectrum Function	Setting
Detector	Peak and Average
RBW	1MHz
VBW	3MHz
Sweep	Auto couple
Restrict bands	2310 MHz ~ 2390 MHz 2483.5 MHz ~ 2500 MHz
Attenuation	Auto

7.2 Test Procedure

The test procedure is the same as Emissions in Restricted Frequency Bands (Radiated emission measurements).

7.3 Operating Environment Condition

Temperature (℃) :	22
Relative Humidity (%) :	56

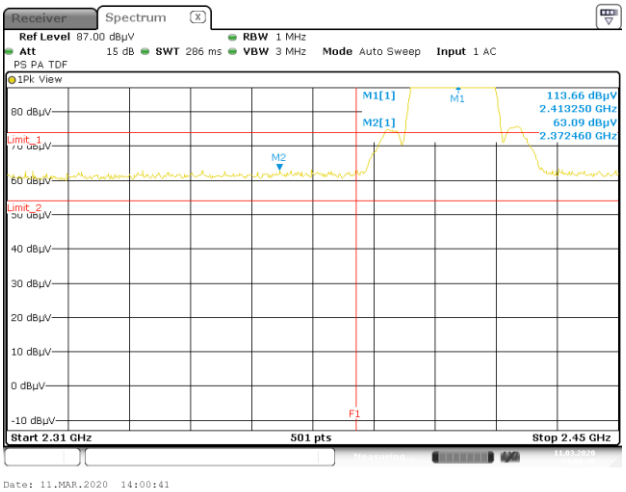
7.4 Test Results

EUT: AP9X

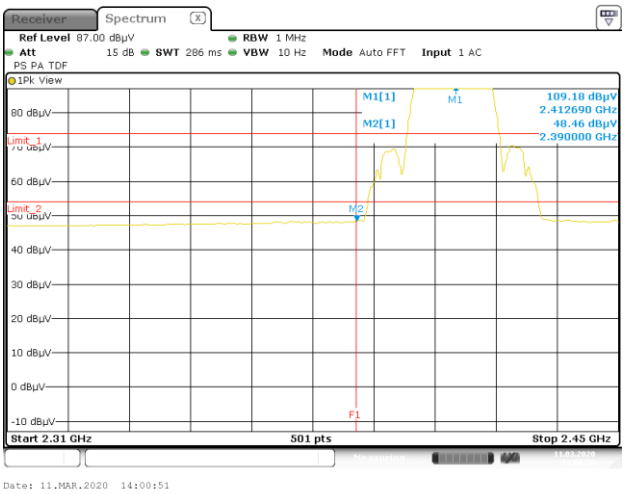
Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)	Restricted band (MHz)
802.11b	2372.46	PK	V	34.49	28.60	63.09	74	-10.91	2310~2390
	2390.00	AV	V	34.56	13.90	48.46	54	-5.54	
	2492.25	PK	V	34.96	29.62	64.58	74	-9.42	2483.5~2500
	2490.57	AV	V	34.95	14.72	49.67	54	-4.33	
802.11g	2390.00	PK	V	34.56	30.68	65.24	74	-8.76	2310~2390
	2390.00	AV	V	34.56	17.71	52.27	54	-1.73	
	2483.50	PK	V	34.93	30.49	65.42	74	-8.58	2483.5~2500
	2483.50	AV	V	34.93	17.74	52.67	54	-1.33	
802.11n (HT20)	2390.00	PK	V	34.56	29.63	64.19	74	-9.81	2310~2390
	2390.00	AV	V	34.56	17.19	51.75	54	-2.25	
	2483.50	PK	V	34.93	32.84	67.77	74	-6.23	2483.5~2500
	2483.50	AV	V	34.93	18.23	53.16	54	-0.84	
802.11n (HT40)	2389.78	PK	V	34.56	35.05	69.61	74	-4.39	2310~2390
	2390.00	AV	V	34.56	18.88	53.44	54	-0.56	
	2484.00	PK	V	34.93	32.55	67.48	74	-6.52	2483.5~2500
	2483.72	AV	V	34.93	17.02	51.95	54	-2.05	

Remark: Correction Factor = Antenna Factor + Cable Loss

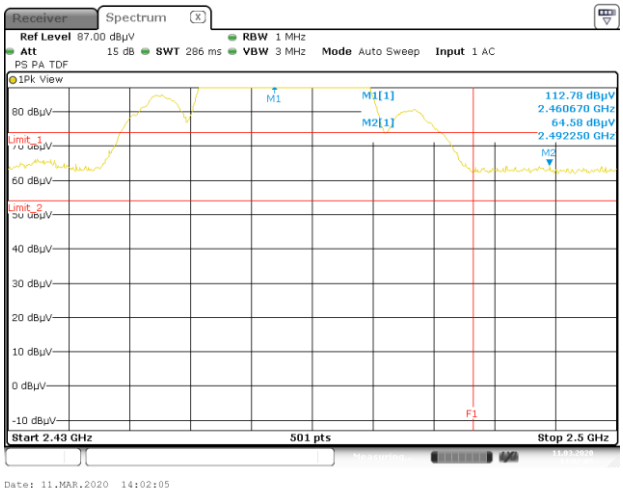
Restricted Band Bandedge @ 802.11b Mode Ch1 PK



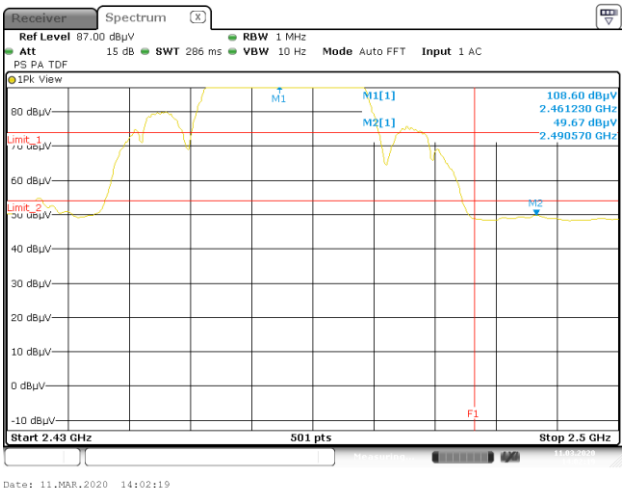
Restricted Band Bandedge @ 802.11b Mode Ch1 AV



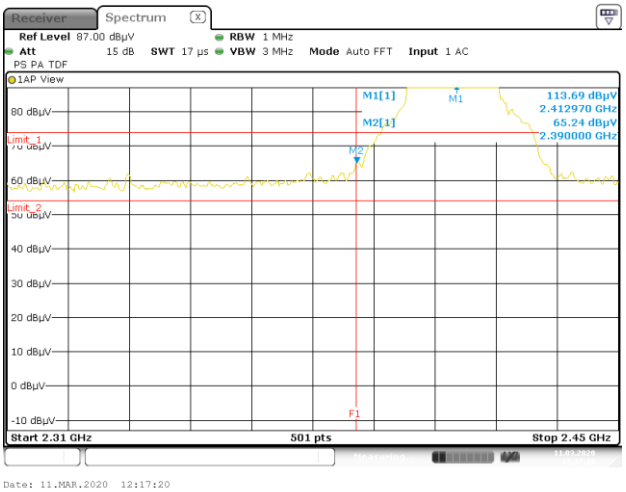
Restricted Band Bandedge @ 802.11b Mode Ch11 PK



Restricted Band Bandedge @ 802.11b Mode Ch11 AV



Restricted Band Bandedge @ 802.11g Mode Ch1 PK



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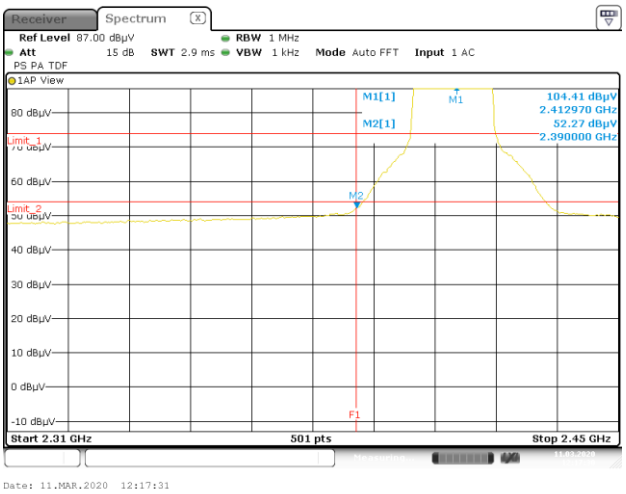

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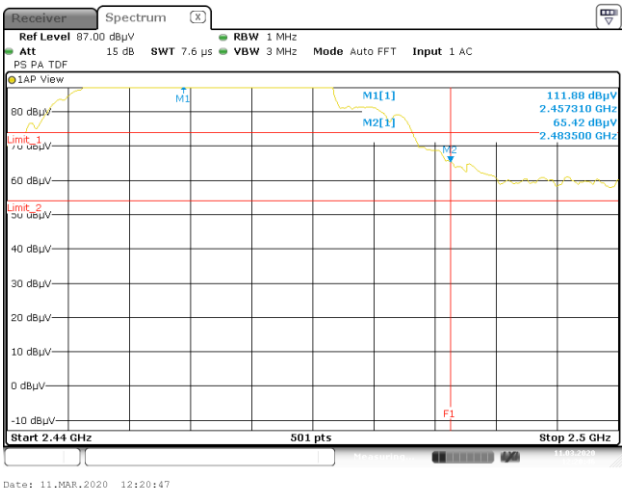
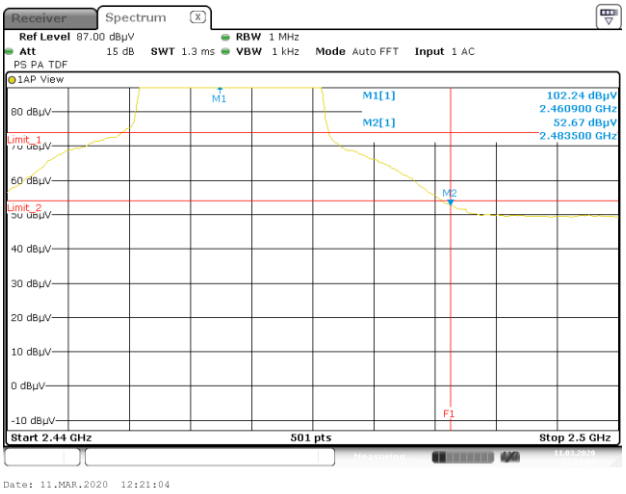
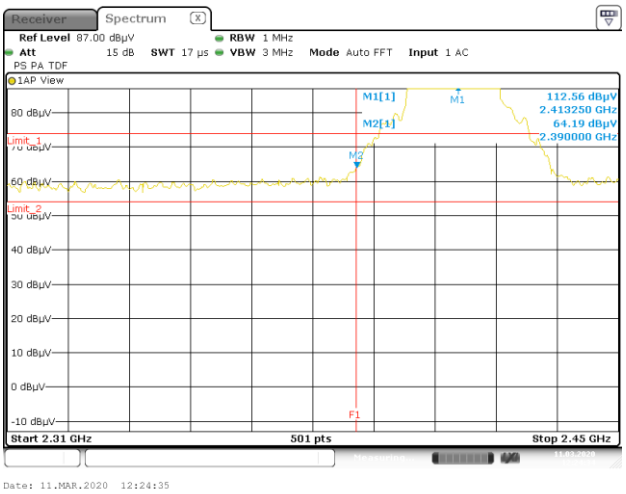


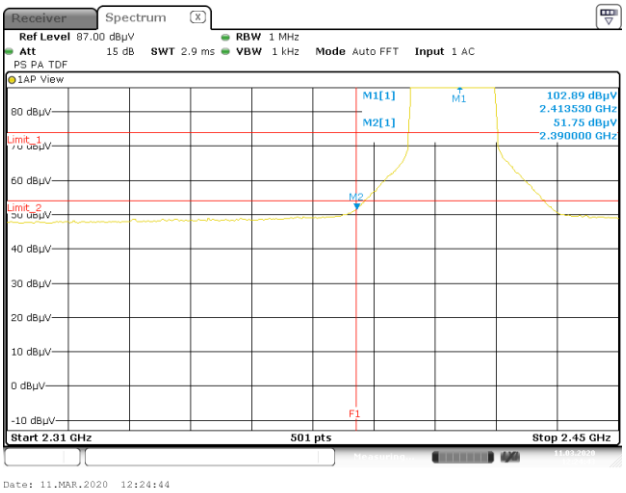
Restricted Band Bandedge @ 802.11g Mode Ch11 AV



Restricted Band Bandedge @ 802.11n(HT20) Mode Ch1 PK



Restricted Band Bandedge @ 802.11n(HT20) Mode Ch1 AV



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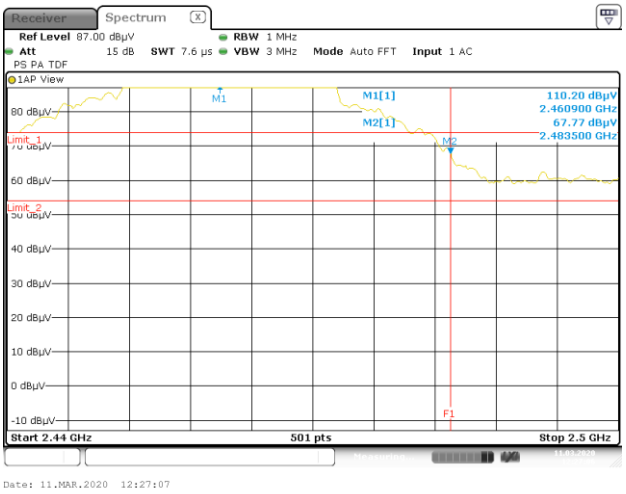
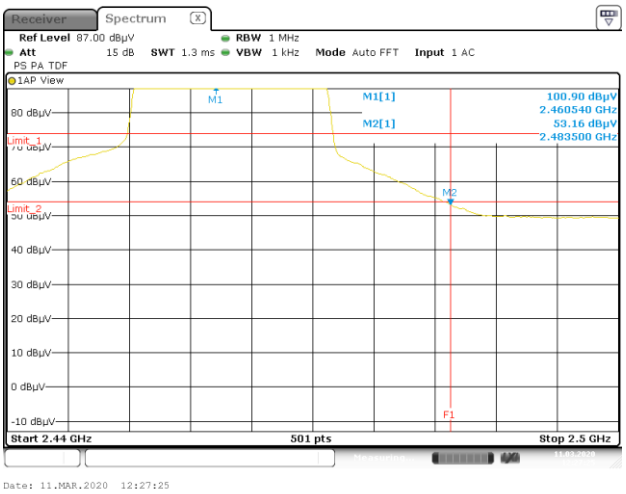
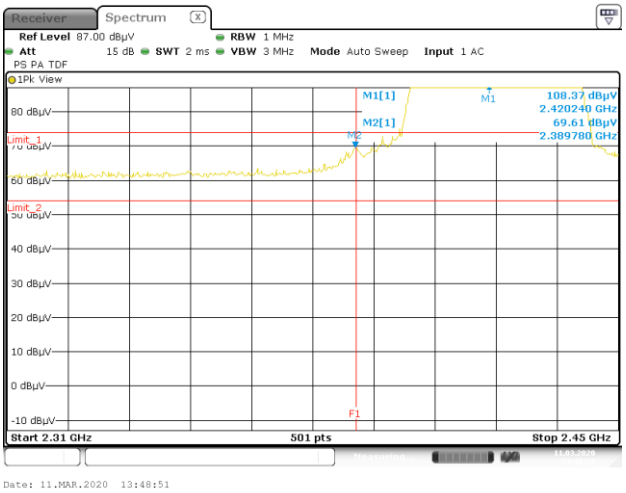


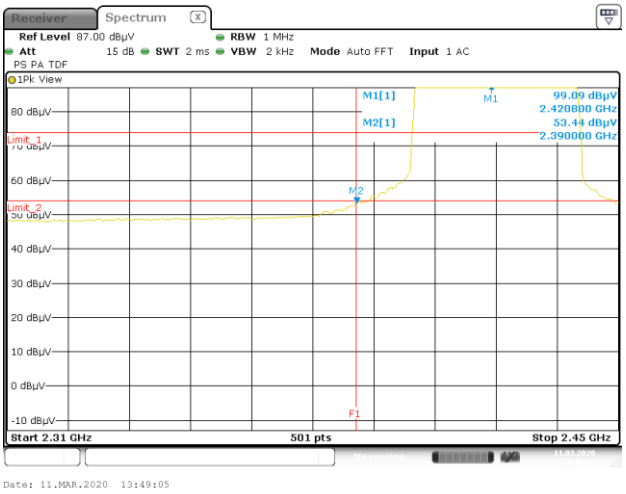
Restricted Band Bandedge @ 802.11n(HT20) Mode Ch11 AV



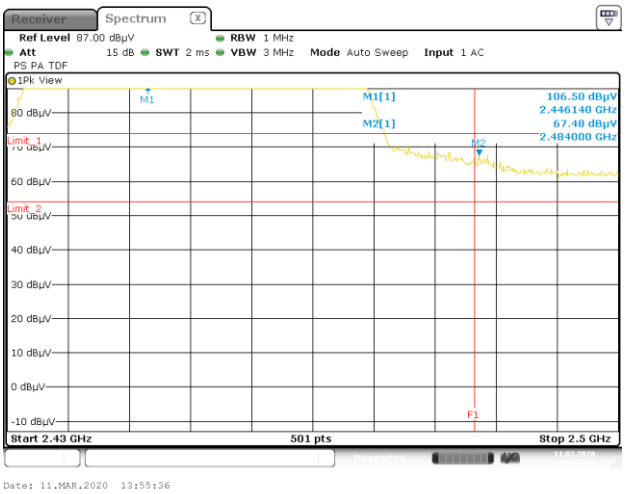
Restricted Band Bandedge @ 802.11n(HT40) Mode Ch3 PK



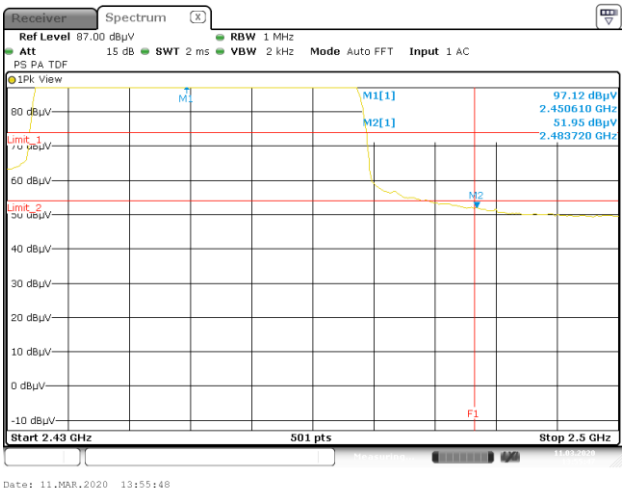
Restricted Band Bandedge @ 802.11n(HT40) Mode Ch3 AV



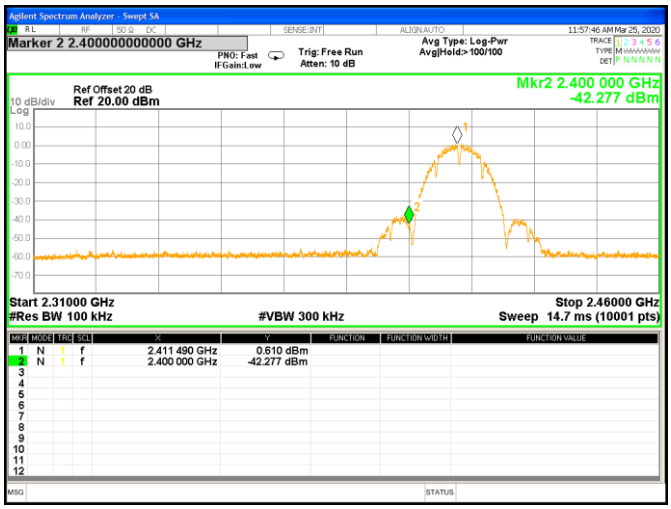
Restricted Band Bandedge @ 802.11n(HT40) Mode Ch9 PK



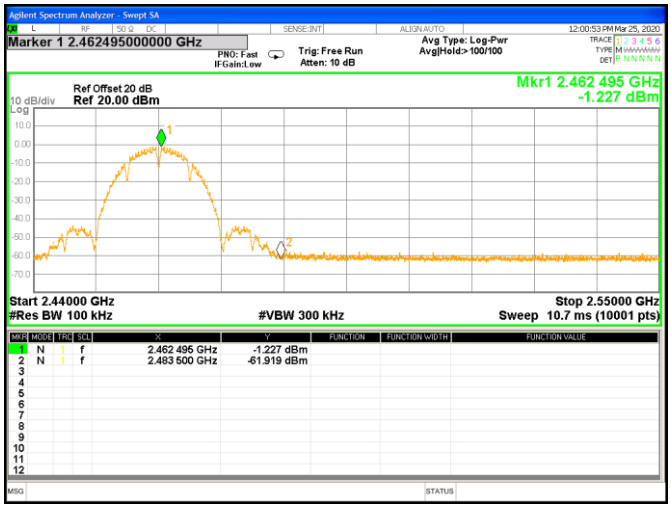
Restricted Band Bandedge @ 802.11n(HT40) Mode Ch9 AV



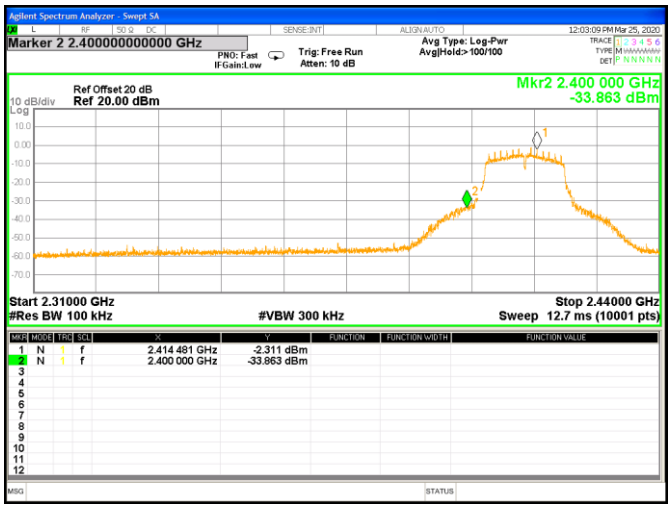
Authorized Band Bandedge @ 802.11b Mode Ch1



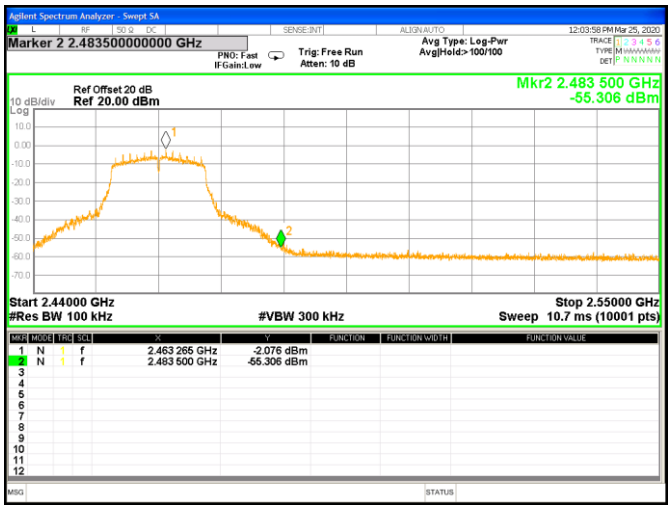
Authorized Band Bandedge @ 802.11b Mode Ch11



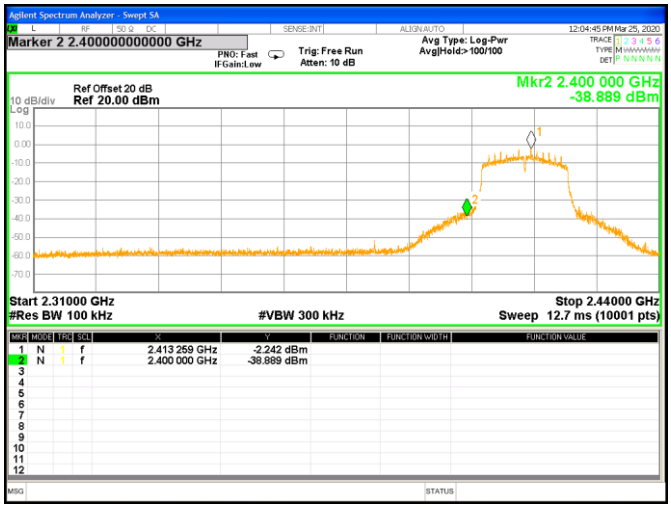
Authorized Band Bandedge @ 802.11g Mode Ch1



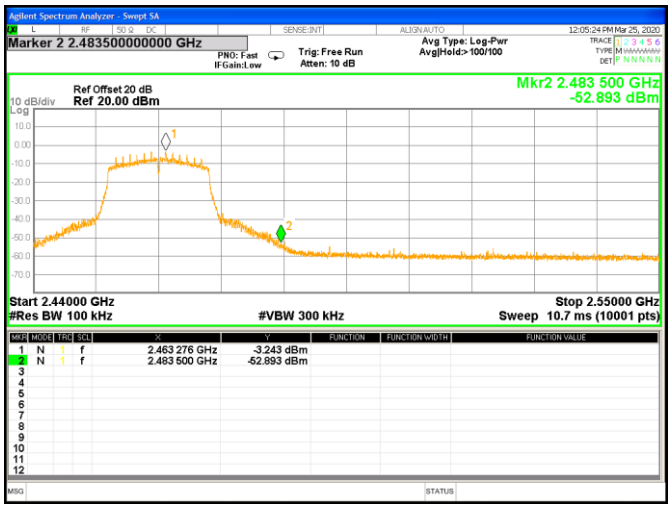
Authorized Band Bandedge @ 802.11g Mode Ch11



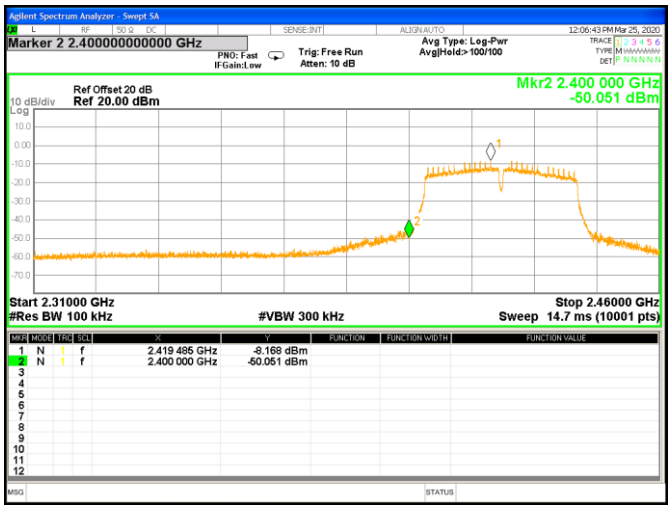
Authorized Band Bandedge @ 802.11n(HT20) Mode Ch1



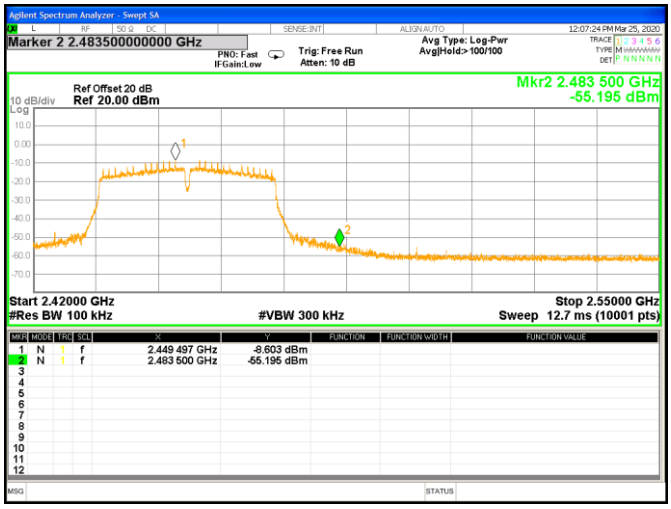
Authorized Band Bandedge @ 802.11n(HT20) Mode Ch11



Authorized Band Bandedge @ 802.11n(HT40) Mode Ch3



Authorized Band Bandedge @ 802.11n(HT40) Mode Ch9



8. AC Power Line Conducted Emission

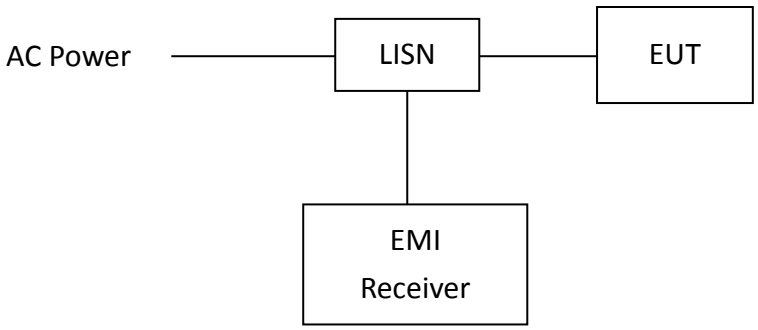
8.1 Measuring instrument setting

Receiver Function	Setting
Detector	QP
Start frequency	0.15MHz
Stop frequency	30MHz
IF bandwidth	9 kHz
Attenuation	10dB

8.2 Test Procedure

Step 1	Configure the EUT according to ANSI C63.10:2013. The EUT or host of EHT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
Step 2	Connect EUT or host of EUT to the power mains through a line impedance stabilization network.
Step 3	All the companion devices are connected to the other LISN. The LISN should provide 50Uh/50ohms coupling impedance.
Step 4	The frequency range from 150 kHz to 30MHz was searched.
Step 5	Set the test-receiver system to peak detector and specified bandwidth with maximum hold mode.
Step 6	The measurement has to be done between each power line and ground at the power terminal.

8.3 Test Diagram



8.4 Limit

Frequency (MHz)	Conducted Limit (dBuV)	
	Q.P.	Ave.
0.15~0.50	66 – 56	56 – 46
0.50~5.00	56	46
5.00~30.0	60	50

8.5 Operating Environment Condition

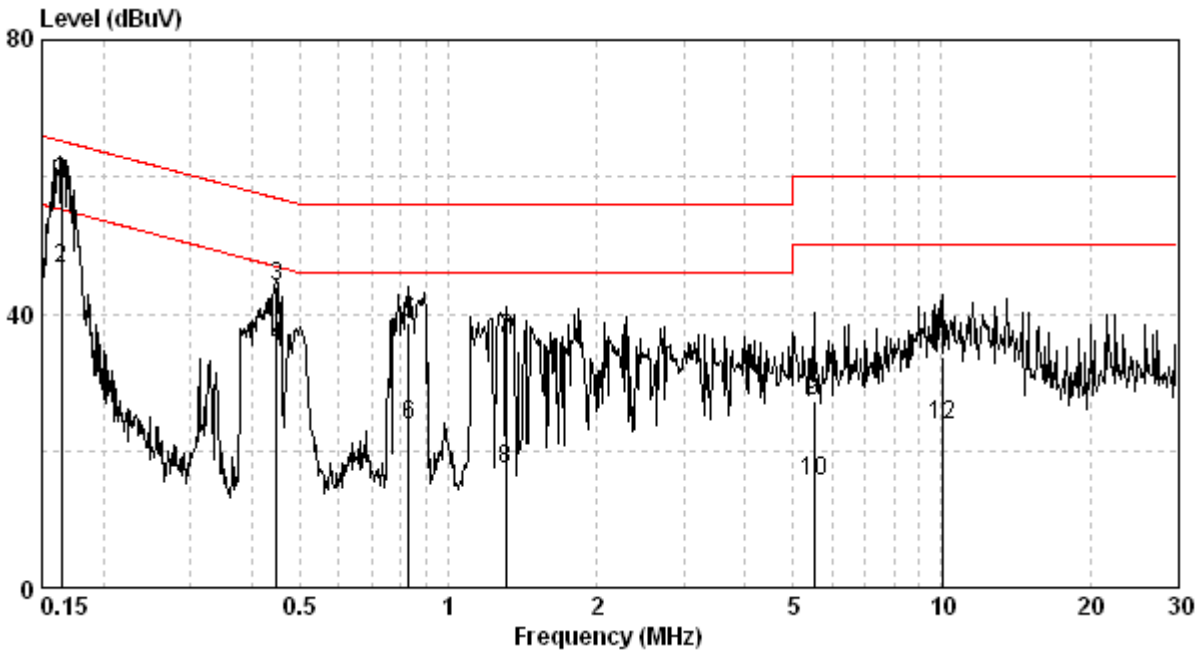
Temperature (℃) :	22
Relative Humidity (%) :	54
Atmospheric Pressure (hPa) :	1008

8.6 Test Results

Phase: Live Line
Model No.: AP9X
Test Condition: Tx mode

Frequency (MHz)	Corr. Factor (dB)	Reading QP (dBuV)	Level QP (dBuV)	Limit QP (dBuV)	Reading AV (dBuV)	Level AV (dBuV)	Limit AV (dBuV)	Margin (dB) QP	Margin (dB) AV
0.164	9.70	49.74	59.44	65.25	36.94	46.64	55.25	-5.81	-8.61
0.449	9.70	34.28	43.98	56.89	25.59	35.29	46.89	-12.92	-11.60
0.830	9.72	28.94	38.66	56.00	14.08	23.80	46.00	-17.34	-22.20
1.310	9.74	26.47	36.21	56.00	7.66	17.40	46.00	-19.79	-28.60
5.505	9.81	17.44	27.25	60.00	5.78	15.59	50.00	-32.75	-34.41
10.072	9.82	23.78	33.60	60.00	13.84	23.66	50.00	-26.40	-26.34

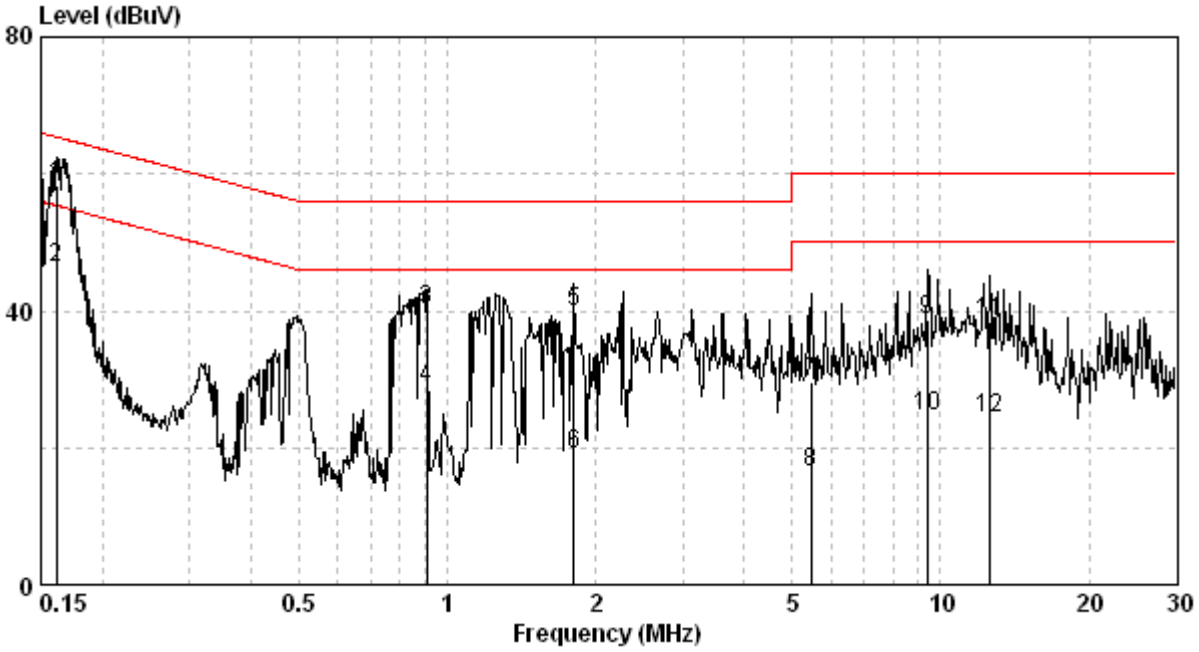
Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Level (dBuV) = Corr. Factor (dB) + Reading (dBuV)
3. Margin (dB) = Level (dBuV) – Limit (dBuV)



Phase: Neutral Line
Model No.: AP9X
Test Condition: Tx mode

Frequency (MHz)	Corr. Factor (dB)	Reading QP (dBuV)	Level QP (dBuV)	Limit QP (dBuV)	Reading AV (dBuV)	Level AV (dBuV)	Limit AV (dBuV)	Margin (dB) QP	Margin (dB) AV
0.162	9.71	48.63	58.34	65.38	36.67	46.38	55.38	-7.05	-9.00
0.909	9.74	30.28	40.02	56.00	19.02	28.75	46.00	-15.98	-17.25
1.810	9.77	30.18	39.95	56.00	9.37	19.14	46.00	-16.05	-26.86
5.476	9.83	19.82	29.65	60.00	6.47	16.29	50.00	-30.35	-33.71
9.401	9.86	28.77	38.63	60.00	14.67	24.53	50.00	-21.37	-25.47
12.582	9.88	28.52	38.40	60.00	14.47	24.35	50.00	-21.60	-25.65

Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Level (dBuV) = Corr. Factor (dB) + Reading (dBuV)
3. Margin (dB) = Level (dBuV) – Limit (dBuV)



Appendix A: Test equipment list

Test Equipment/ Test site	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
EMI Test Receiver	Rohde & Schwarz	ESR-7	101232	2020/01/18	2021/01/16
Signal Analyzer	Agilent	N9030A	MY51380492	2019/08/21	2020/08/19
Active Loop Antenna	SCHWARZBECK MESS-ELEKTRONIC	FMZB1519	1519-067	2019/04/19	2020/04/17
Broadband Antenna	SHWARZBECK	VULB 9168	9168-172	2019/06/05	2020/06/03
Horn Antenna	SHWARZBECK	BBHA 9120 D	9120D-456	2020/01/20	2021/01/18
Pre-amplifier	SCHWARZBECK	BBV9718	9718-004	2019/10/16	2020/10/14
Power Meter	Anritsu	ML2495A	0844001	2019/10/23	2020/10/21
Power Sensor	Anritsu	MA2411B	0738452	2019/10/23	2020/10/21
966-2(A) Cable	SUHNER	SMA / EX 100	N/A	2019/08/19	2020/08/17
966-2(B) Cable	SUHNER	SUCOFLEX 104P	CB0005	2019/08/19	2020/08/17
RF Cable	SUHNER	SUCOFLEX 102	CB0006	2019/05/02	2020/04/30
Hight Pass Filter	Wainwright	WHKX3.0/18G-12SS	N/A	2019/05/30	2020/05/28
966-2_3m Semi-Anechoic Chamber	966_2	CEM-966_2	N/A	2020/02/23	2021/02/22

Note: No Calibration Required (NCR)

Test Equipment/ Test site	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
EMI Receiver	R&S	ESCI	100059	2019/11/05	2020/11/03
Two-Line V-Network	R&S	ENV216	101159	2019/06/12	2020/06/10
Two-Line -V-Network	R&S	ESH3-Z5	825562/003	2019/08/27	2020/08/25
CON-1 Shielded Room	N/A	N/A	N/A	NCR	NCR
CON-1 Cable	SUHNER	SUCOFLEX-104	26438414	2019/05/02	2020/04/30
Test software	Audix	e3	4.20040112L	NCR	NCR

Note: No Calibration Required (NCR).

Appendix B: Measurement Uncertainty

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of k=2.

Item	Uncertainty
Vertically polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	4.90 dB
Horizontally polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	4.89 dB
Vertically polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	4.29 dB
Horizontally polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	4.29 dB
Vertically polarized Radiated disturbances from 18GHz~26.5GHz in a semi-anechoic chamber at a distance of 1m	2.45 dB
Horizontally polarized Radiated disturbances from 18GHz~26.5GHz in a semi-anechoic chamber at a distance of 1m	2.45 dB
Radiated disturbances from 9kHz~30MHz in a semi-anechoic chamber at a distance of 3m	3.32 dB
Emission on the Band Edge Test	4.29 dB
Minimum 6 dB Bandwidth	7.69 %
Maximum Peak Conducted Output Power	0.37 dB
Power Spectral Density	1.15 dB
Emissions In Non-Restricted Frequency Bands	1.15 dB
AC Power Line Conducted Emission	2.52 dB