

FCC TEST REPORT

Application No.: ZR/2020/70002
Applicant: LG Electronics USA, Inc.
Address of Applicant: 111 Sylvan Avenue, North Building Englewood Cliffs, NJ 07632
Manufacturer: Huaqin Telecom Technology Co.,Ltd.
Address of Manufacturer: No.1 Building, No.9 Building, No.399,Keyuan Road,Zhangjiang Hi-tech Park,Shanghai,P.R.China
EUT Description: Mobile handset
Model No.: LM-K420YMW, LM-K420YM
Trade Mark: LG
FCC ID: ZNFK420YMW
Standards: 47 CFR FCC Part 2, Subpart J
 47 CFR Part 15, Subpart C
Test Method: KDB558074 D01 15.247 Meas Guidance v05r02
 ANSI C63.10 (2013)
Date of Receipt: 2020/7/16
Date of Test: 2020/7/16 to 2020/7/31
Date of Issue: 2021/5/2

Test Result:	PASS *
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. * In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

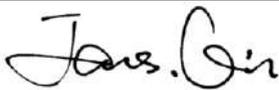
Derek Yang
Wireless Laboratory Manager



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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2020/8/14		Original
02		2021/5/2	James Qin	1.Add test site Information 2.Modify data conversion error of antenna height 3.Update equipment list

Authorized for issue by:	
Prepared By	 (James Qin) / Engineer
Checked By	 (David Chen) / Reviewer



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2 Test Summary

Test Item	Test Requirement	Test method	Test Result	Result	Test Lab*
AC Power Line Conducted Emission	15.207	ANSI C63.10 2013	Clause 4.2	PASS	B
Duty Cycle	--	--	Clause 4.3	PASS	A
Conducted Output Power	15.247 (b)(3)	ANSI C63.10 2013	Clause 4.4	PASS	A
DTS (6 dB) Bandwidth & 99% Occupied Bandwidth	15.247 (a)(2)	ANSI C63.10 2013	Clause 4.5	PASS	A
Power Spectral Density	15.247 (e)	ANSI C63.10 2013	Clause 4.6	PASS	A
Band-edge for RF Conducted Emissions	15.247(d)	ANSI C63.10 2013	Clause 4.7	PASS	A
RF Conducted Spurious Emissions	15.247(d)	ANSI C63.10 2013	Clause 4.8	PASS	A
Radiated Spurious Emissions	15.247(d);15.205/15.209	ANSI C63.10 2013	Clause 4.9	PASS	B
Restricted bands around fundamental frequency (Radiated Emission)	15.247(d);15.205/15.209	ANSI C63.10 2013	Clause 4.10	PASS	B

All test were performed by Lab A and B.

Parts of test items above were subcontracted to Lab B.

Lab A: SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch

Lab B: SGS-CSTC STANDARDS TECHNICAL SERVICES (XI 'AN) CO., LTD



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3 General Information

3.1 Client Information

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Address of Applicant	111 Sylvan Avenue, North Building Englewood Cliffs, NJ 07632
Manufacturer:	Huaqin Telecom Technology Co.,Ltd.
Address of Manufacturer:	No.1 Building, No.9 Building, No.399,Keyuan Road,Zhangjiang Hi-tech Park,Shanghai,P.R.China

3.2 Test Location

Lab A:

Company:	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
Address:	No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China
Post code:	518057
Test engineer:	Dee Zheng, Mike Hu

Lab B:

Company:	SGS-CSTC STANDARDS TECHNICAL SERVICES (XI 'AN) CO., LTD.
Address:	1/F, Unit D, Building 1, Kanghong Orange Technology Park, No.137, Keyuan 3rd Road, Fengdong New City, Xi'an, Shaanxi China
Post code:	710086
Test engineer:	Ben Huang, Leah Chen



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3.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

Lab A:

• A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• VCCI

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• FCC –Designation Number: CN1178

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

• Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

Lab B:

A2LA (Certificate No. 4854.01)

SGS-CSTC STANDARDS TECHNICAL SERVICES (XI 'AN) CO., LTD. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4854.01.

Designation Number: CN1271.



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3.4 General Description of EUT

EUT Description::	Mobile handset
Model No.:	LM-K420YMW, LM-K420YM
Trade Mark:	LG
IEEE 802.11 WLAN Mode Supported	<input checked="" type="checkbox"/> 802.11B (20 MHz channel bandwidth), <input checked="" type="checkbox"/> 802.11G (20 MHz channel bandwidth) <input checked="" type="checkbox"/> 802.11N (20 MHz channel bandwidth), <input type="checkbox"/> 802.11N (40 MHz channel bandwidth)
Operation Frequency:	2400 MHz -2483.5MHz fc = 2407 MHz + N * 5 MHz, where: -fc = "Operating Frequency" in MHz, -N = "Channel Number" with the range from 1 to 11 for the 20 MHz channel bandwidth, or 3 to 9 for the 40 MHz channel bandwidth.
Type of Modulation:	IEEE for 802.11B: DSSS IEEE for 802.11G : OFDM IEEE for 802.11N(HT20) : OFDM
Sample Type:	<input checked="" type="checkbox"/> Portable Device, <input type="checkbox"/> Module
Antenna Type:	<input type="checkbox"/> External, <input checked="" type="checkbox"/> Integrated
Antenna Ports	<input checked="" type="checkbox"/> Ant 1, <input type="checkbox"/> Ant 2, <input type="checkbox"/> Ant 3
Smart System	<input checked="" type="checkbox"/> SISO (for 802.11B/G/N), <input type="checkbox"/> MIMO (for 802.11N): 2 Tx & 2 Rx, <input type="checkbox"/> Diversity (for 802.11B/G) : Tx & Rx
Antenna Gain:	-3.8dBi
Power Supply	<input checked="" type="checkbox"/> AC/DC Adapter; <input checked="" type="checkbox"/> Battery <input type="checkbox"/> PoE;; <input type="checkbox"/> Other:

Operation Frequency of each channel (802.11B/G/N HT20)

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2412MHz	4	2427MHz	7	2442MHz	10	2457MHz
2	2417MHz	5	2432MHz	8	2447MHz	11	2462MHz
3	2422MHz	6	2437MHz	9	2452MHz	12	2467MHz
13	2472MHz						



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Remark:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency for 802.11B/G/N (HT20)
CH 1	2412MHz
CH 6	2437MHz
CH 11	2462MHz
CH 12	2467MHz
CH 13	2472MHz



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3.5 Test Environment and Mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	50 % RH
Atmospheric Pressure:	101.30 KPa
Test mode:	
Transmitting mode:	Keep the EUT in transmitting mode with all kind of modulation and all kind of data rate.

3.6 Description of Support Units

The EUT has been tested independent unit.



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3.7 MCC Country code detection mechanism specification

Network mode	Description
No country code received	The device only operates with the default country code. (12 /13 channels enable)
Invalid country code received	The device can't get invalid country code. If the network is connected, the country code is set in US. (12/13 channels disable) Otherwise, if the network is not connected, the device operates with the default country code. (12/13 channels enable)
US country code	If the network is connected, the country code is set in US. (12/13 channels disable) Otherwise, if the network is not connected, the device operates with the default country code. (12/13 channels enable)
US territories country code (Guam, Puerto Rico)	If the network is connected, the country code is set according to the network service. Otherwise, if the network is not connected, the device operates with the default country code. (12/13 channels enable)
Airplane mode	The device only operates with the default county code. (12/ 13 channels enable)
On loss of non-US country code (drop the link any verify device returns to default state)	The device only operates with the default county code. (12/ 13 channels enable)



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Remark:

1.Channel 12 and 13 are enable in default mode for this device.Channel 12 and 13 use lower target power.

2.The device always use country code as geo-location information and it is determined only when the device is attached to 2G/3G/LTE network.Additionally,in case of the invalid country code, Wi-Fi driver will revert to the NV Binary code in which channels 1-13 are enabled.Therefore there will be no problem with those scenarios.

3.The device always use the country code as location information and it periodically checks the information in a few seconds until the device is attached to 2G/3G/LTE network.For the multiple cell network environment with different MCC codes, there will be network roam search with intervals below and the device will get the updated country code when the device is attached to the different network.

-2G/3G/LTE network:Every 2 seconds



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4 Test results and Measurement Data

4.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(c)
<p>15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p> <p>15.247(b) (4) requirement: 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.</p>	
<p>The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -3.8dBi.</p>	



4.2 AC Power Line Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207		
Test Method:	ANSI C63.10: 2013		
Test Frequency Range:	150kHz to 30MHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
	* Decreases with the logarithm of the frequency.		
Test Procedure:	<ol style="list-style-type: none"> 1) The mains terminal disturbance voltage test was conducted in a shielded room. 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded. 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2. 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement. 		



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<p>Test Setup:</p>	
<p>Exploratory Test Mode:</p>	<p>Transmitting with all kind of modulations, data rates at lowest, middle and highest channel. Charge + Transmitting mode.</p>
<p>Final Test Mode:</p>	<p>Through Pre-scan, find the 1Mbps of rate of 802.11B at lowest channel is the worst case. Charge + Transmitting mode. Only the worst case is recorded in the report.</p>
<p>Instruments Used:</p>	<p>Refer to section 5.10 for details</p>
<p>Test Results:</p>	<p>Pass</p>



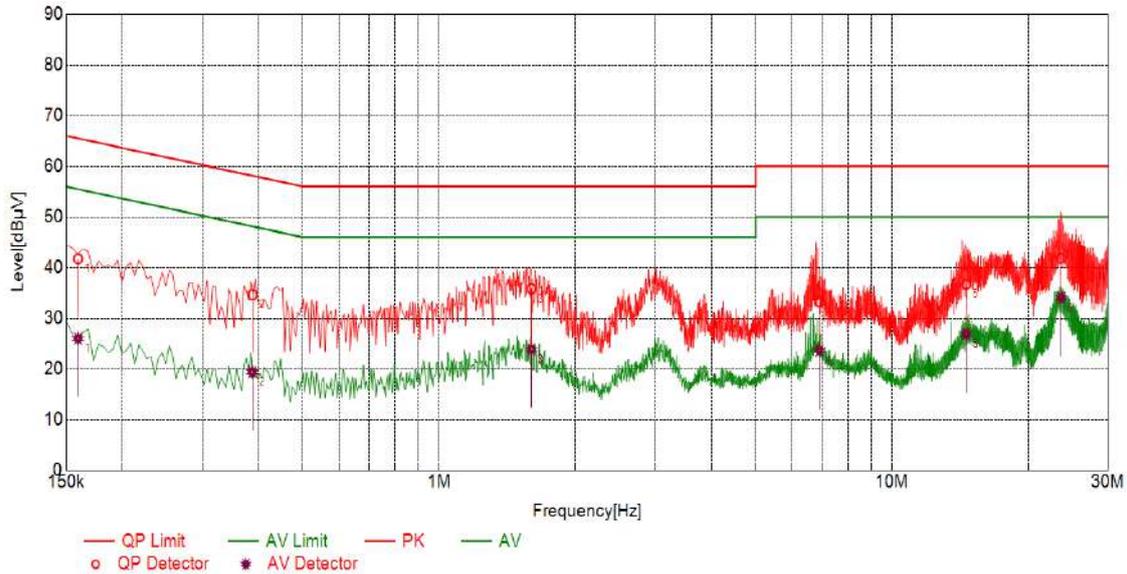
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Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Live Line:



Test Graph

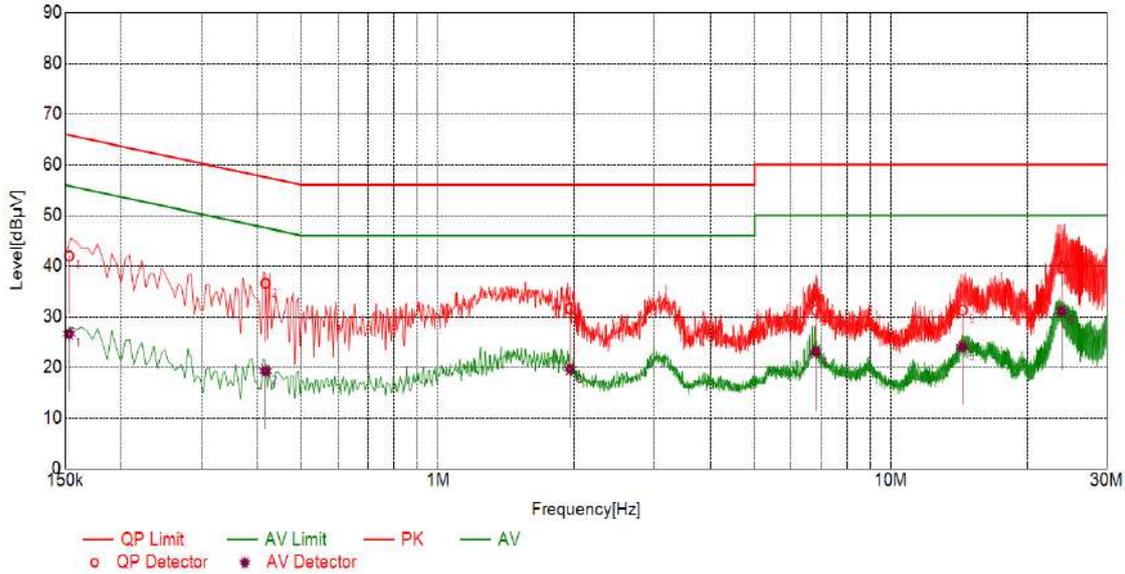
Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Type
1	0.1594	10.10	41.74	65.49	23.75	25.99	55.49	29.50	L
2	0.3867	10.10	34.65	58.13	23.48	19.38	48.13	28.75	L
3	1.5998	10.10	35.83	56.00	20.17	23.85	46.00	22.15	L
4	6.9251	10.10	33.27	60.00	26.73	23.64	50.00	26.36	L
5	14.6003	10.11	36.74	60.00	23.26	26.91	50.00	23.09	L
6	23.6678	10.11	41.84	60.00	18.16	34.07	50.00	15.93	L



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Neutral Line:



Test Graph

Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Type
1	0.1531	10.10	42.00	65.83	23.83	26.63	55.83	29.20	N
2	0.4156	10.10	36.56	57.54	20.98	19.30	47.54	28.24	N
3	1.9574	10.10	31.62	56.00	24.38	19.68	46.00	26.32	N
4	6.8337	10.10	31.25	60.00	28.75	23.05	50.00	26.95	N
5	14.3885	10.11	31.27	60.00	28.73	24.06	50.00	25.94	N
6	23.8502	10.11	39.68	60.00	20.32	31.07	50.00	18.93	N

Remarks:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level = Receiver Reading + LISN Factor + Cable Loss.



4.3 Duty Cycle

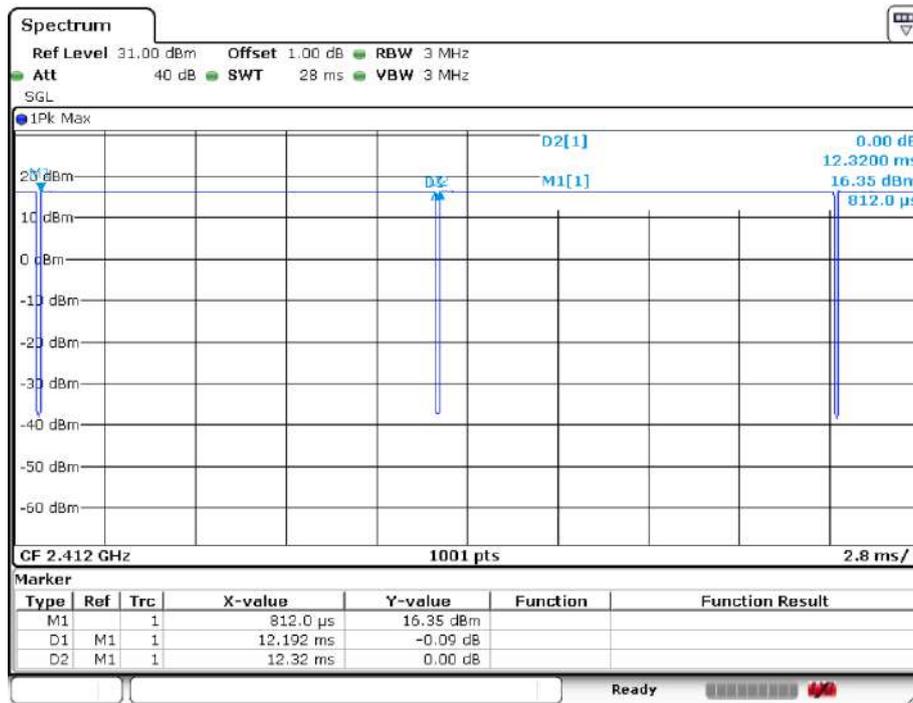
4.3.1 Test Results

Test Mode	TX Freq. [MHz]	Duty cycle [%]
11B	Ant 1: CH1,CH6,CH11	98.96
11G	Ant 1: CH1,CH6,CH11	95.52
11N20	Ant 1: CH1,CH6,CH11	95.80

4.3.1 Test Plots

4.3.1.1 ANT1

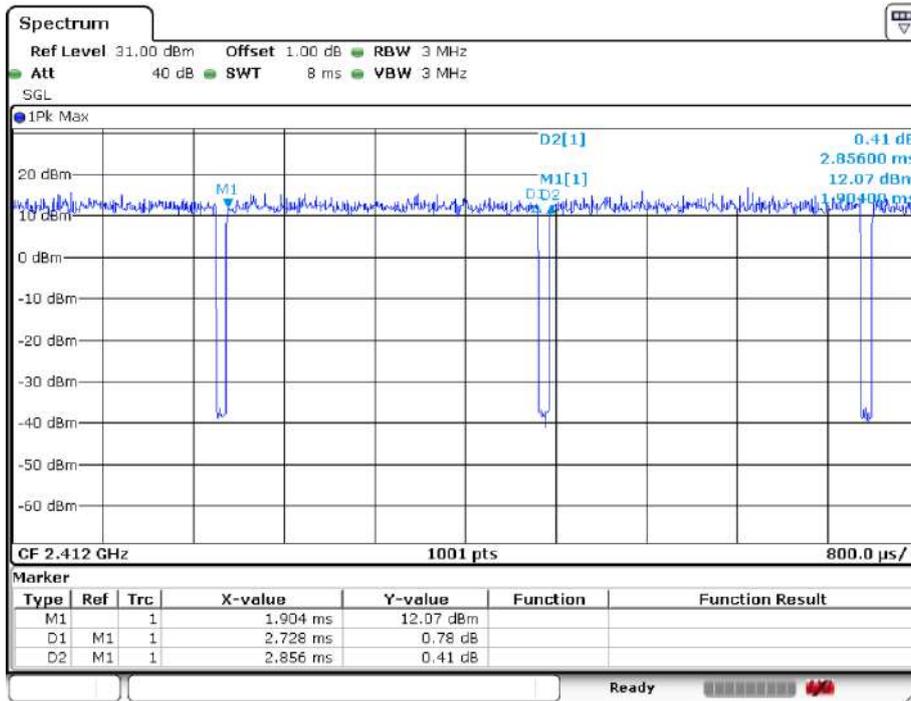
4.3.1.1.1 11B



Date: 27.JUL.2020 09:46:19

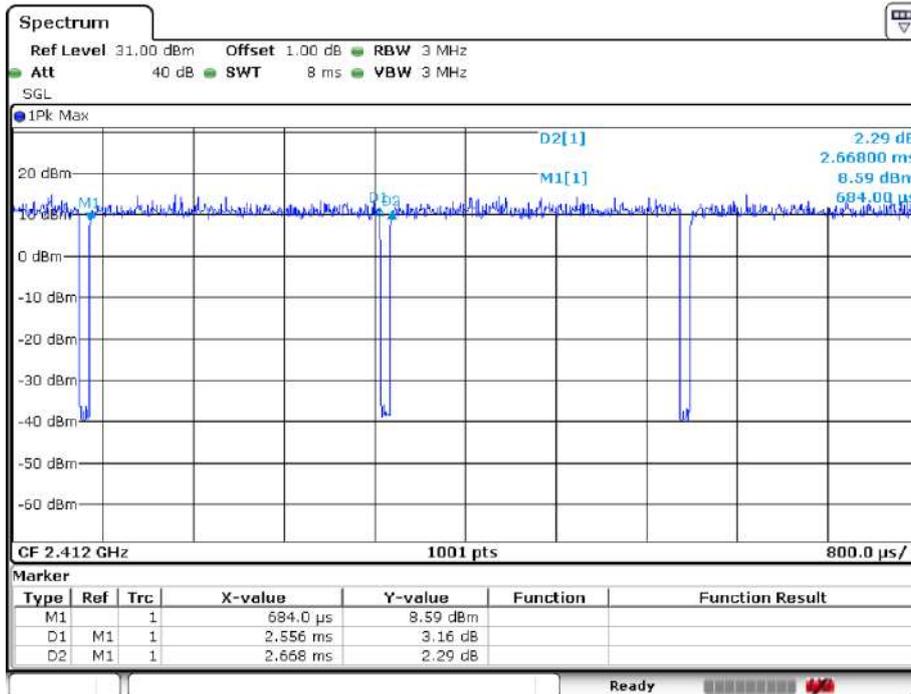


4.3.1.1.2 11G



Date: 27 JUL 2020 09:45:26

4.3.1.1.3 11N20



Date: 27 JUL 2020 09:47:13



4.4 Conducted Output Power

Test Requirement:	47 CFR Part 15C Section 15.247 (b)(3)
Test Method:	ANSI C63.10 :2013 Section 11.9.1.3
Test Setup:	
Test Instruments:	Refer to section 5.10 for details
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G ; 6.5Mbps of rate is the worst case of 802.11N(HT20);
Limit:	30dBm
Test Results:	Pass



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4.4.1 Test Results

Measurement Data of Peak Power:

Mode	Test Channel	Peak Output Power (dBm)	Limit (dBm)	Result
802.11B	CH1	16.19	30.00	Pass
	CH6	16.92	30.00	Pass
	CH11	16.71	30.00	Pass
	CH12	5.44	30.00	Pass
	CH13	5.08	30.00	Pass
802.11G	CH1	14.01	30.00	Pass
	CH6	15.43	30.00	Pass
	CH11	14.13	30.00	Pass
	CH12	5.27	30.00	Pass
	CH13	4.77	30.00	Pass
802.11N20	CH1	13.08	30.00	Pass
	CH6	15.56	30.00	Pass
	CH11	13.36	30.00	Pass
	CH12	5.21	30.00	Pass
	CH13	4.67	30.00	Pass



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4.5 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)
Test Method:	ANSI C63.10: 2013 Section 11.8.1 Option 1
Test Setup:	<p>The diagram shows a Spectrum Analyzer on the left and an E.U.T. on the right, connected by a red cable. They are both on a brown table labeled 'Non-Conducted Table'. Below the table is a grey bar labeled 'Ground Reference Plane'.</p>
Instruments Used:	Refer to section 5.10 for details
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G; 6.5Mbps of rate is the worst case of 802.11N(HT20);
Limit:	≥ 500 kHz
Test Results:	Pass



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4.5.1 Test Results

Mode	Test Channel	Occupied Bandwidth (MHz)	6dB Emission Bandwidth (MHz)	Limit (kHz)	Result
802.11B	CH1	13.42	9.03	≥500	Pass
	CH6	13.29	9.07	≥500	Pass
	CH11	12.55	8.08	≥500	Pass
	CH12	13.24	8.99	≥500	Pass
	CH13	13.33	9.07	≥500	Pass
802.11G	CH1	17.19	16.32	≥500	Pass
	CH6	17.24	15.85	≥500	Pass
	CH11	16.45	15.67	≥500	Pass
	CH12	17.06	15.85	≥500	Pass
	CH13	17.02	16.24	≥500	Pass
802.11N20	CH1	18.19	17.58	≥500	Pass
	CH6	18.15	16.45	≥500	Pass
	CH11	17.58	16.02	≥500	Pass
	CH12	17.97	17.41	≥500	Pass
	CH13	17.97	17.54	≥500	Pass

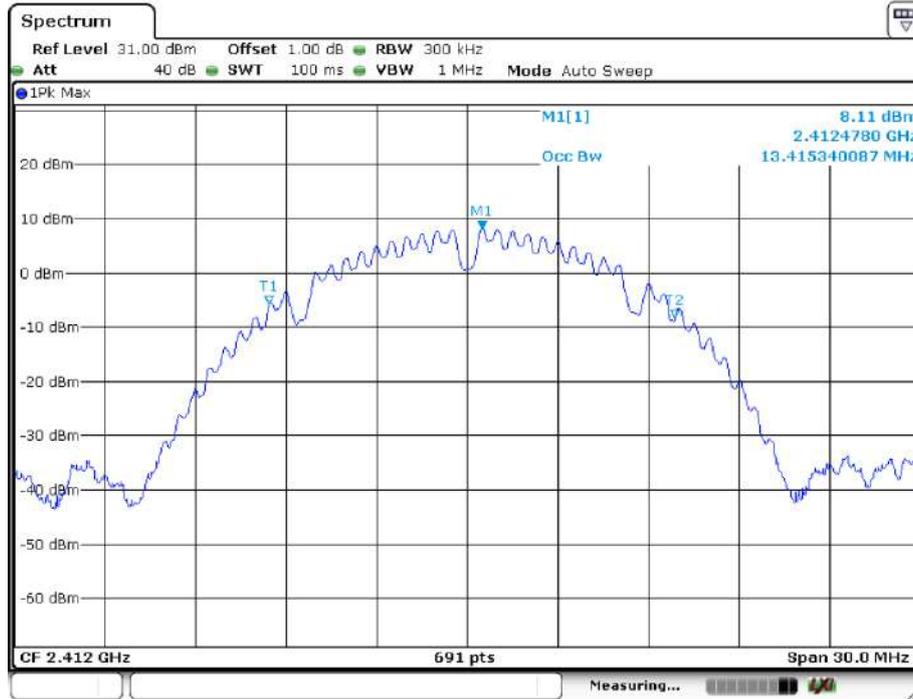


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4.5.2 Test plots

4.5.2.1 802.11B_CH1

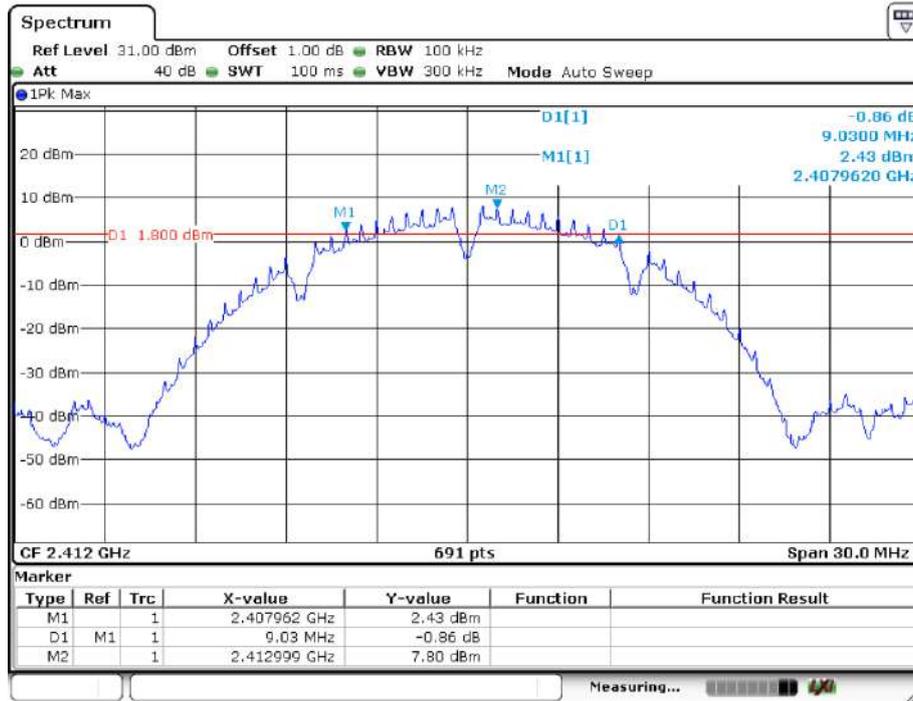


Date: 26 JUL 2020 20:19:36



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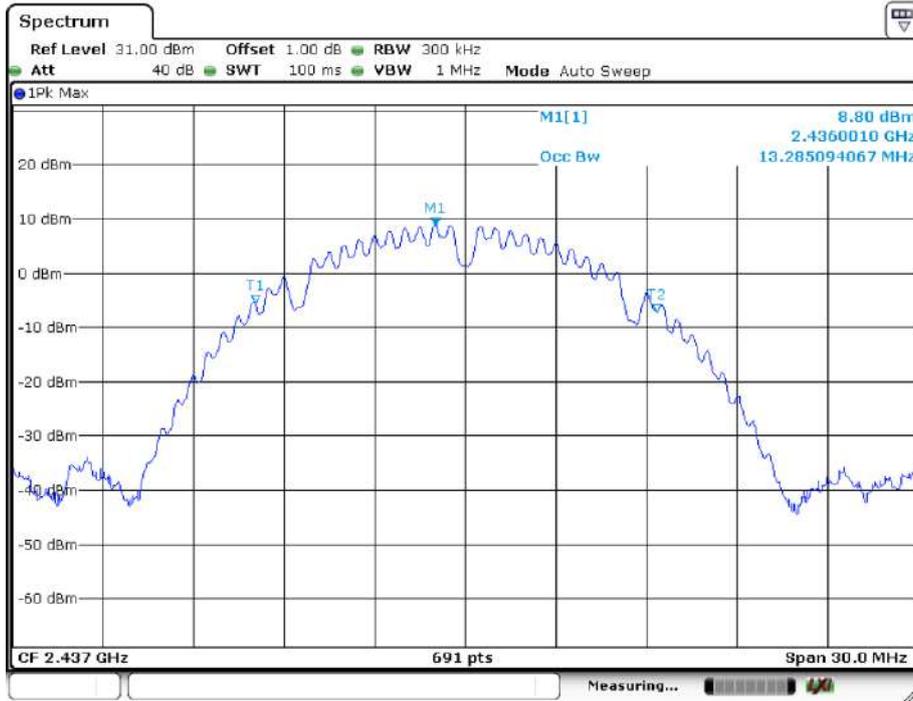


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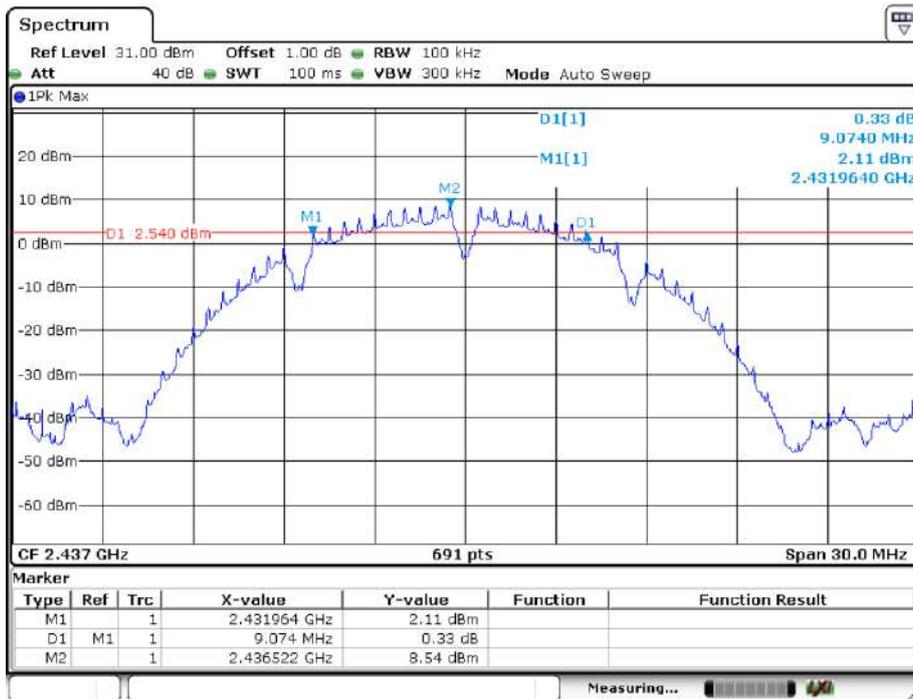
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4.5.2.2

802.11B_CH6



Date: 26 JUL 2020 20:19:24



Date: 26 JUL 2020 20:15:21

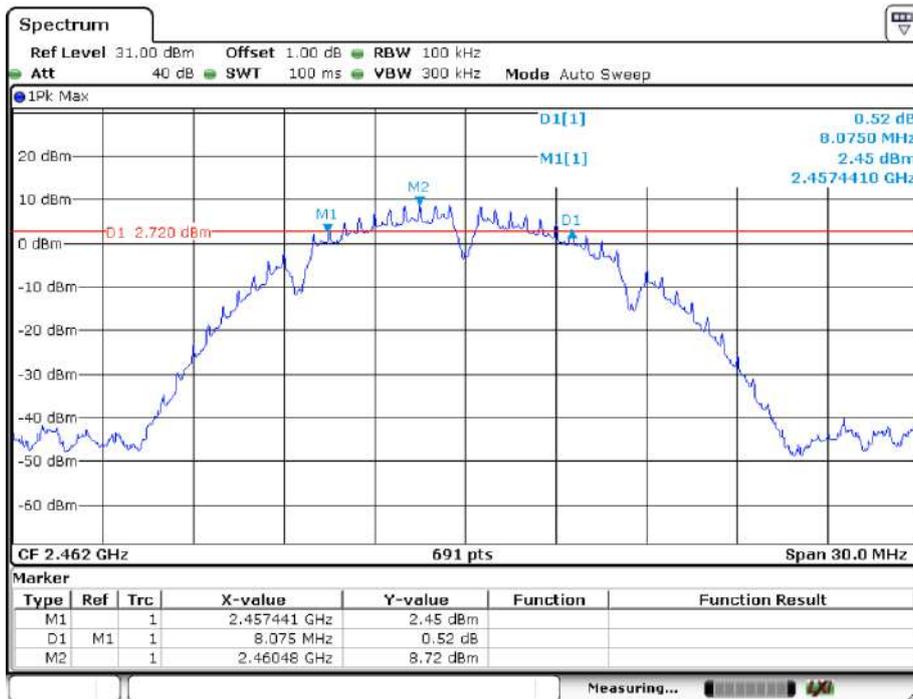


4.5.2.3

802.11B_CH11



Date: 26 JUL 2020 20:19:10

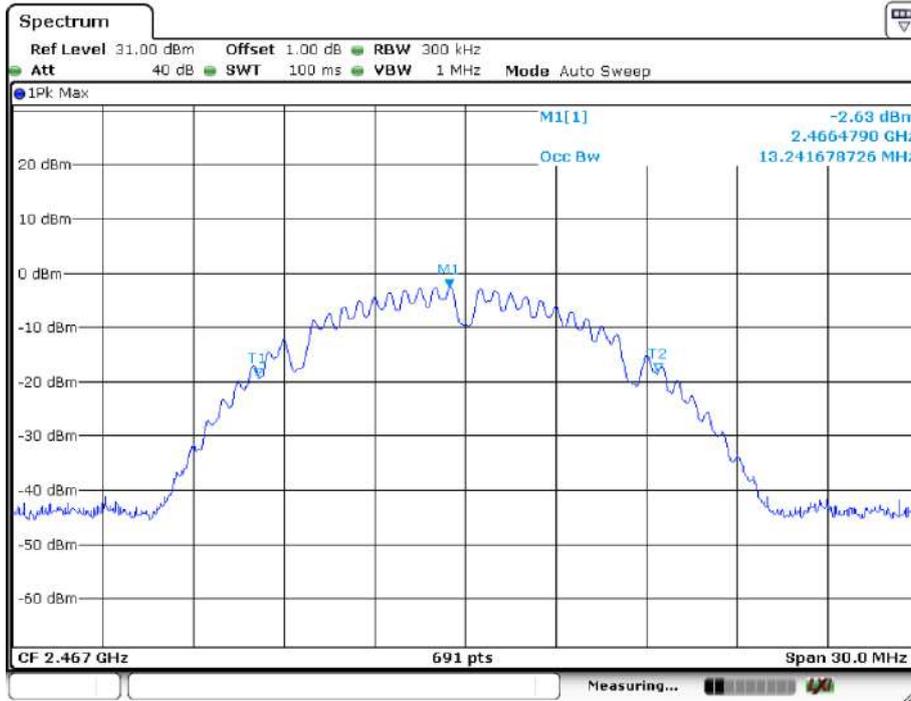


Date: 26 JUL 2020 20:15:55

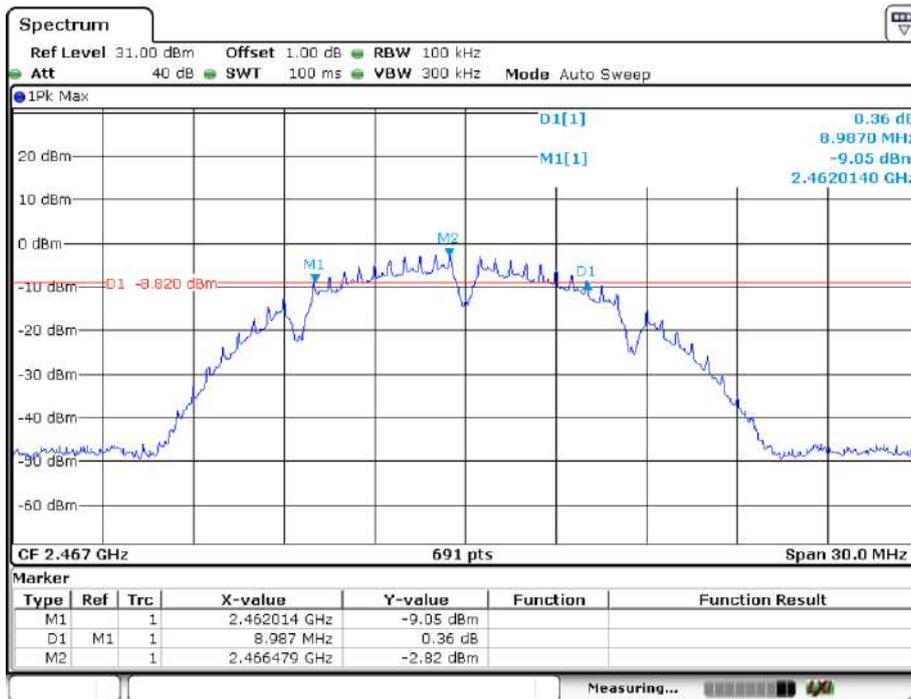


4.5.2.4

802.11B_CH12



Date: 26 JUL 2020 20:33:41

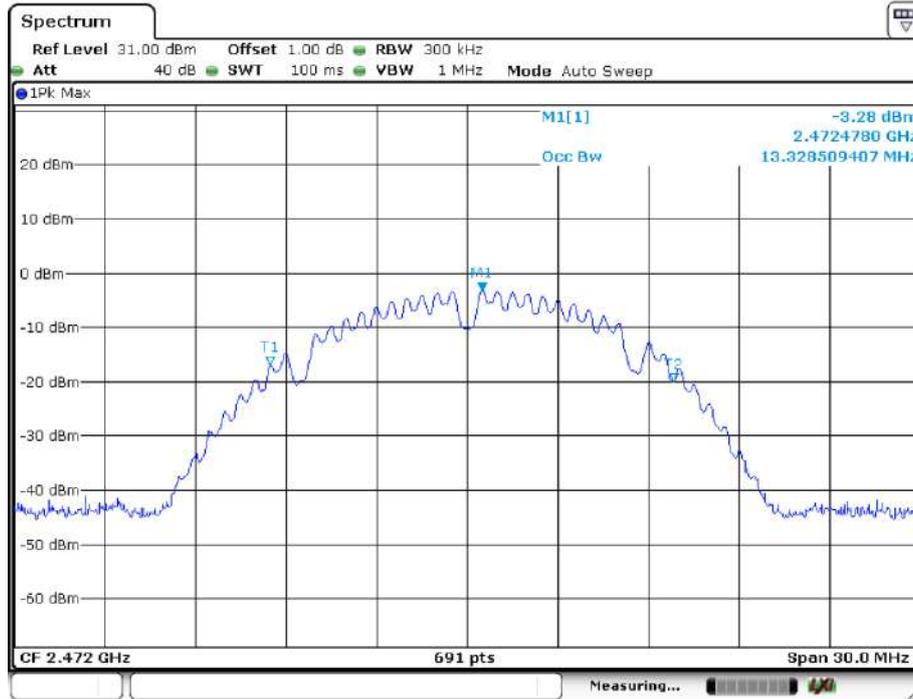


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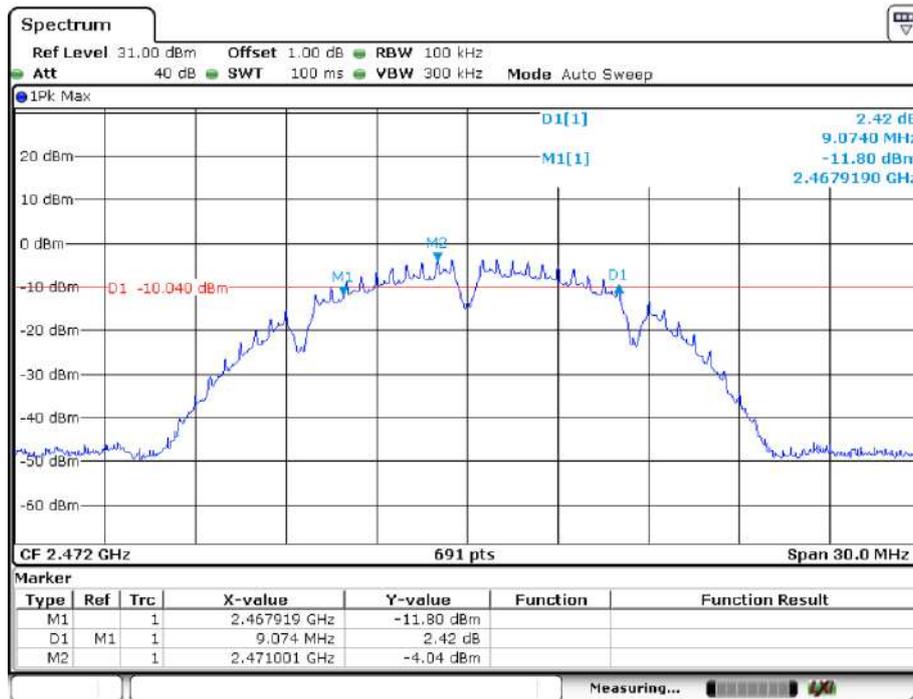


4.5.2.5

802.11B_CH13



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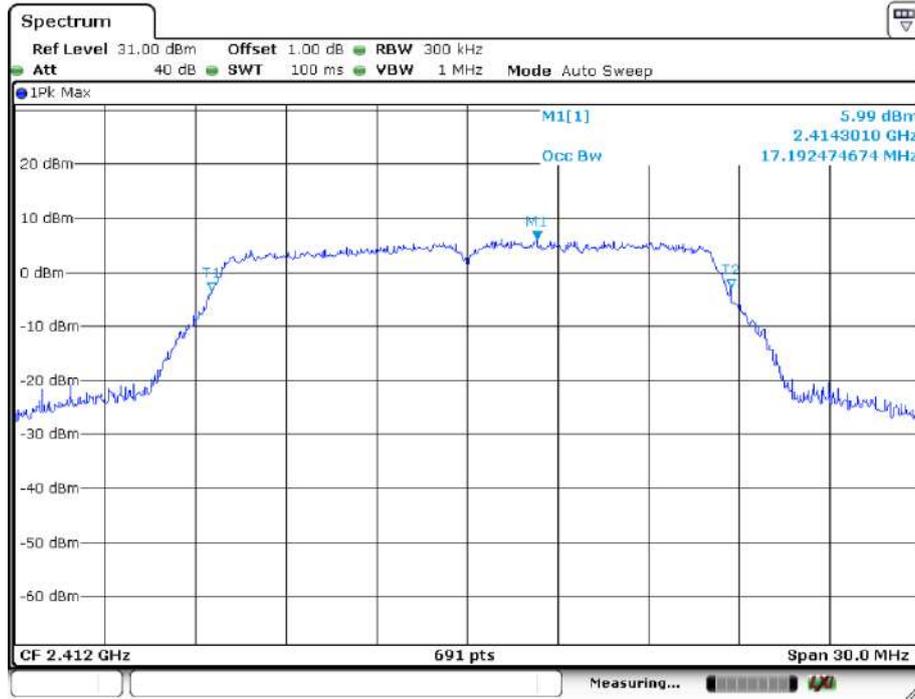


Date: 26 JUL 2020 20:31:23

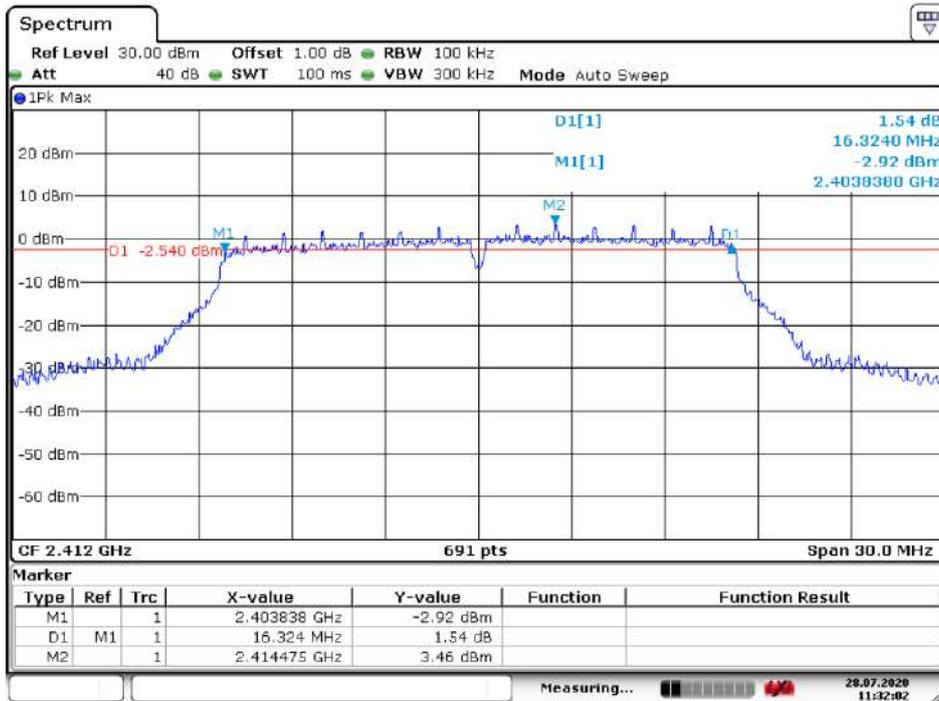


4.5.2.6

802.11G_CH1



Date: 26.JUL.2020 20:18:18



Date: 28.JUL.2020 11:32:02

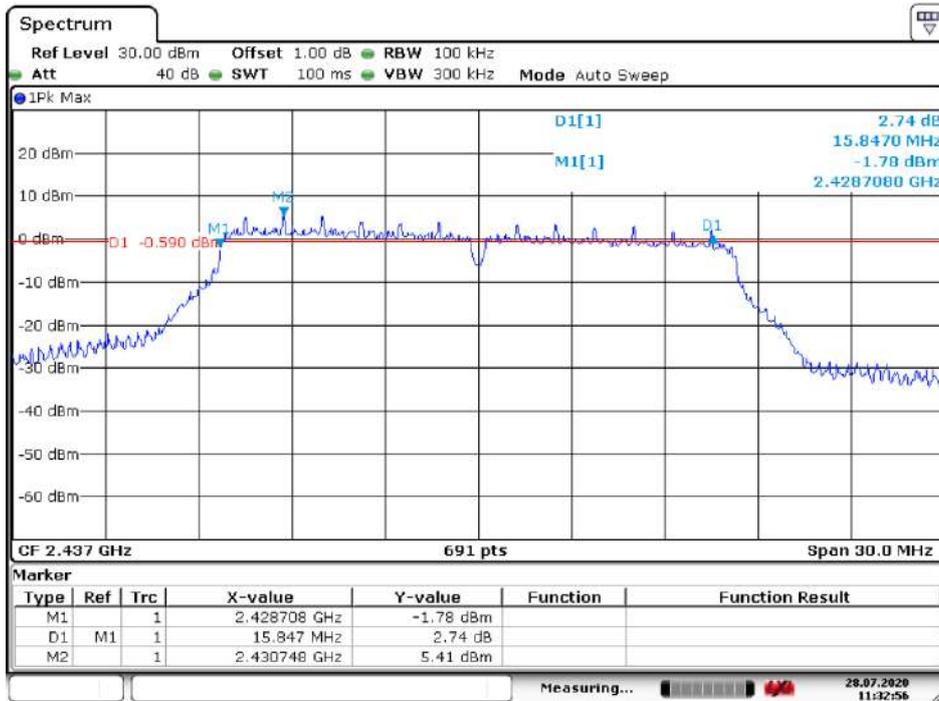


4.5.2.7

802.11G_CH6



Date: 26 JUL 2020 20:18:41



Date: 28 JUL 2020 11:32:56

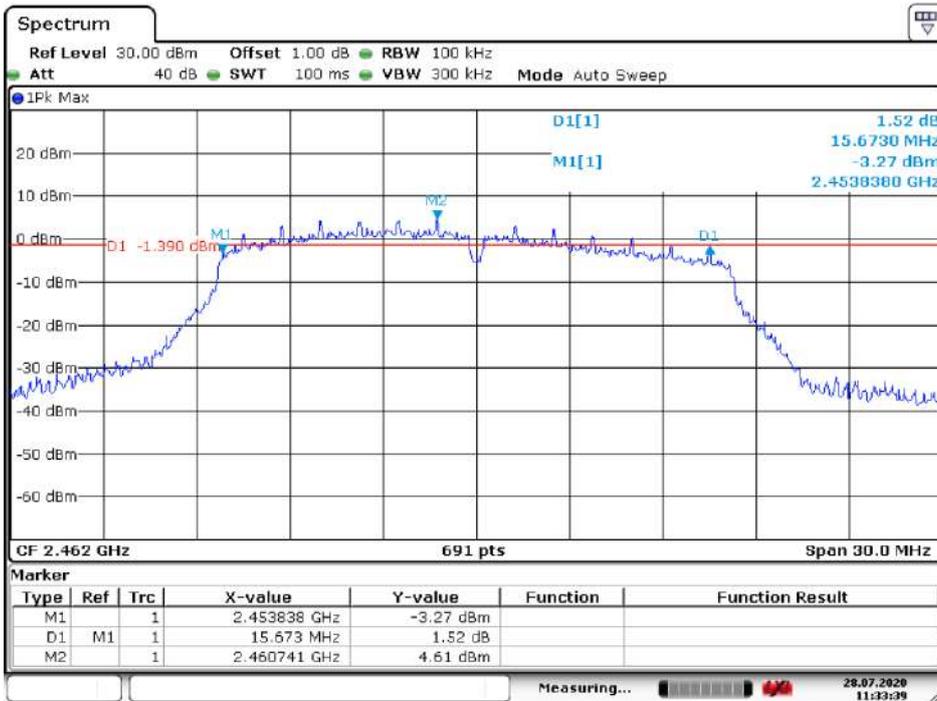


4.5.2.8

802.11G_CH11



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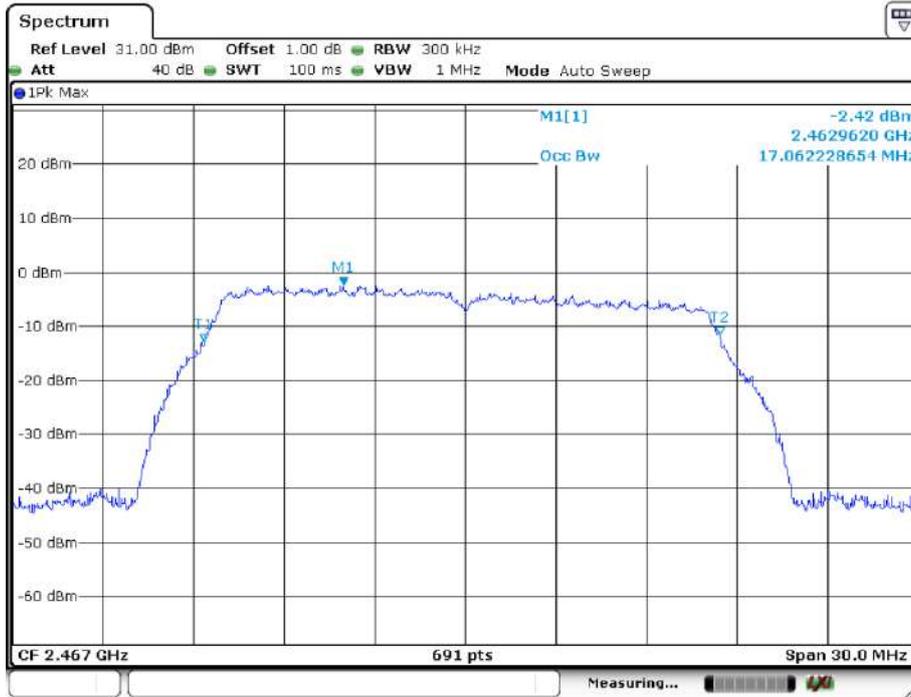


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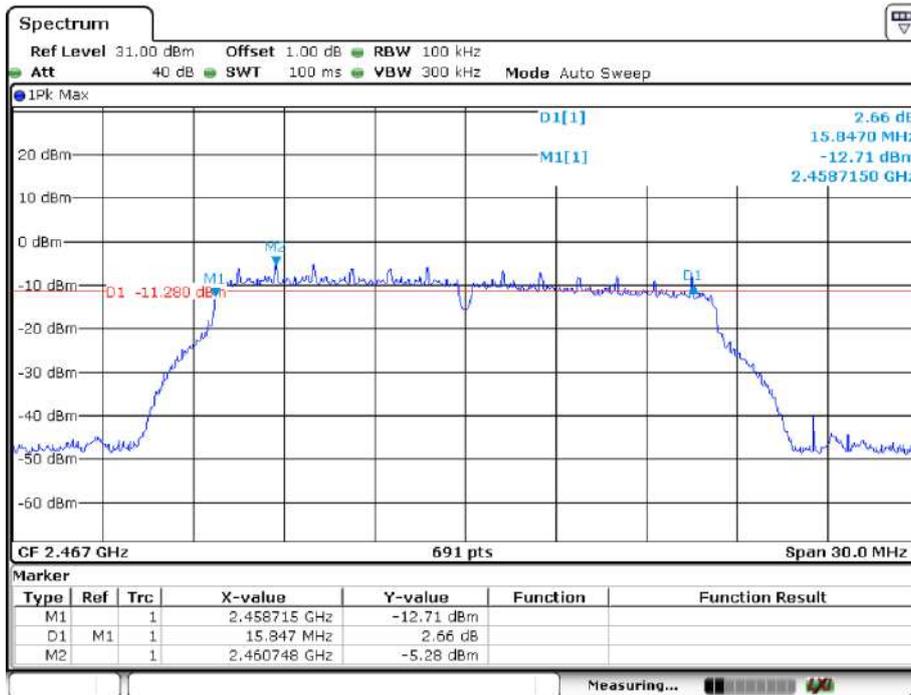


4.5.2.9

802.11G_CH12



Date: 26 JUL 2020 20:32:56



Date: 26 JUL 2020 20:32:39



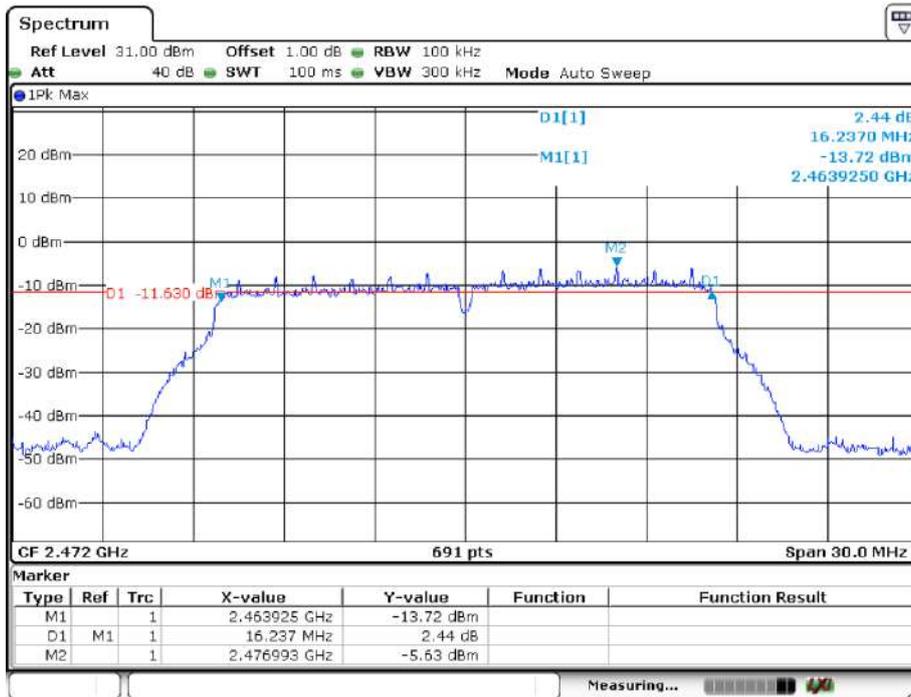
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4.5.2.10

802.11G_CH13



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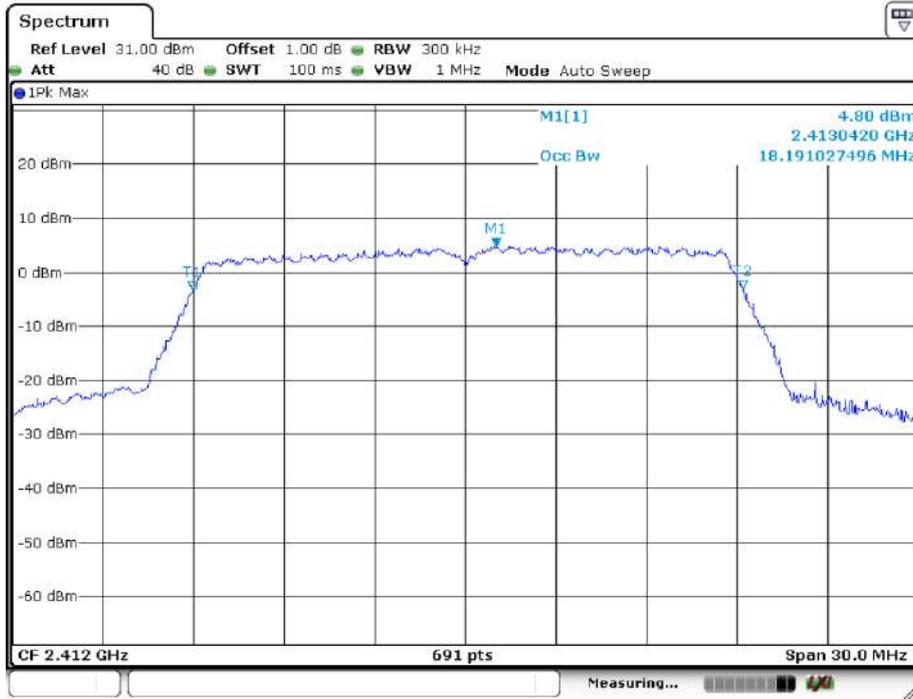


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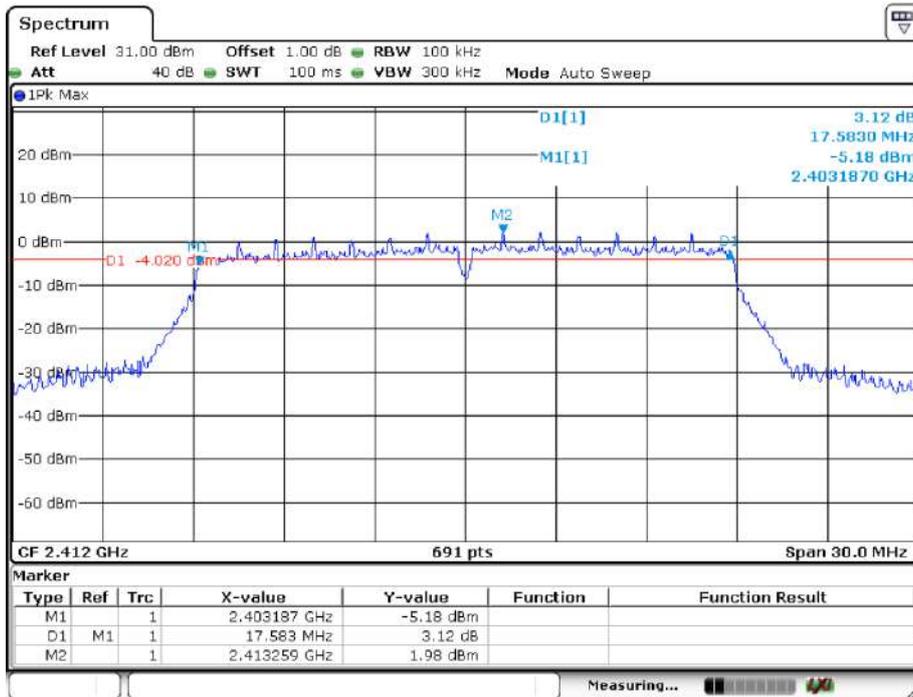


4.5.2.11

802.11N20_CH1



Date: 26 JUL 2020 20:20:10

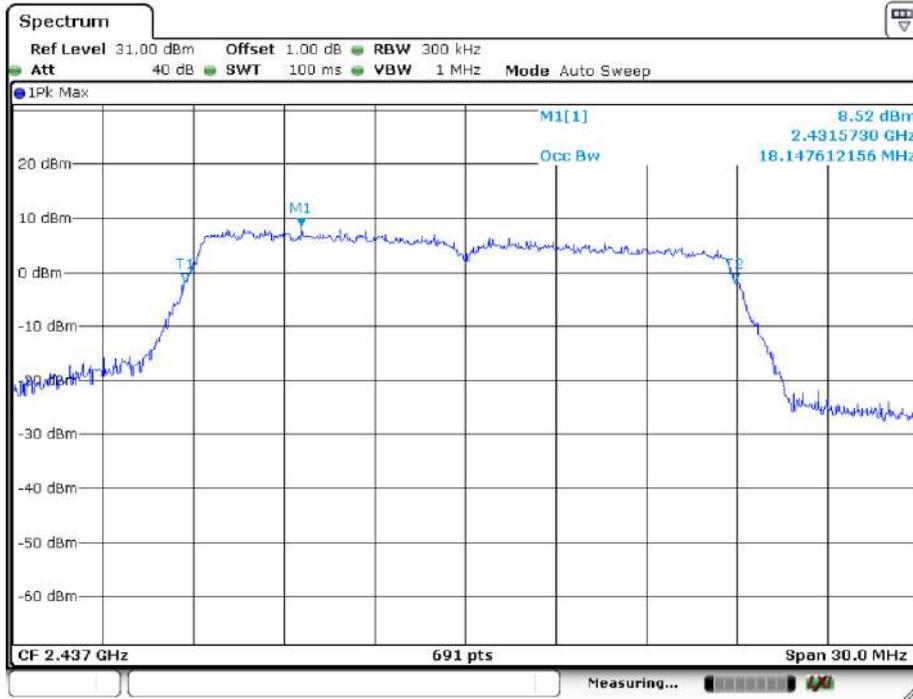


Date: 26 JUL 2020 20:13:04

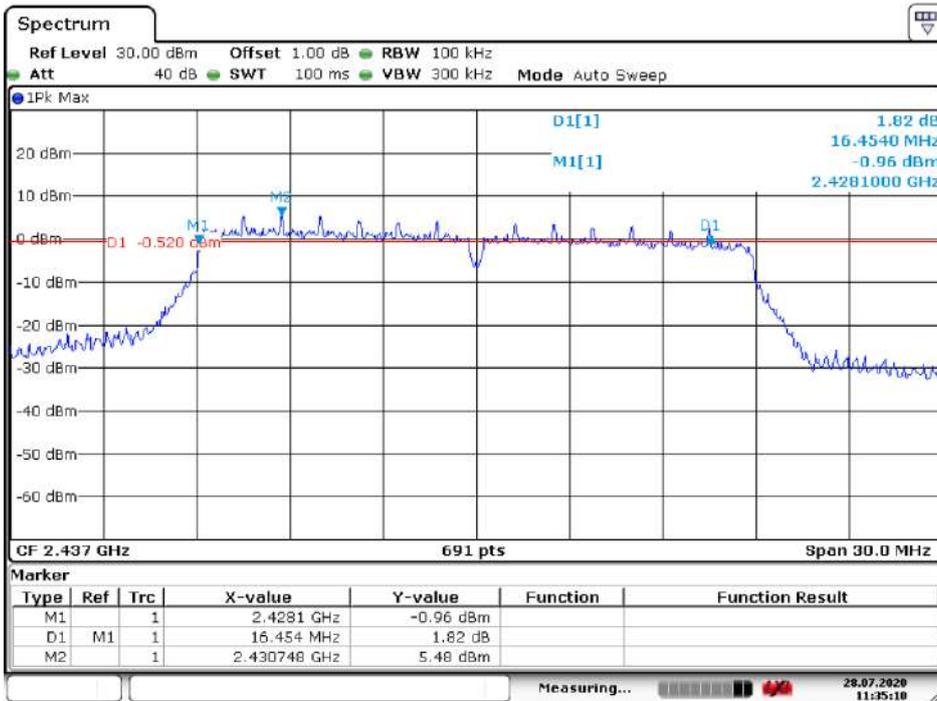


4.5.2.12

802.11N20_CH6



Date: 26 JUL 2020 20:20:26

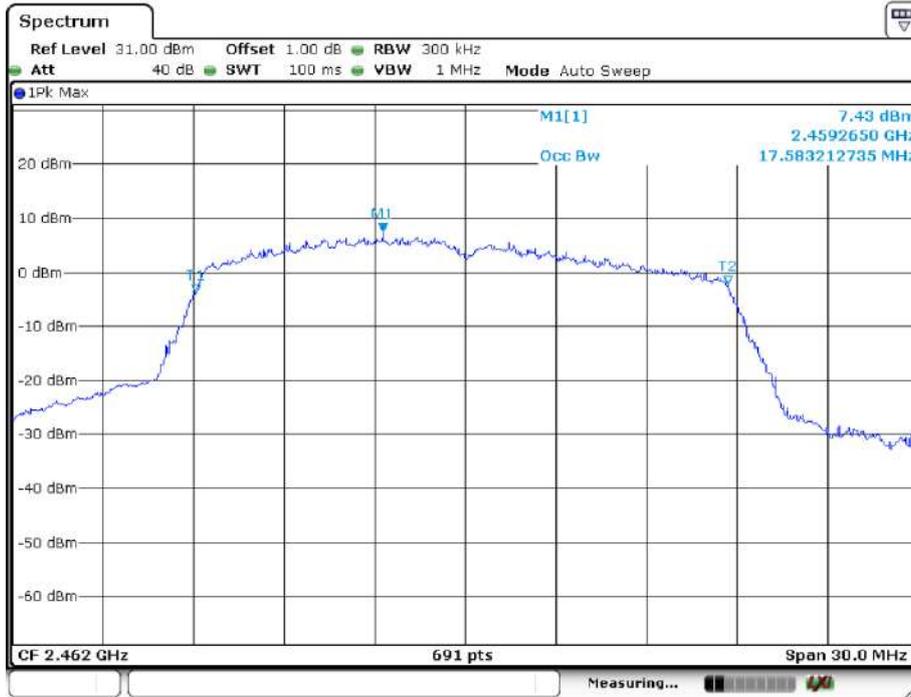


Date: 28 JUL 2020 11:35:10

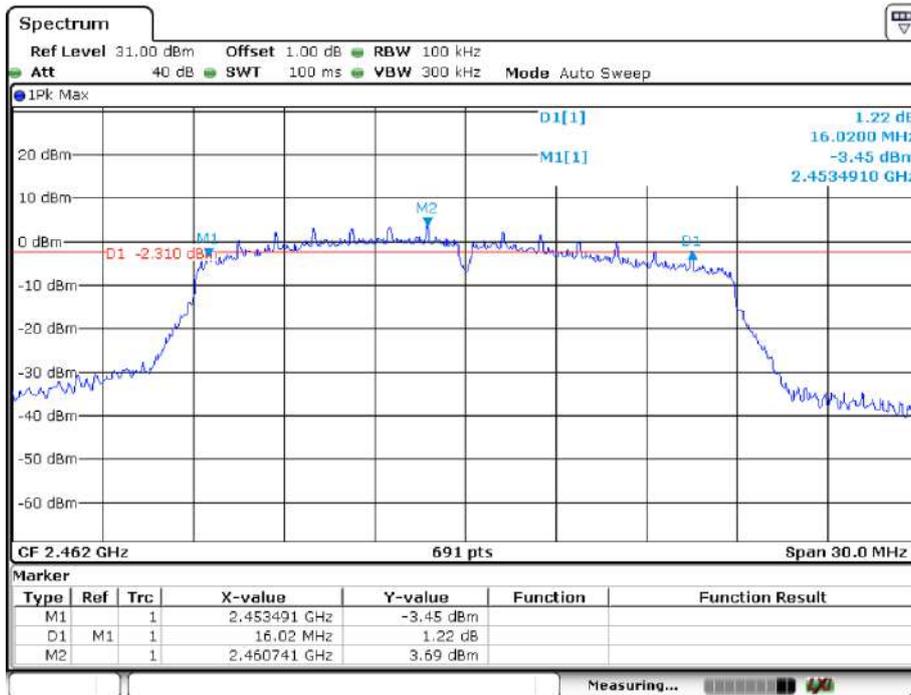


4.5.2.13

802.11N20_CH11



Date: 26 JUL 2020 20:20:45

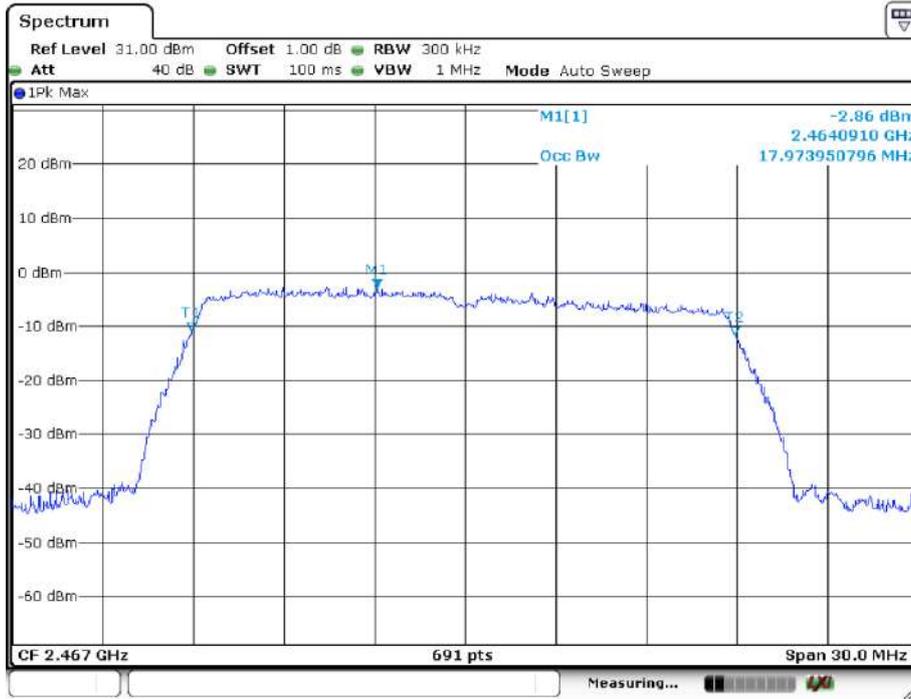


Date: 26 JUL 2020 20:11:29

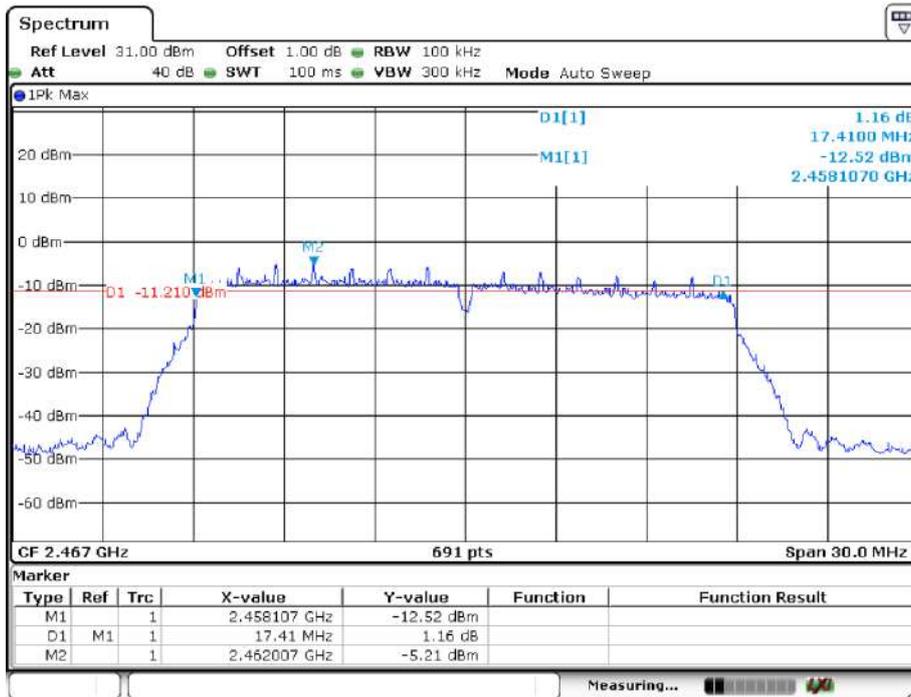


4.5.2.14

802.11N20_CH12



Date: 26 JUL 2020 20:33:58



Date: 26 JUL 2020 20:30:17

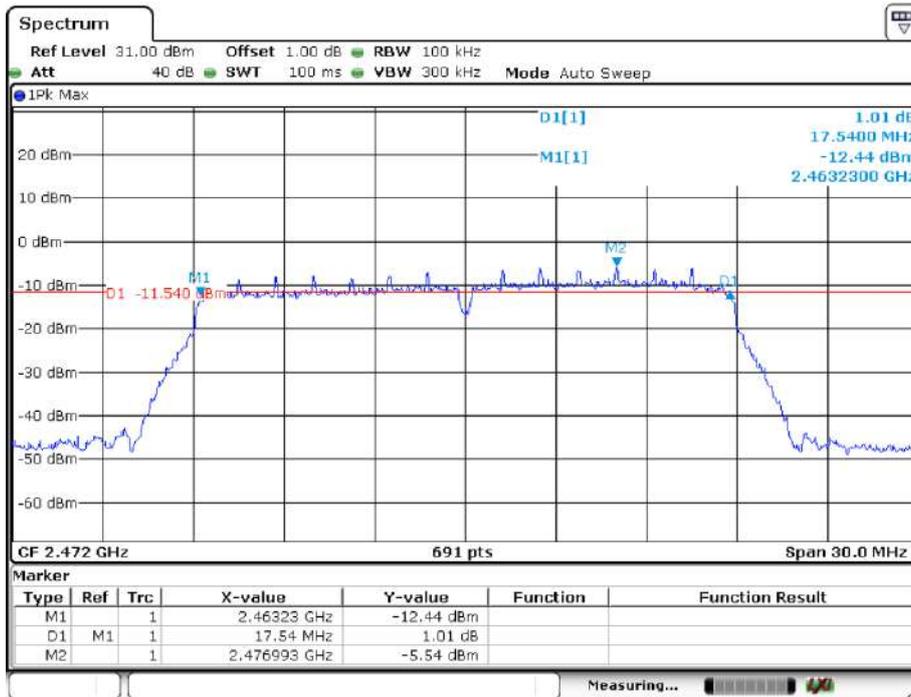


4.5.2.15

802.11N20_CH13



Date: 26 JUL 2020 20:34:13



Date: 26 JUL 2020 20:29:34



4.6 Power Spectral Density

Test Requirement:	47 CFR Part 15C Section 15.247 (e)
Test Method:	ANSI C63.10 :2013 Section 11.10.2
Test Setup:	
Test Instruments:	Refer to section 5.10 for details
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G ; 6.5Mbps of rate is the worst case of 802.11N(HT20);
Limit:	≤8.00dBm/3kHz
Test Results:	Pass

4.6.1 Test Results

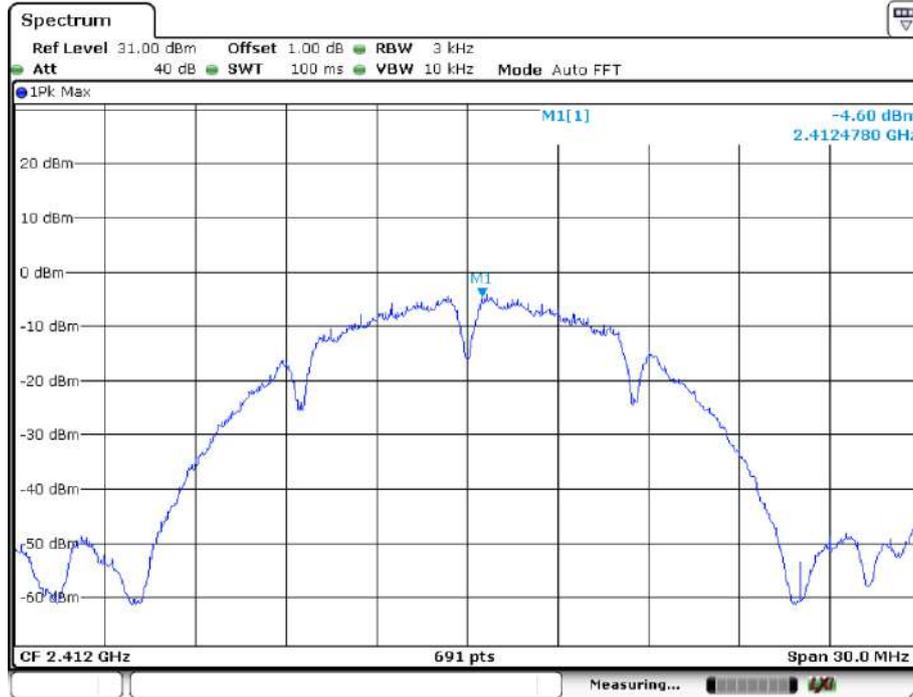
Mode	Test Channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
802.11B	CH1	-4.60	≤8.00	Pass
	CH6	-5.18	≤8.00	Pass
	CH11	-3.89	≤8.00	Pass
	CH12	-15.25	≤8.00	Pass
	CH13	-17.01	≤8.00	Pass
802.11G	CH1	-9.58	≤8.00	Pass
	CH6	-7.63	≤8.00	Pass
	CH11	-7.26	≤8.00	Pass
	CH12	-18.47	≤8.00	Pass
	CH13	-17.16	≤8.00	Pass
802.11N20	CH1	-11.19	≤8.00	Pass
	CH6	-7.17	≤8.00	Pass
	CH11	-9.42	≤8.00	Pass
	CH12	-18.75	≤8.00	Pass
	CH13	-19.14	≤8.00	Pass



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4.6.2 Test plots

4.6.2.1 802.11B_CH1



Date: 26 JUL 2020 20:07:42



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 No.1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, China 518057 t (86-755) 26012053 f (86-755) 26710594 www.sgsgroup.com.cn
 中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

4.6.2.2

802.11B_CH6



Date: 26 JUL 2020 20:08:06

4.6.2.3

802.11B_CH11



Date: 30 JUL 2020 10:53:06



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4.6.2.4

802.11B_CH12



Date: 26 JUL 2020 20:35:09

4.6.2.5

802.11B_CH13



Date: 26 JUL 2020 20:35:09

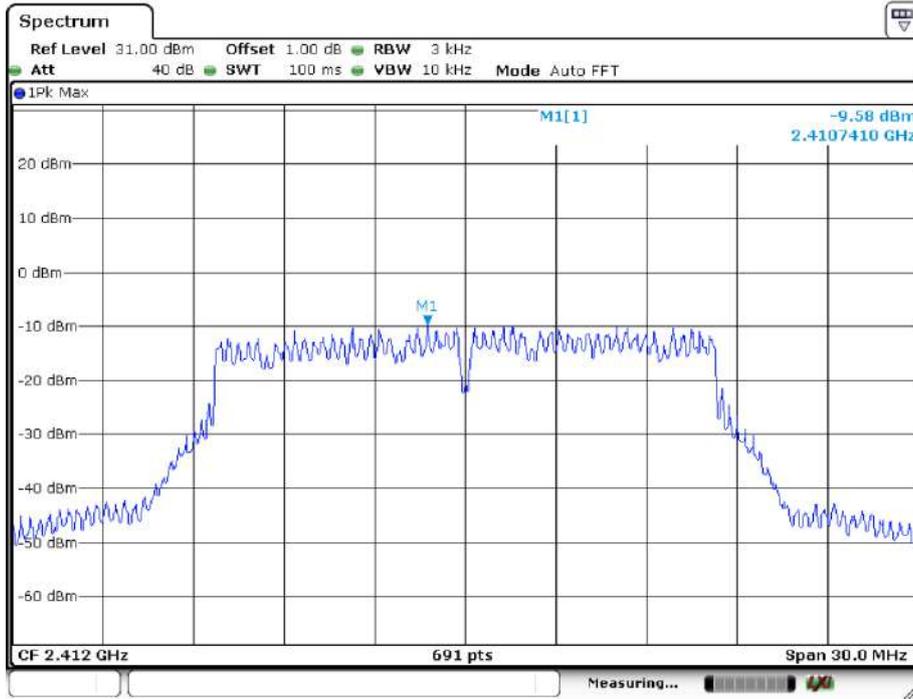


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4.6.2.6

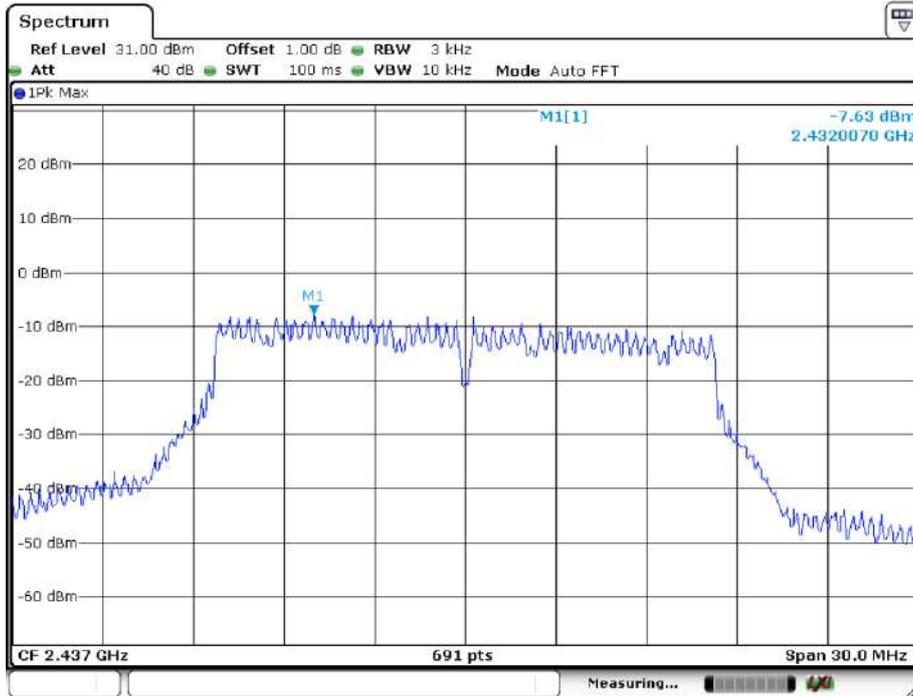
802.11G_CH1



Date: 26 JUL 2020 20:09:22

4.6.2.7

802.11G_CH6



Date: 26 JUL 2020 20:09:06

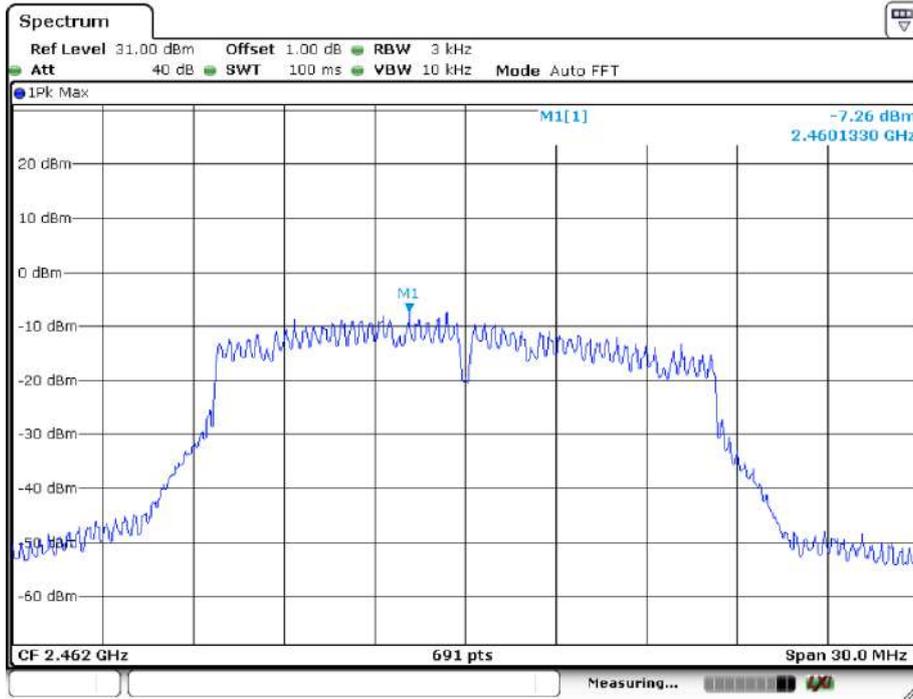


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4.6.2.8

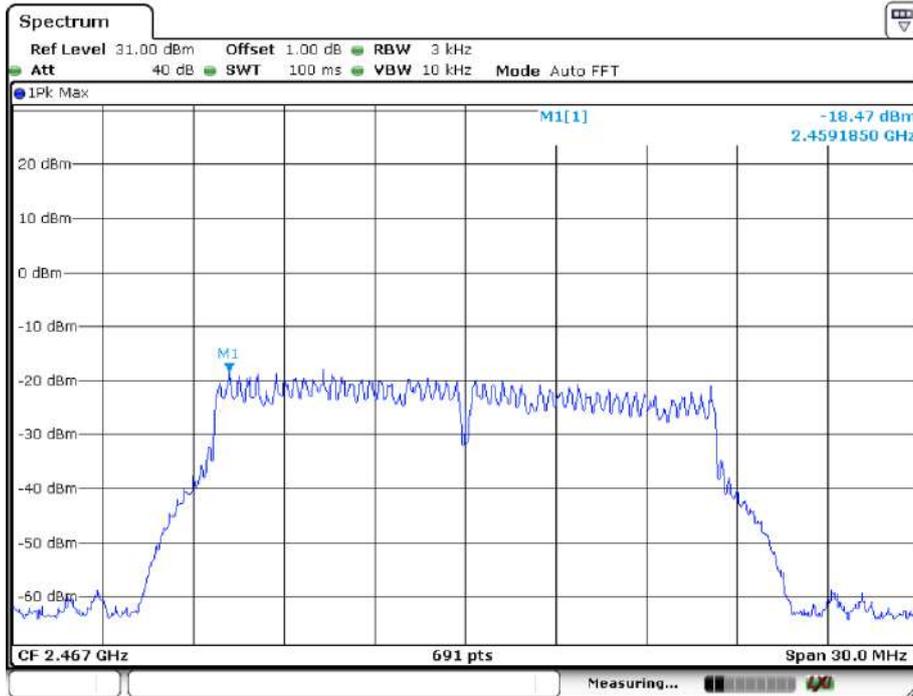
802.11G_CH11



Date: 26 JUL 2020 20:08:45

4.6.2.9

802.11G_CH12

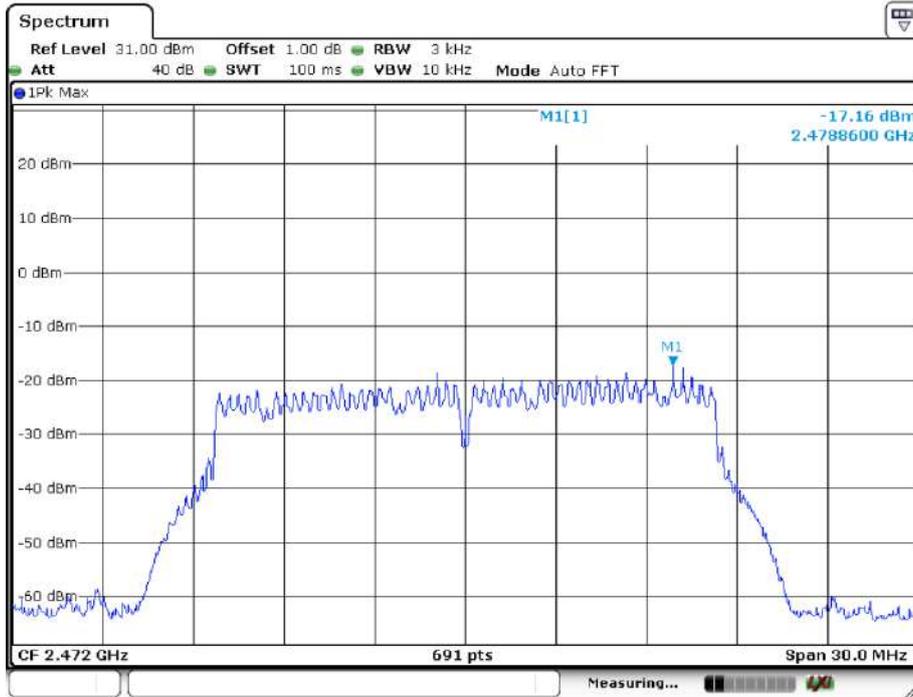


Date: 26 JUL 2020 20:35:39



4.6.2.10

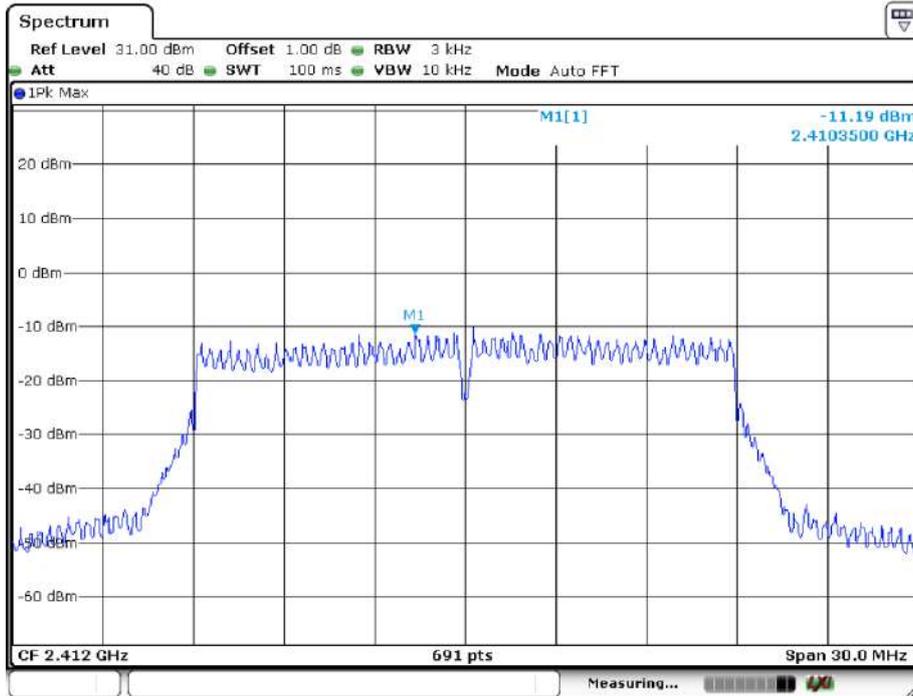
802.11G_CH13



Date: 26 JUL 2020 20:35:25

4.6.2.11

802.11N20_CH1

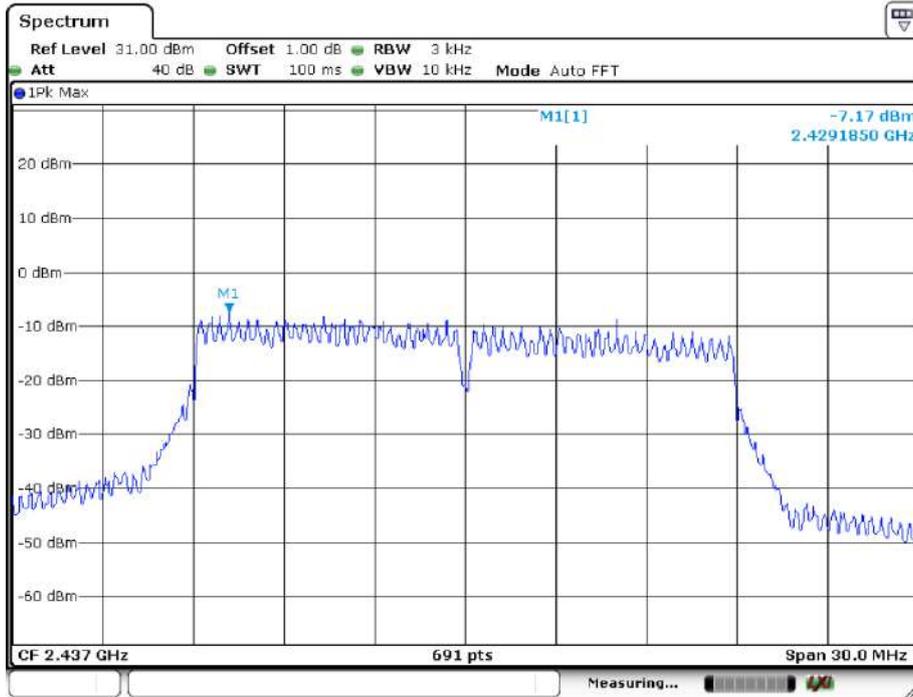


Date: 26 JUL 2020 20:09:43



4.6.2.12

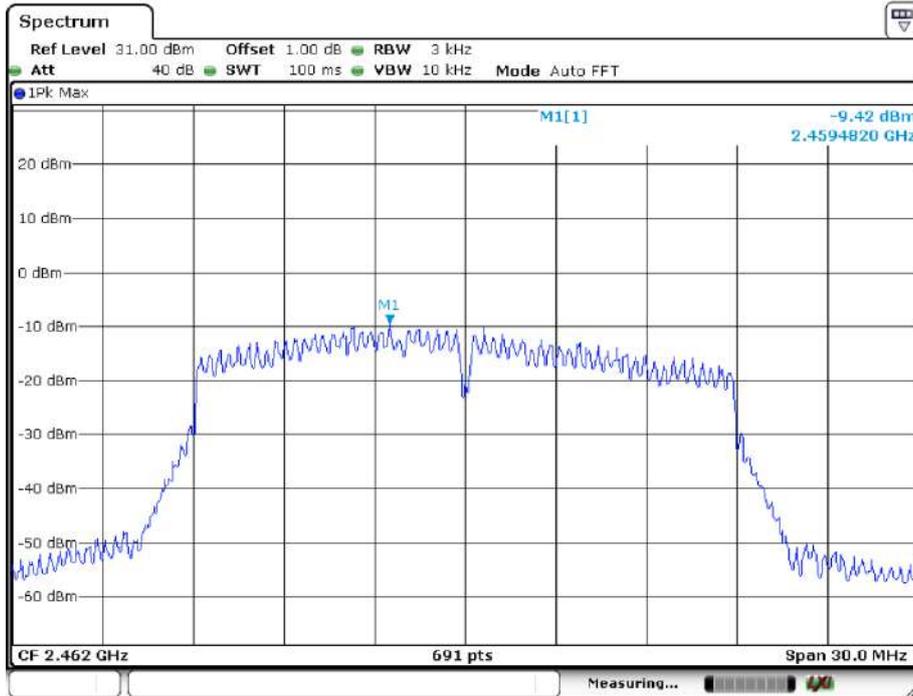
802.11N20_CH6



Date: 26 JUL 2020 20:10:01

4.6.2.13

802.11N20_CH11



Date: 26 JUL 2020 20:10:15

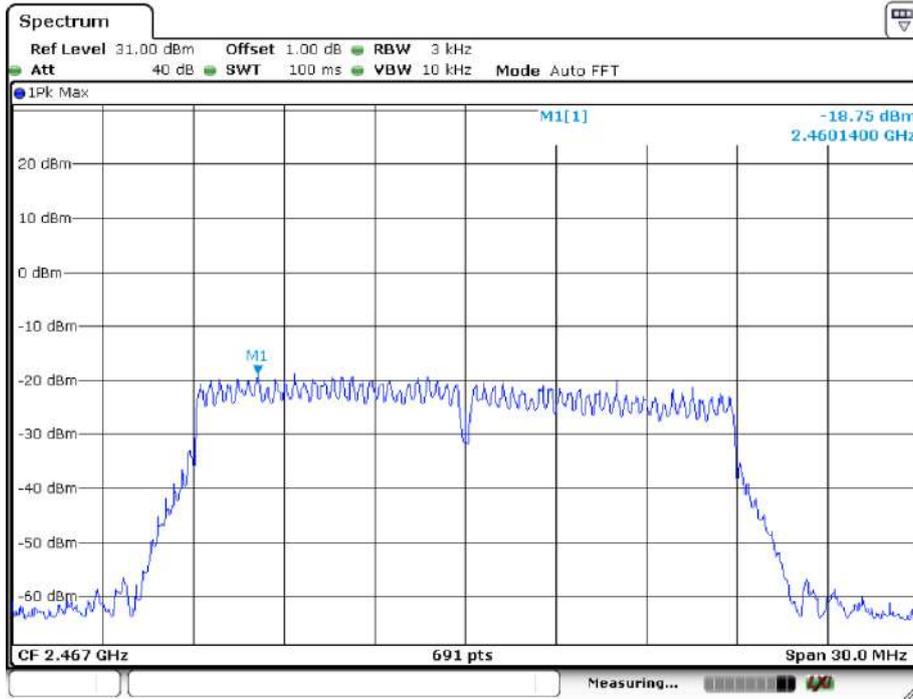


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4.6.2.14

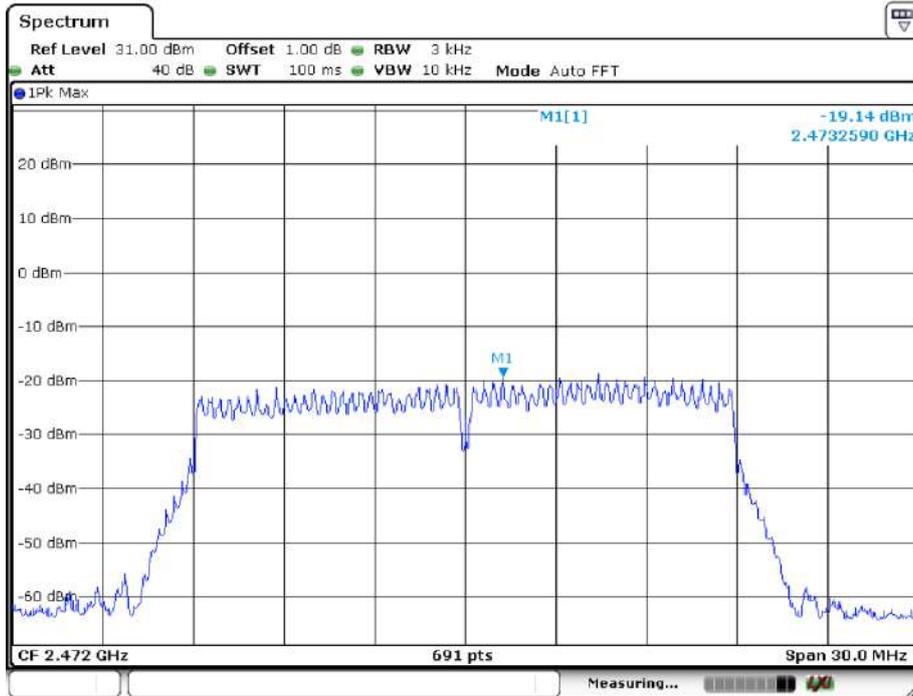
802.11N20_CH12



Date: 26 JUL 2020 20:34:42

4.6.2.15

802.11N20_CH13



Date: 26 JUL 2020 20:34:25



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4.7 Band-edge for RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.13
Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G ; 6.5Mbps of rate is the worst case of 802.11N(HT20) ;
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is 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.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

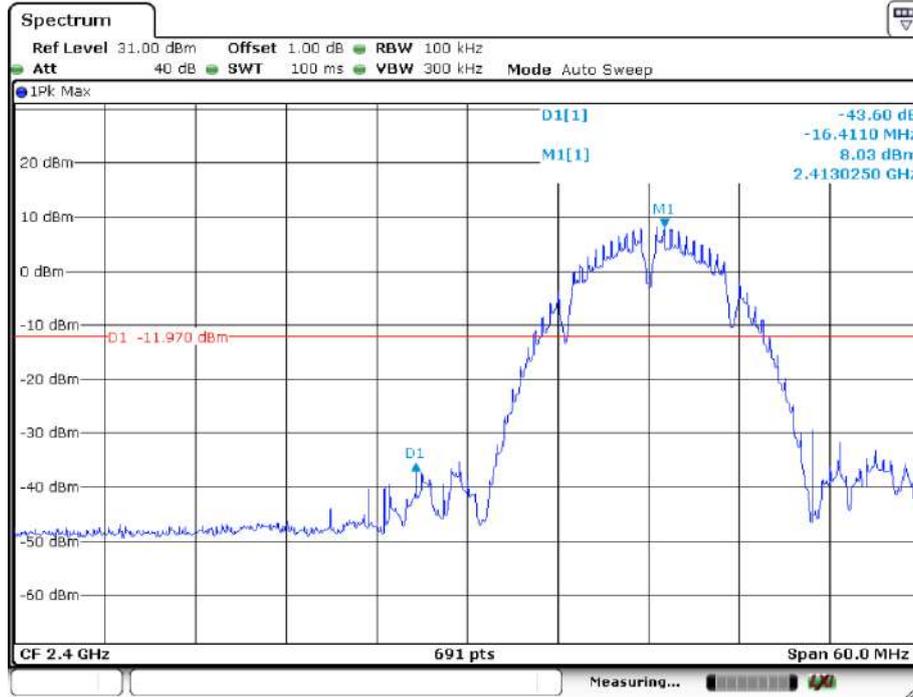


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4.7.1 Test plots

4.7.1.1 802.11B_CH1



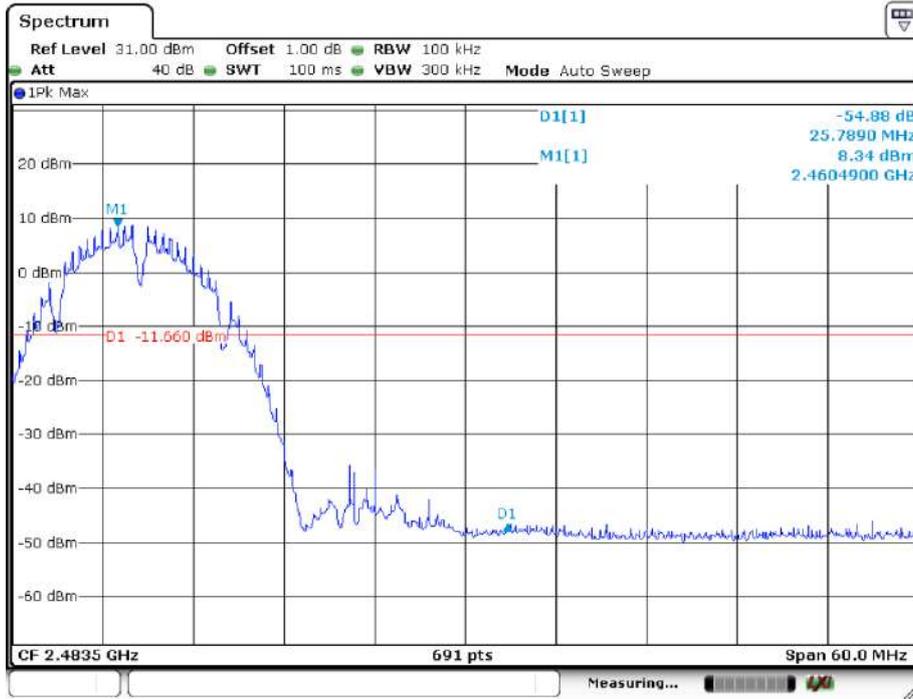
Date: 26 JUL 2020 20:23:30



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4.7.1.2

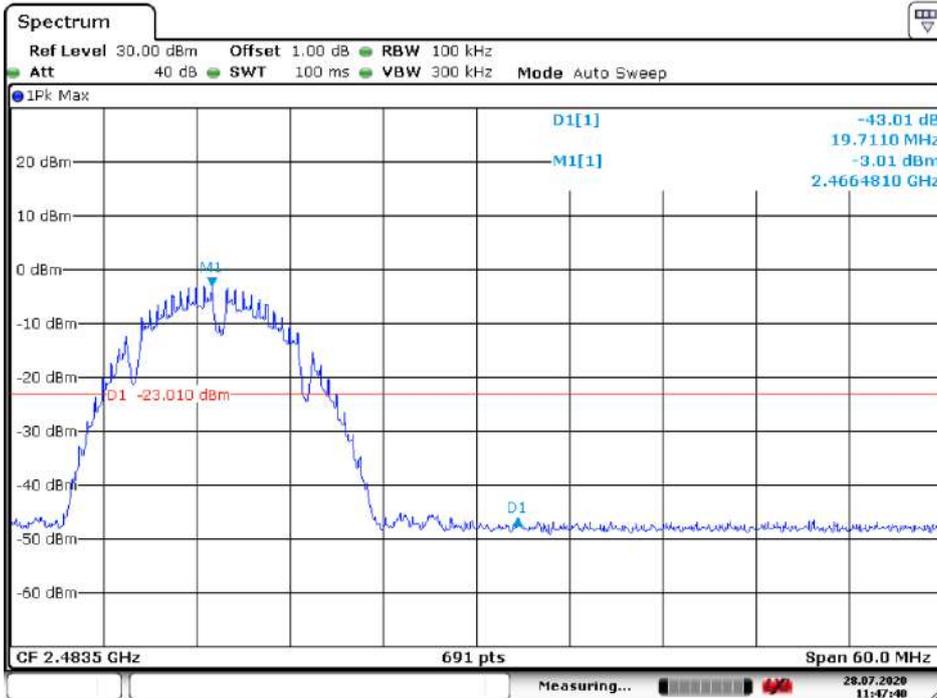
802.11B_CH11



Date: 26.JUL.2020 20:24:09

4.7.1.3

802.11B_CH12

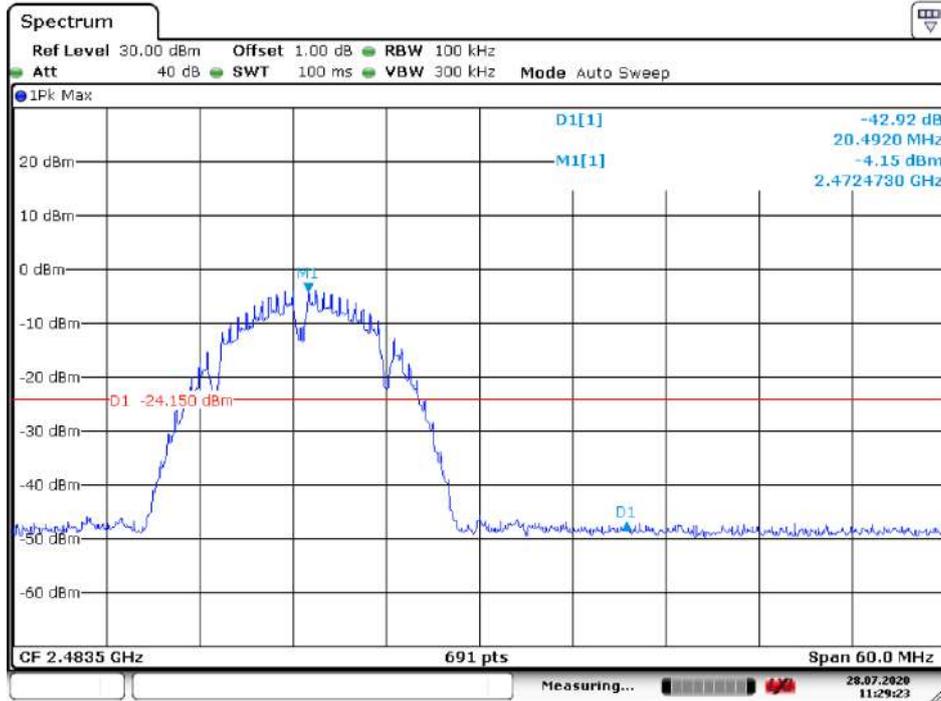


Date: 28.JUL.2020 11:47:41



4.7.1.4

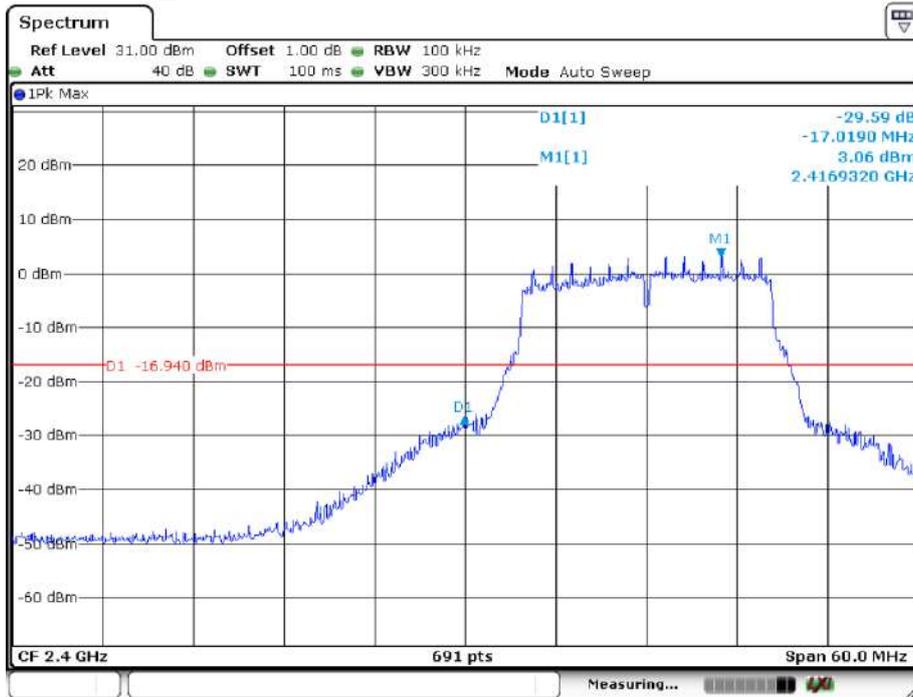
802.11B_CH13



Date: 28. JUL. 2020 11:29:23

4.7.1.5

802.11G_CH1

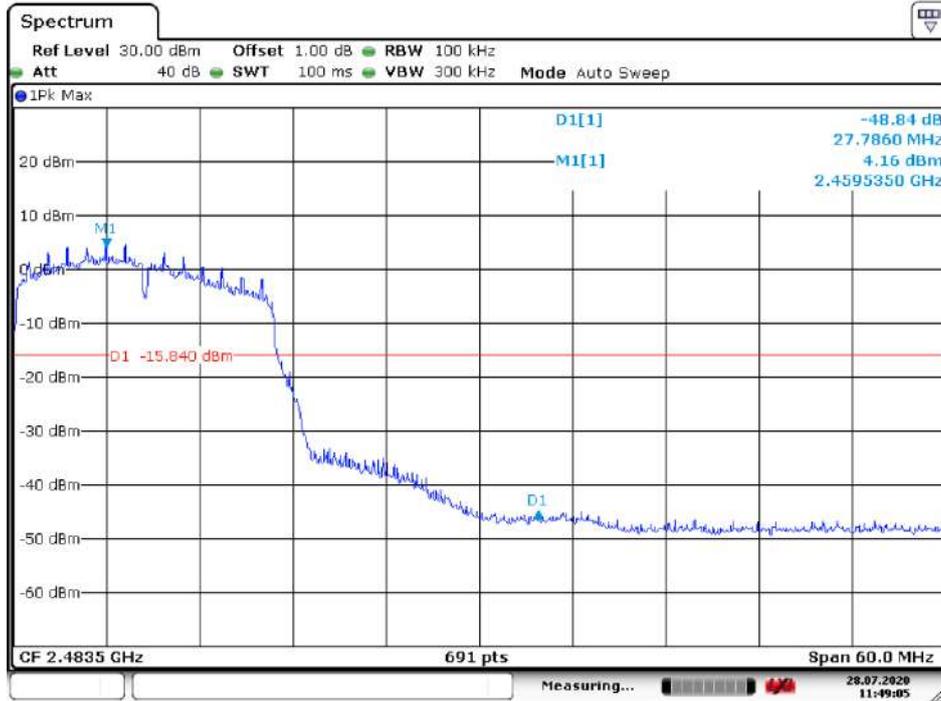


Date: 28. JUL. 2020 20:25:16



4.7.1.6

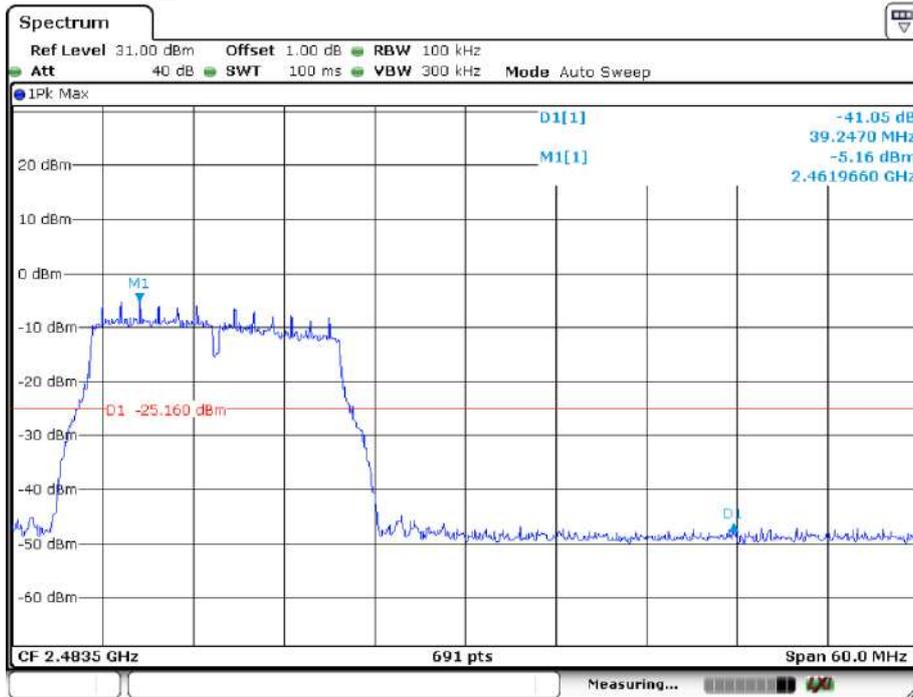
802.11G_CH11



Date: 28.JUL.2020 11:49:06

4.7.1.7

802.11G_CH12

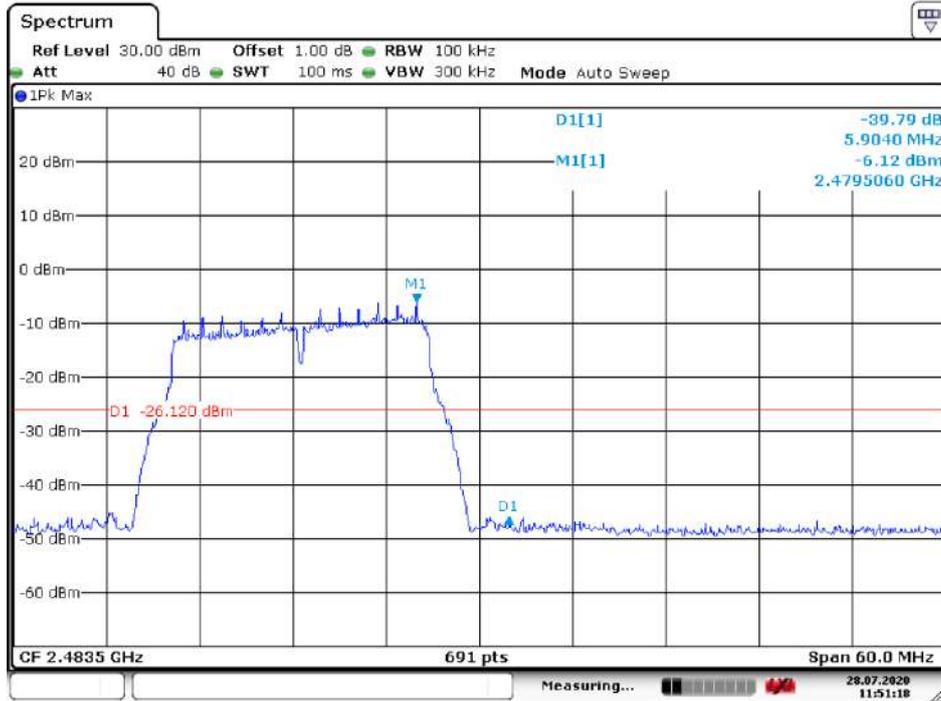


Date: 28.JUL.2020 20:25:49



4.7.1.8

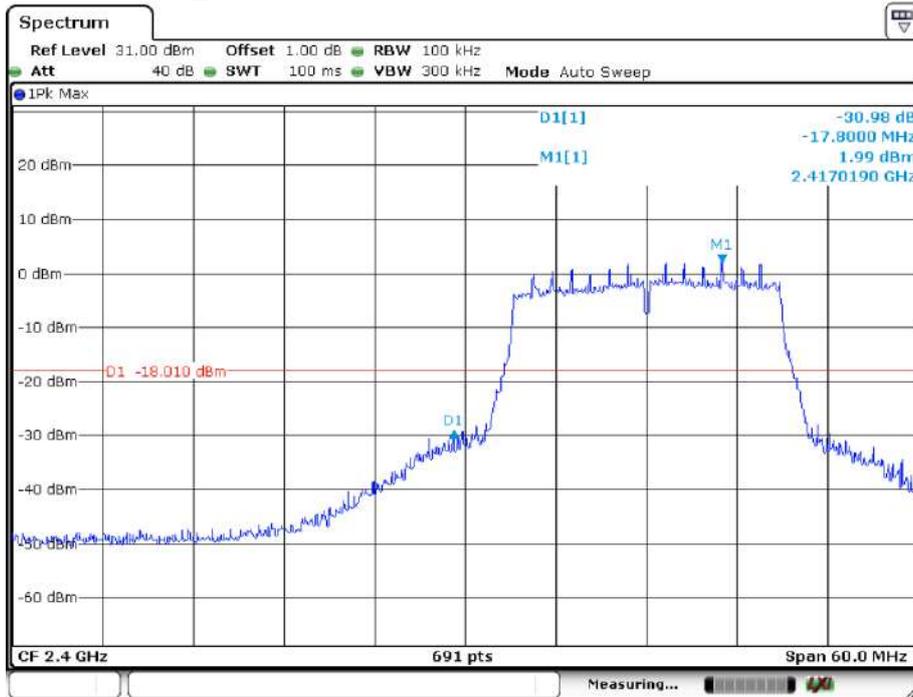
802.11G_CH13



Date: 28.JUL.2020 11:51:19

4.7.1.9

802.11N20_CH1

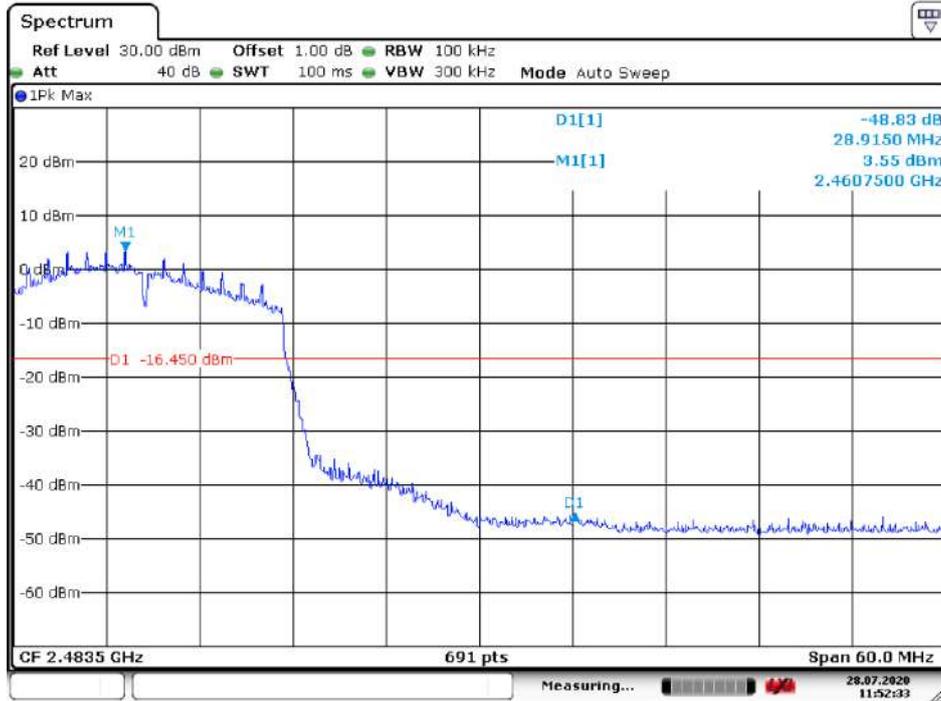


Date: 28.JUL.2020 20:22:13



4.7.1.10

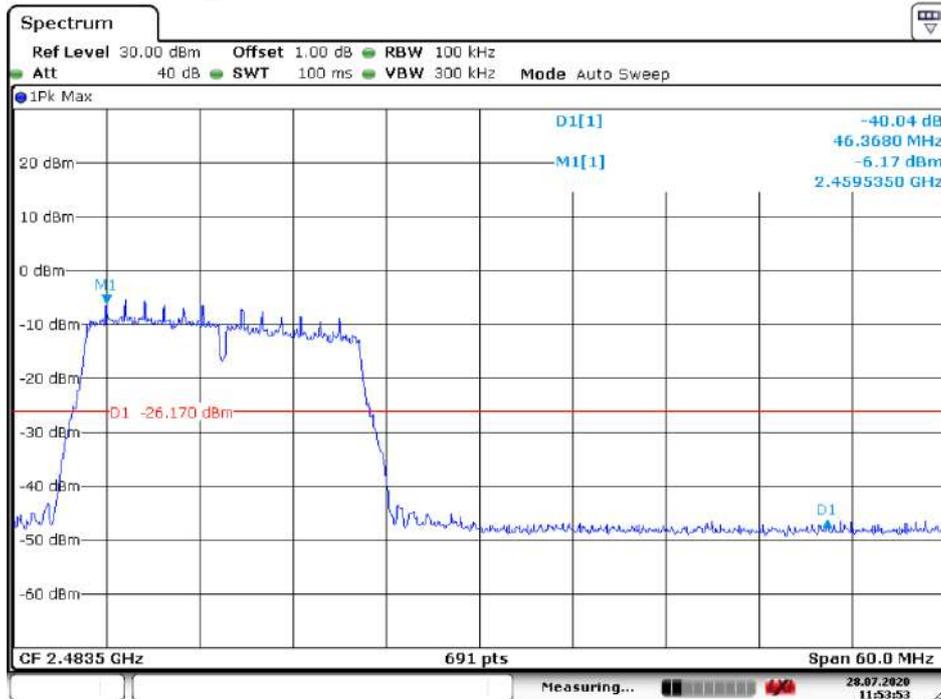
802.11N20_CH11



Date: 28.JUL.2020 11:52:33

4.7.1.11

802.11N20_CH12

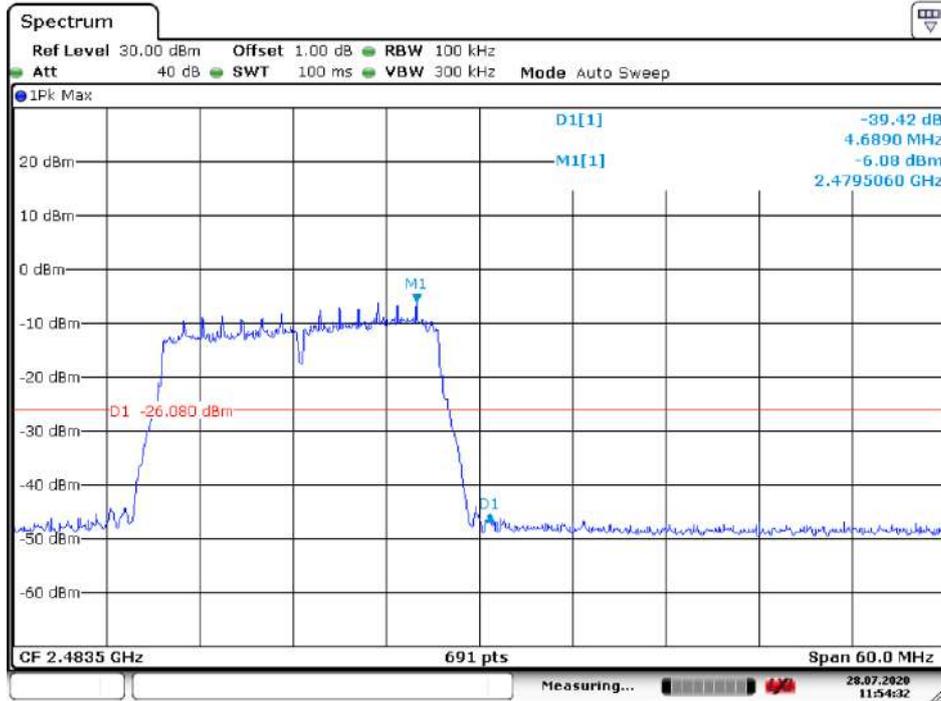


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4.7.1.12

802.11N20_CH13



Date: 28.JUL.2020 11:54:33



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4.8 RF Conducted Spurious Emissions

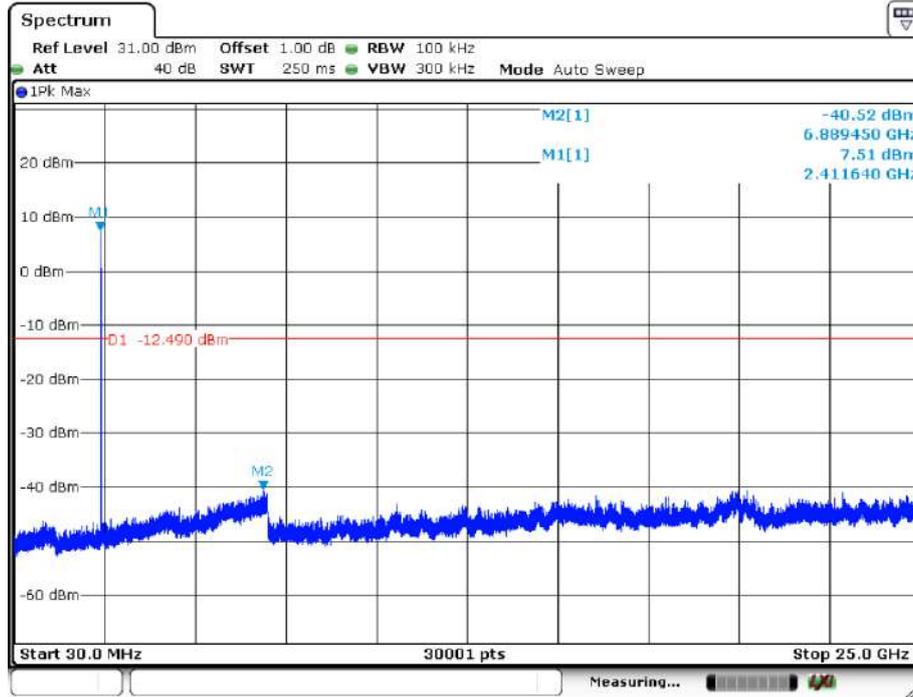
Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.11
Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G; 6.5Mbps of rate is the worst case of 802.11N(HT20);
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is 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.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass



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4.8.1 Test plots

4.8.1.1 802.11B_CH1



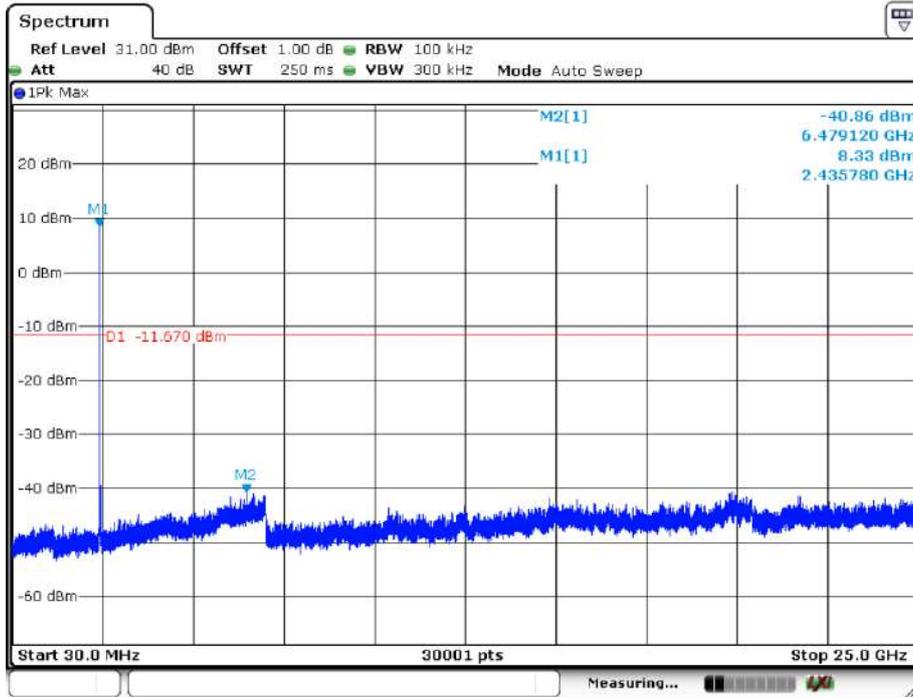
Date: 27 JUL 2020 09:14:31



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4.8.1.2

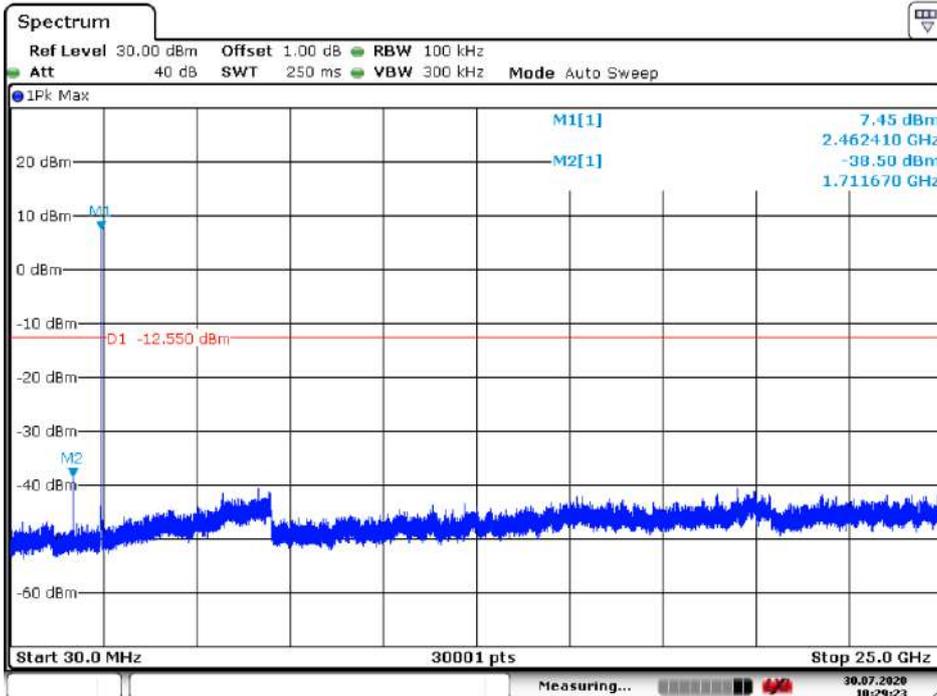
802.11B_CH6



Date: 27.JUL.2020 09:15:26

4.8.1.3

802.11B_CH11

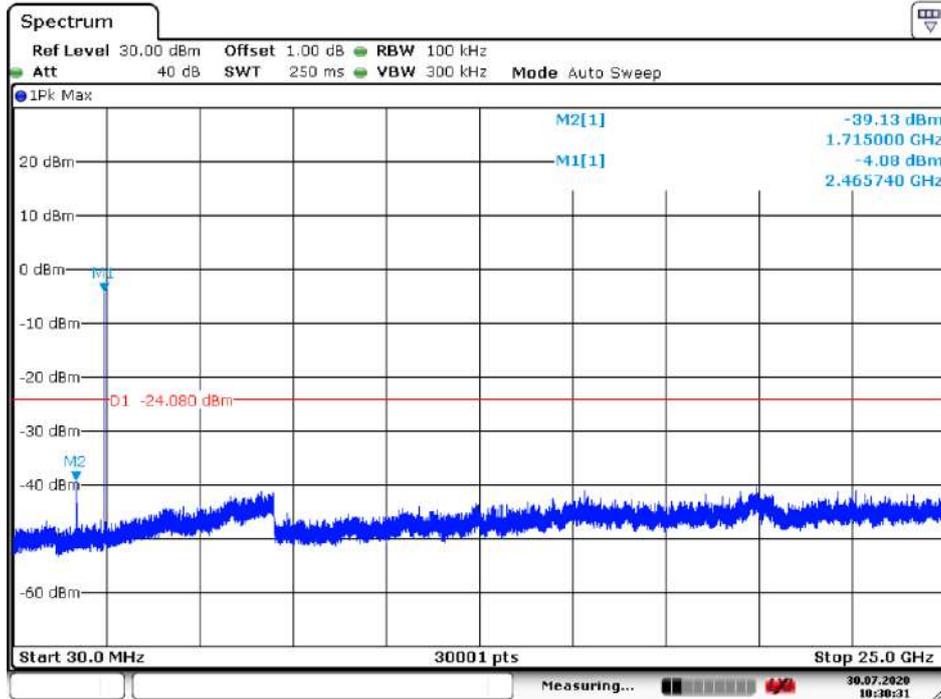


Date: 30.JUL.2020 10:29:24



4.8.1.4

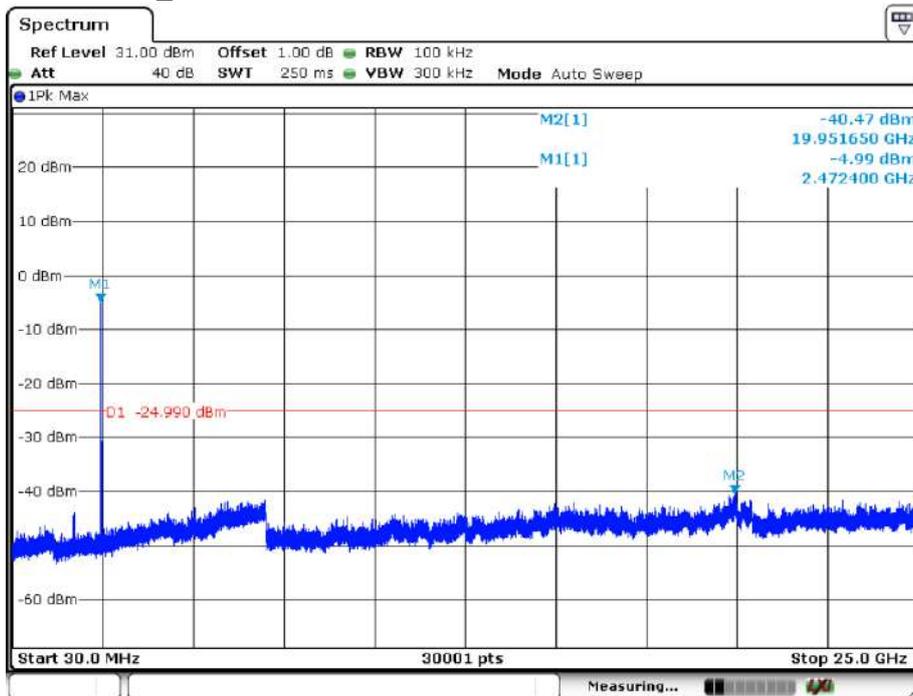
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4.8.1.5

802.11B_CH13

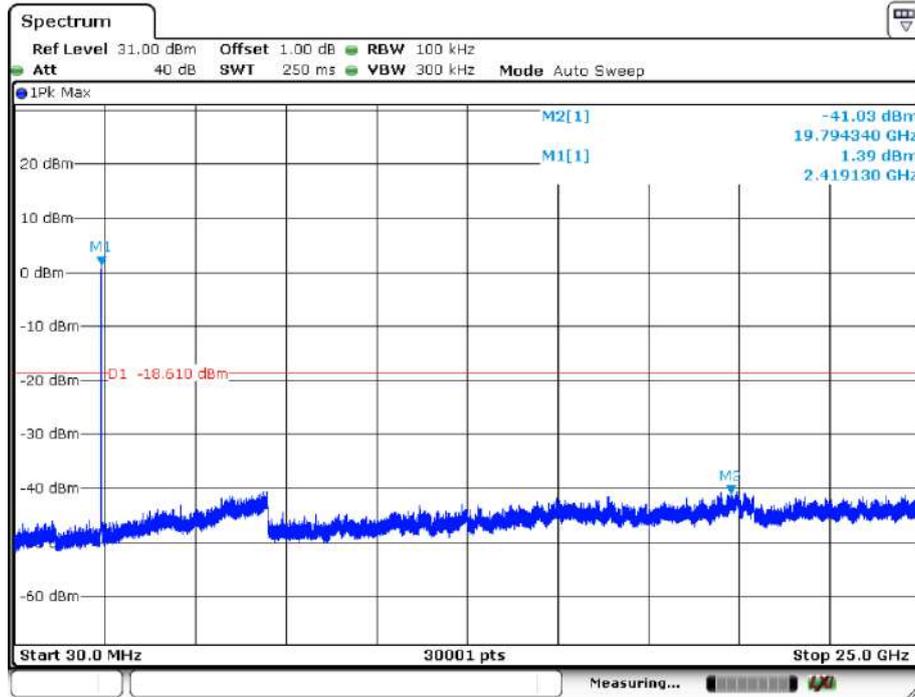


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4.8.1.6

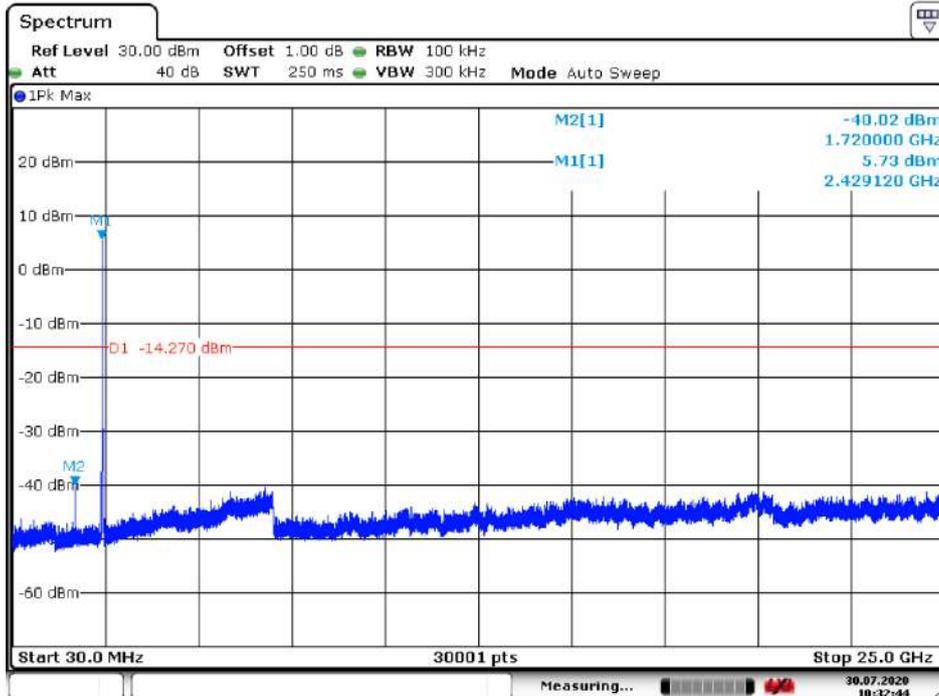
802.11G_CH1



Date: 27.JUL.2020 09:24:37

4.8.1.7

802.11G_CH6



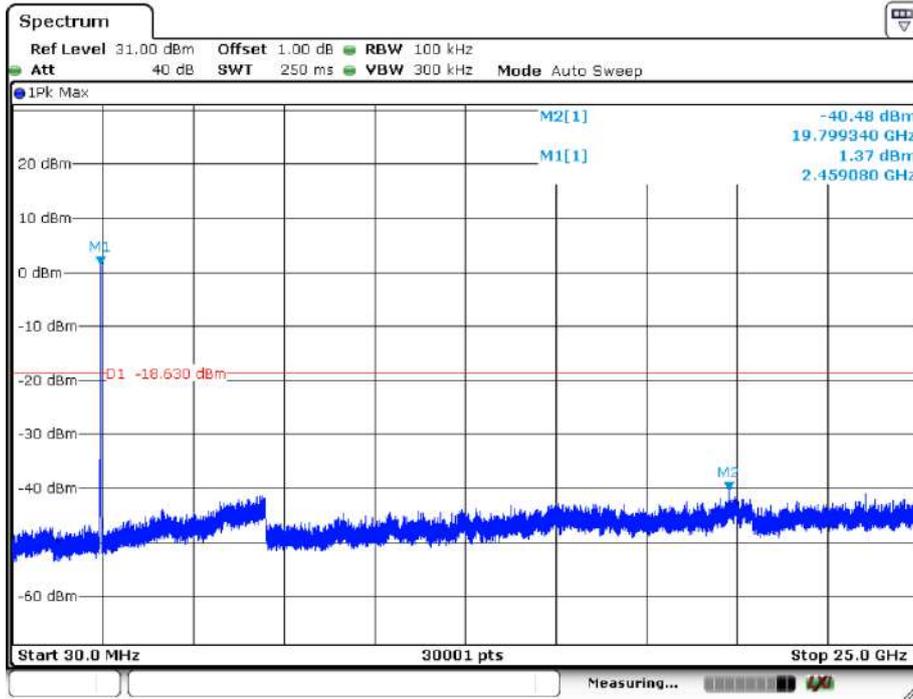
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4.8.1.8

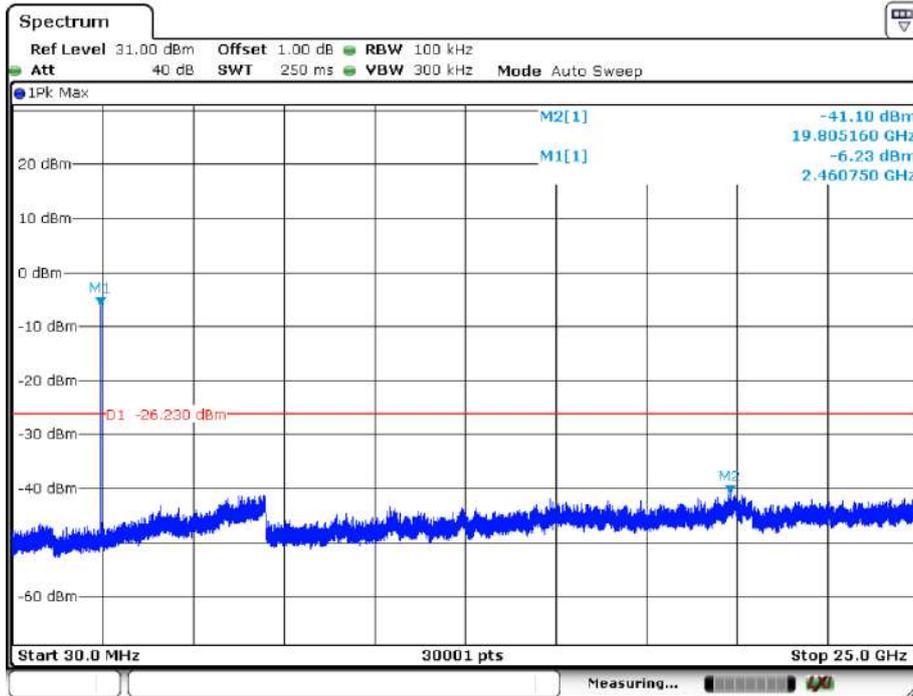
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4.8.1.9

802.11G_CH12

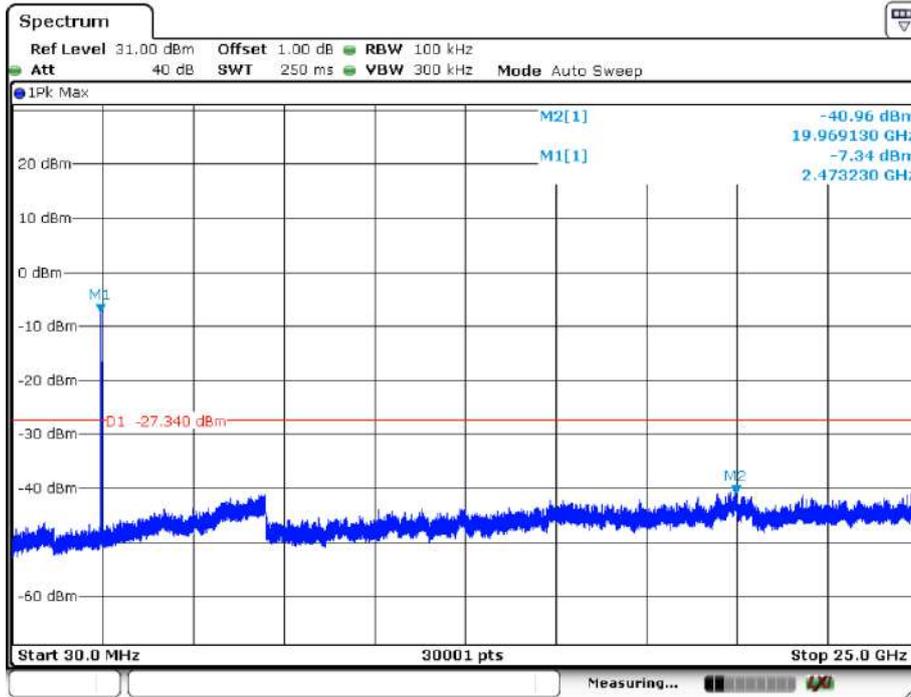


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4.8.1.10

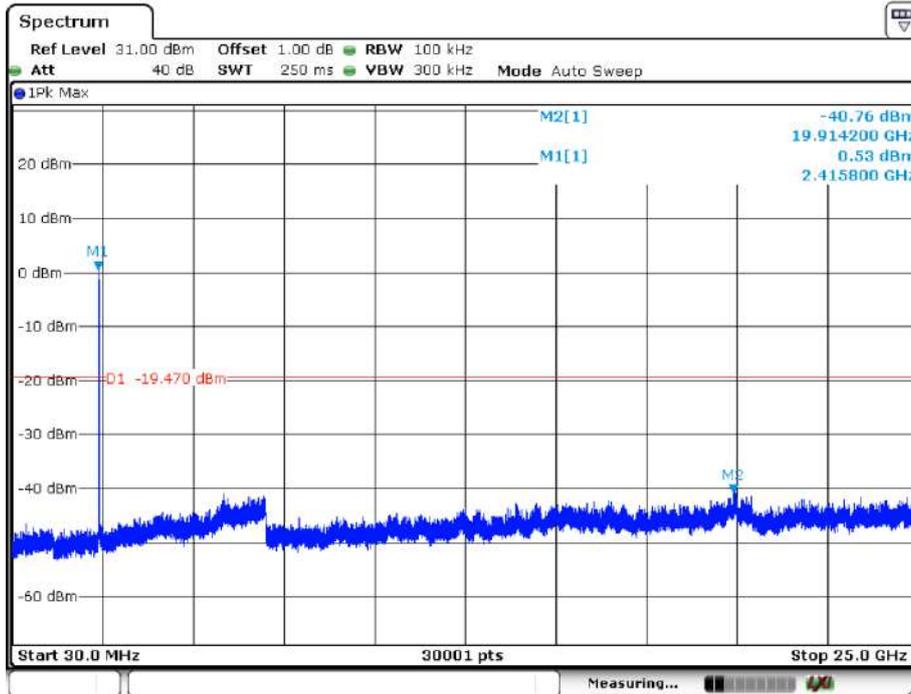
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4.8.1.11

802.11N20_CH1

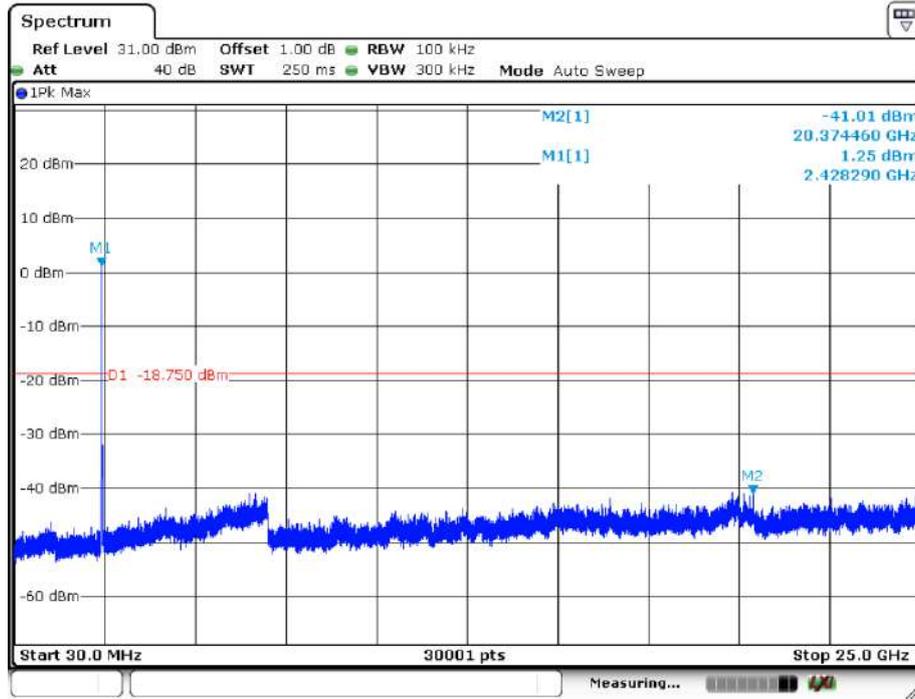


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4.8.1.12

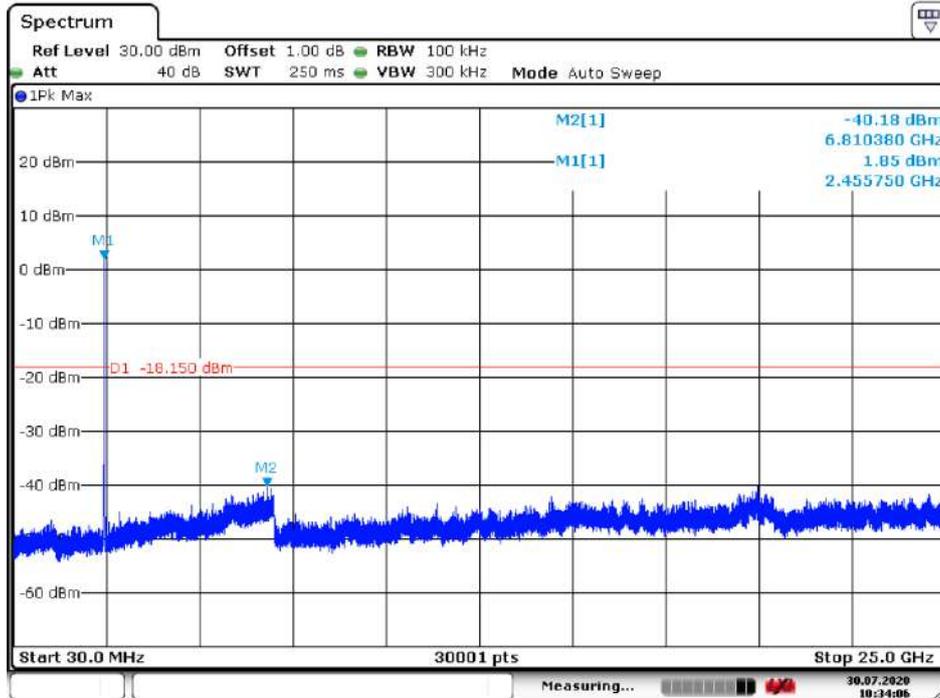
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4.8.1.13

802.11N20_CH11



Date: 30.JUL.2020 10:34:07

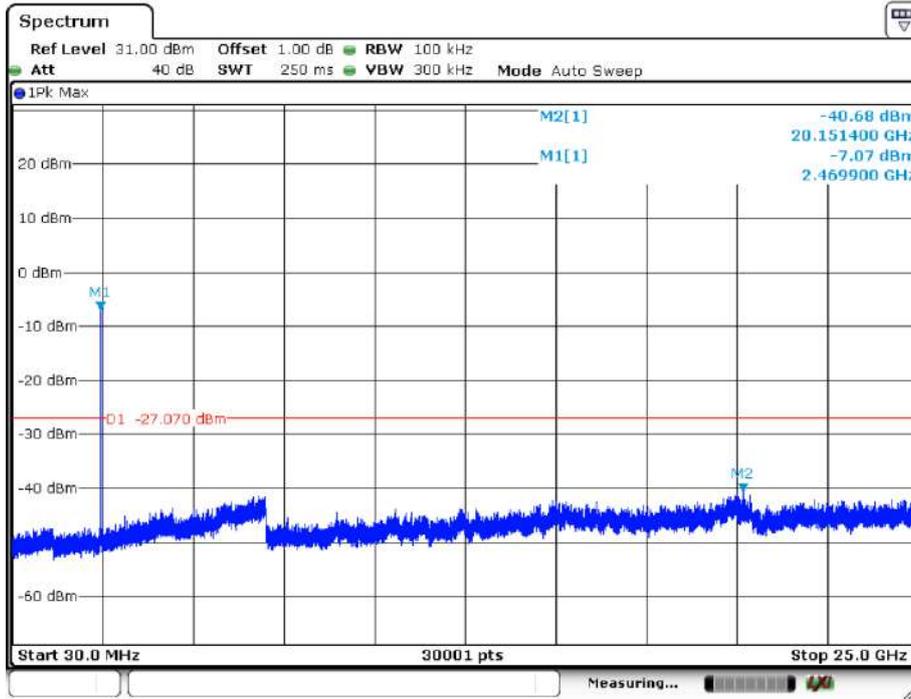


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4.8.1.14

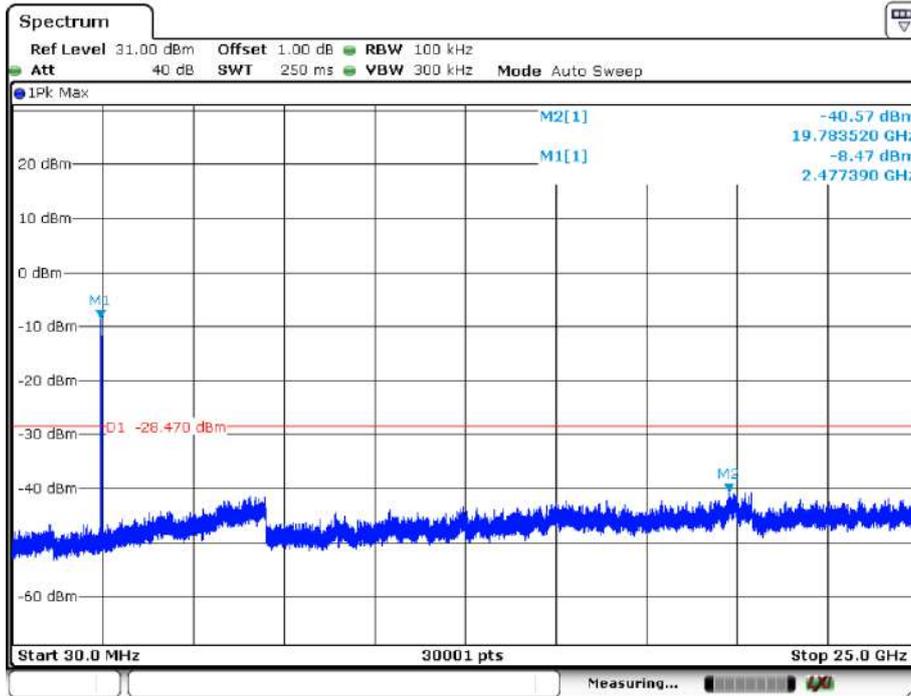
802.11N20_CH12



Date: 27 JUL 2020 09:27:40

4.8.1.15

802.11N20_CH13



Date: 27 JUL 2020 09:28:20

Remark:



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Scan from 9kHz to 25GHz, the disturbance between 9KHz to 30MHz was very low, and the above harmonics were the highest point could be found when testing, The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.



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4.9 Radiated Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205				
Test Method:	ANSI C63.10 :2013 Section 11.12				
Test Site:	Measurement Distance: 3m or 10m (Semi-Anechoic Chamber)				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	100 kHz	300kHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
Peak		1MHz	10Hz	Average	
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
Remark: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.					

Test Setup:	
-------------	--



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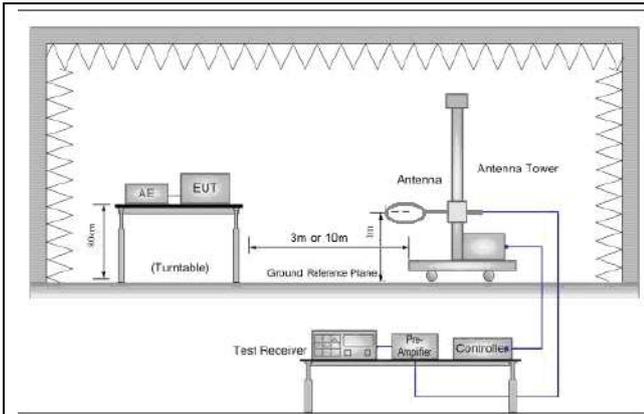


Figure 1. Below 30MHz

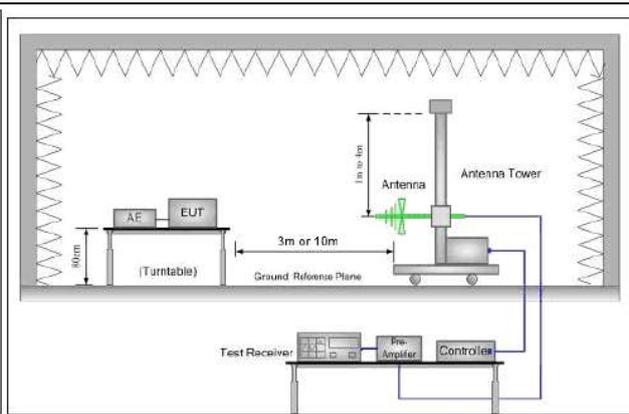


Figure 2. 30MHz to 1GHz

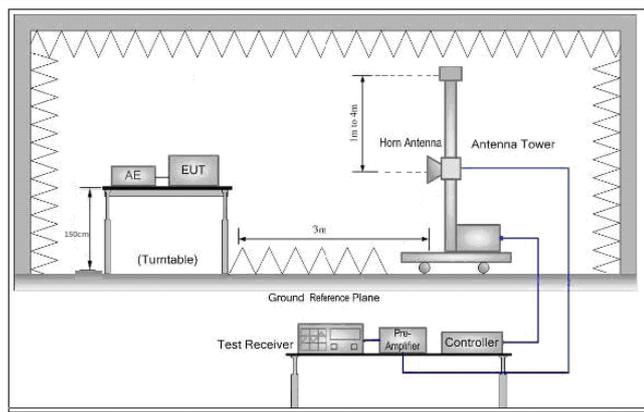


Figure 3. Above 1 GHz

Test Procedure:

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for $f < 1 \text{ GHz}$, RBW=1MHz for $f > 1\text{GHz}$; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
 - (3) For average measurement: use duty cycle correction factor method per 15.35(c).

Duty cycle = On time/100 milliseconds



	<p>On time = $N_1 * L_1 + N_2 * L_2 + \dots + N_{n-1} * L_{n-1} + N_n * L_n$</p> <p>Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.</p> <p>Average Emission Level = Peak Emission Level + $20 * \log(\text{Duty cycl}$</p> <p>f. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.</p> <p>g. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</p> <p>h. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</p> <p>i. Test the EUT in the lowest channel, the middle channel, the Highest channel</p> <p>j. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the X axis positioning which it is worse case.</p> <p>k. Repeat above procedures until all frequencies measured was complete.</p>
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates. Charge + Transmitting mode.
Final Test Mode:	Pretest the EUT at Charge + Transmitting mode. Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G; 6.5Mbps of rate is the worst case of 802.11N(HT20); For below 1GHz, through Pre-scan, find the 1Mbps of rate of 802.11B at lowest channel is the worst case. Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

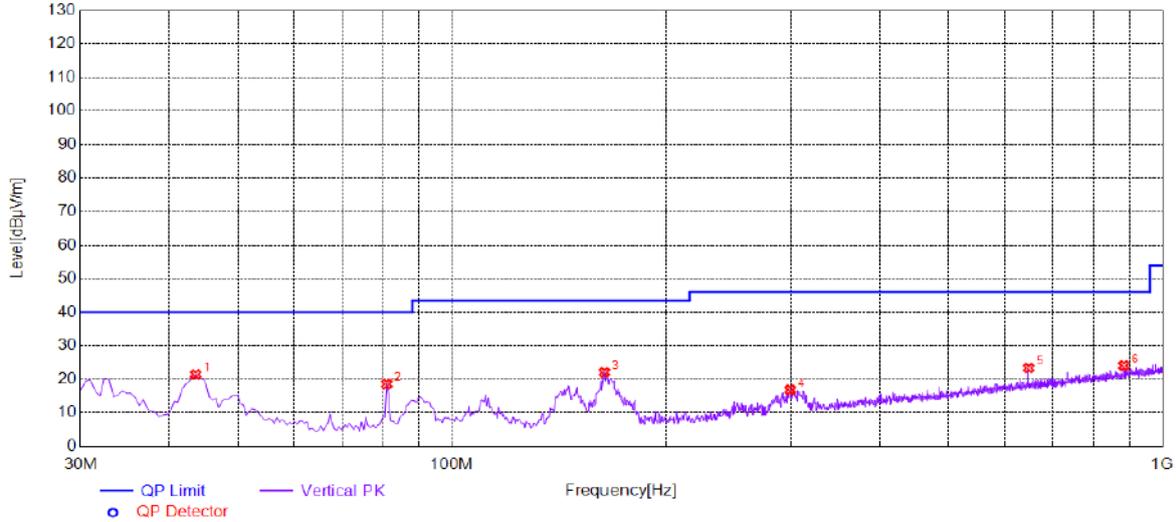


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4.9.1 Radiated emission below 1GHz

4.9.1.1 Charge + Transmitting, Vertical



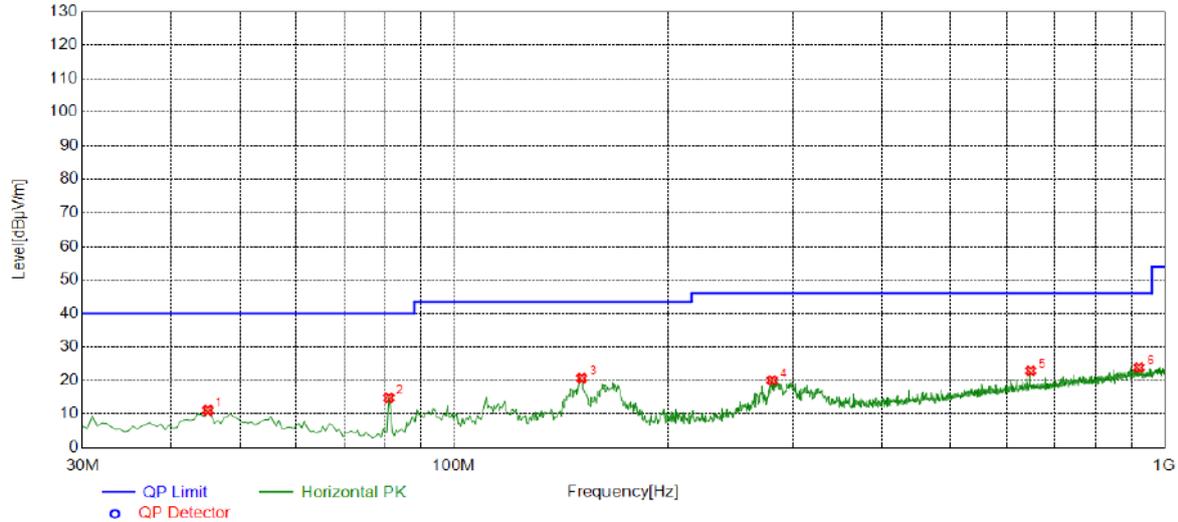
Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	43.5868	21.45	-30.48	40.00	18.55	169	319	Vertical
2	80.9505	18.61	-35.64	40.00	21.39	156	291	Vertical
3	163.927	22.11	-34.03	43.50	21.39	275	360	Vertical
4	299.309	16.90	-27.88	46.00	29.10	247	194	Vertical
5	648.199	23.42	-19.41	46.00	22.58	299	334	Vertical
6	882.571	24.11	-15.51	46.00	21.89	270	78	Vertical



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4.9.1.2 Charge + Transmitting, Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	45.0425	11.16	-30.21	40.00	28.84	166	204	Horizontal
2	80.9505	14.90	-35.64	40.00	25.10	197	98	Horizontal
3	151.310	20.72	-34.72	43.50	22.78	198	116	Horizontal
4	280.385	20.05	-28.37	46.00	25.95	126	113	Horizontal
5	648.199	22.93	-19.41	46.00	23.07	118	267	Horizontal
6	920.905	23.94	-14.91	46.00	22.06	119	335	Horizontal



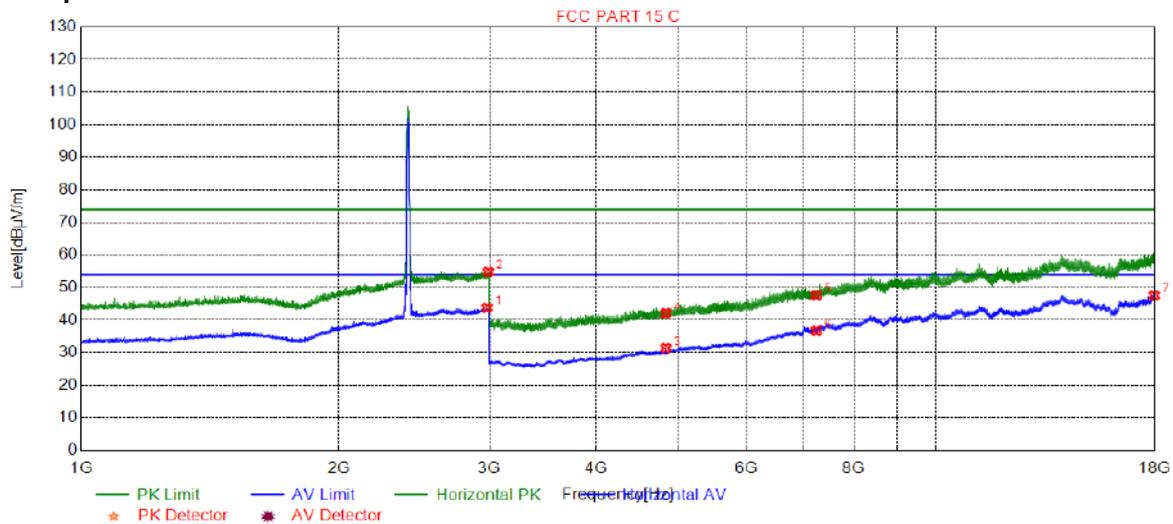
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4.9.2 Transmitter emission above 1GHz

4.9.2.1 802.11B_Channel 1

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2981.49	43.83	9.54	54.00	10.17	240	346	Horizontal
2	2989.99	54.82	9.50	74.00	19.18	128	346	Horizontal
3	4824.00	31.43	-18.21	54.00	22.57	226	351	Horizontal
4	4824.00	42.17	-18.21	74.00	31.83	206	211	Horizontal
5	7236.00	47.68	-9.99	74.00	26.32	195	142	Horizontal
6	7236.00	36.81	-9.99	54.00	17.19	230	42	Horizontal
7	17964.2	47.62	0.71	54.00	6.38	161	242	Horizontal

Final Data List

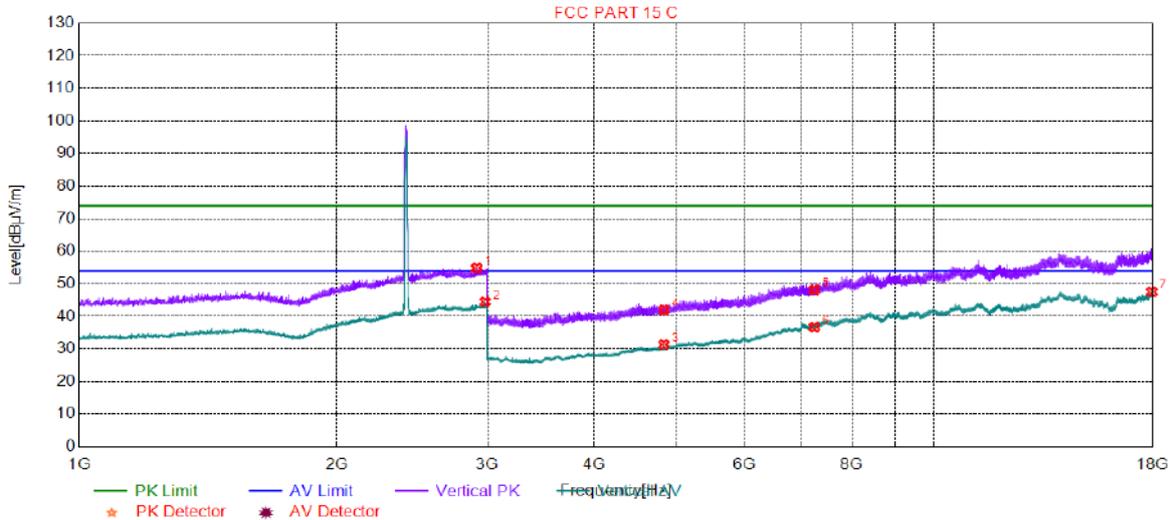


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4.9.2.2 **802.11B_Channel 1**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2916.47	54.85	9.32	74.00	19.15	159	179	Vertical
2	2982.49	44.54	9.53	54.00	9.46	188	138	Vertical
3	4824.00	31.36	-18.21	54.00	22.64	201	211	Vertical
4	4824.00	42.02	-18.21	74.00	31.98	166	74	Vertical
5	7236.00	48.18	-9.99	74.00	25.82	172	342	Vertical
6	7236.00	36.72	-9.99	54.00	17.28	163	342	Vertical
7	17950.4	47.56	0.71	54.00	6.44	213	40	Vertical

Final Data List



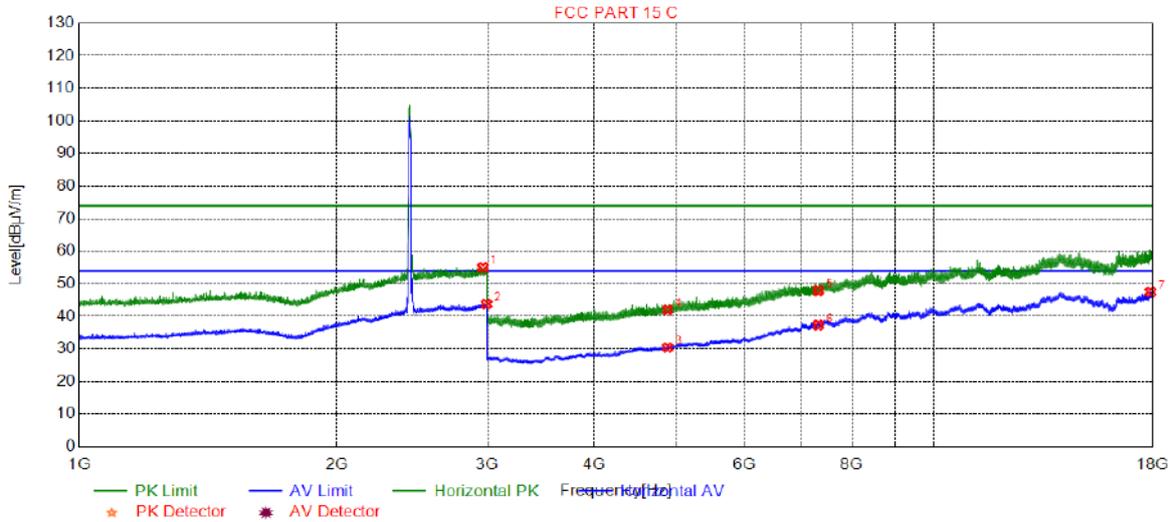
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4.9.2.3 802.11B_Channel 6

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2964.49	55.01	9.61	74.00	18.99	152	45	Horizontal
2	2992.99	43.82	9.48	54.00	10.18	216	209	Horizontal
3	4874.00	30.42	-17.99	54.00	23.58	179	46	Horizontal
4	4874.00	42.07	-17.99	74.00	31.93	162	357	Horizontal
5	7311.00	47.95	-9.74	74.00	26.05	209	91	Horizontal
6	7311.00	37.36	-9.74	54.00	16.64	158	140	Horizontal
7	17886.1	47.52	0.51	54.00	6.48	194	91	Horizontal

Final Data List



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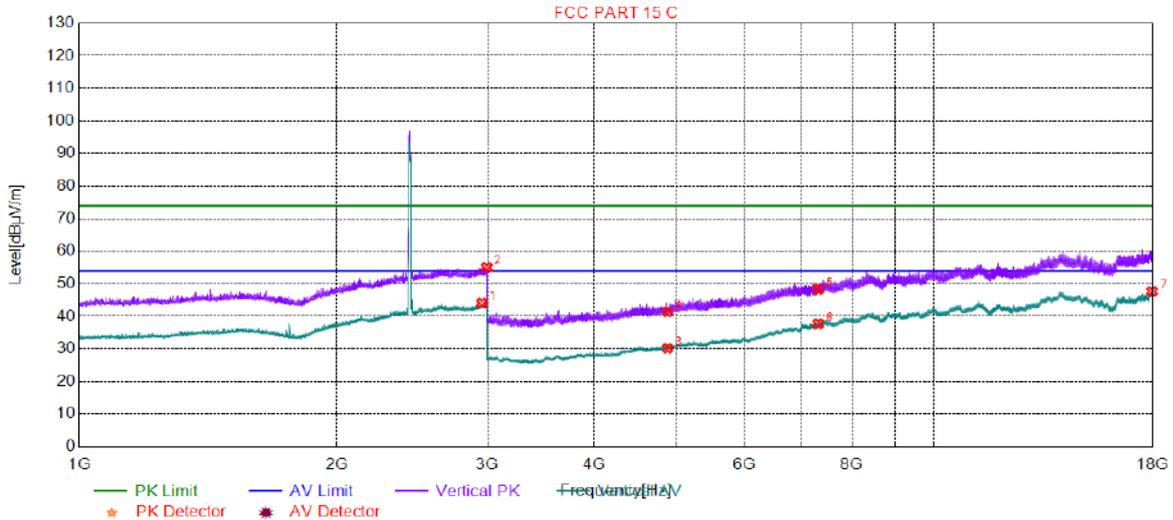
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4.9.2.4 802.11B_Channel 6

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2955.48	44.12	9.65	54.00	9.88	231	275	Vertical
2	2994.49	55.04	9.48	74.00	18.96	169	275	Vertical
3	4874.00	30.17	-17.99	54.00	23.83	230	331	Vertical
4	4874.00	41.36	-17.99	74.00	32.64	229	45	Vertical
5	7311.00	48.38	-9.74	74.00	25.62	235	185	Vertical
6	7311.00	37.73	-9.74	54.00	16.27	270	290	Vertical
7	17955.9	47.70	0.71	54.00	6.30	169	134	Vertical

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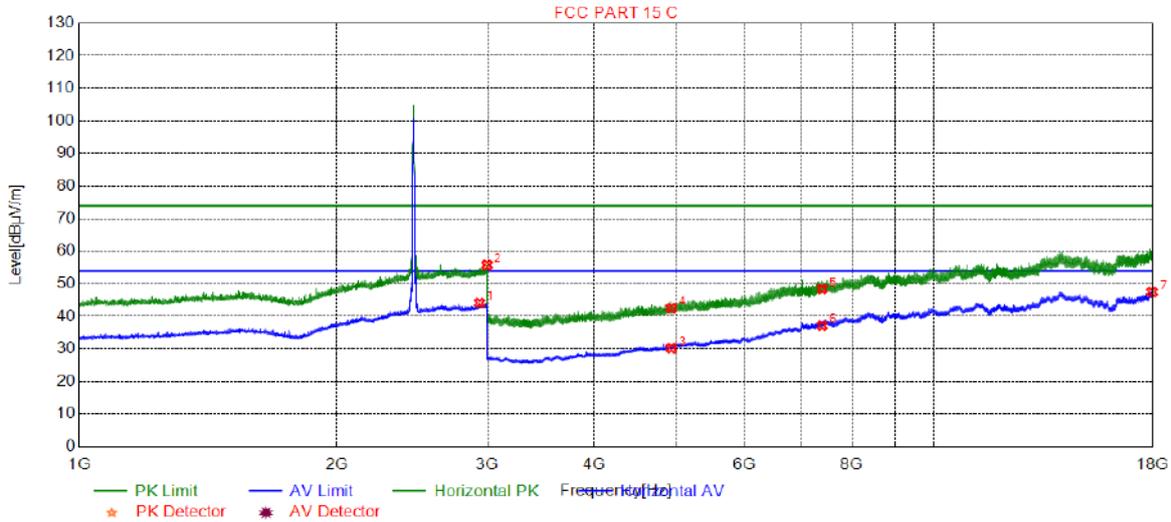
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4.9.2.5 **802.11B_Channel 11**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2937.48	44.18	9.54	54.00	9.82	130	141	Horizontal
2	2997.49	55.77	9.46	74.00	18.23	103	291	Horizontal
3	4924.00	30.22	-17.72	54.00	23.78	209	271	Horizontal
4	4924.00	42.55	-17.72	74.00	31.45	248	45	Horizontal
5	7386.00	48.42	-9.55	74.00	25.58	220	90	Horizontal
6	7386.00	37.18	-9.55	54.00	16.82	108	240	Horizontal
7	17957.6	47.50	0.71	54.00	6.50	231	190	Horizontal

Final Data List



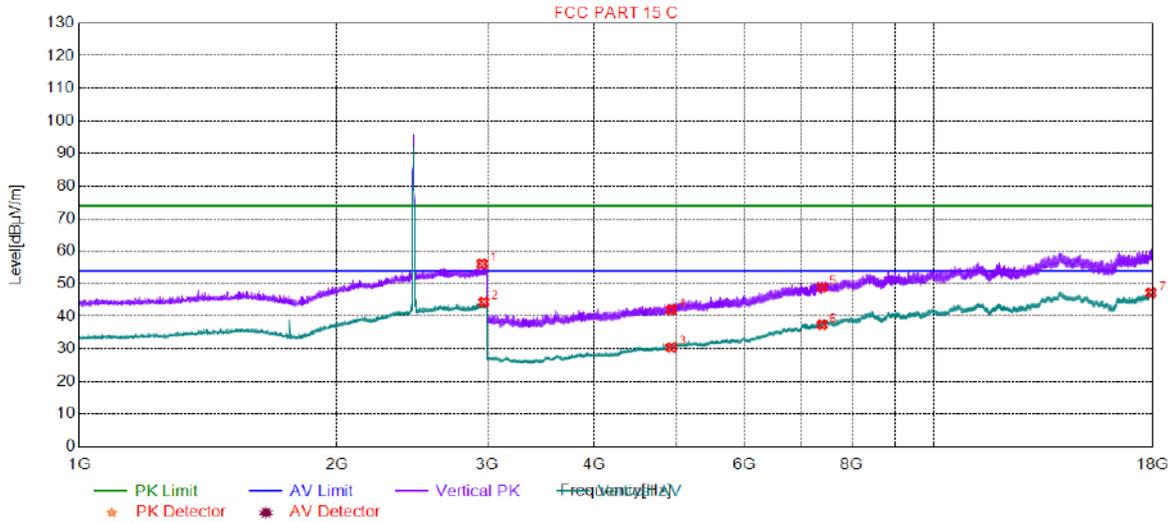
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4.9.2.6 **802.11B_Channel 11**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2957.48	56.12	9.65	74.00	17.88	263	234	Vertical
2	2971.99	44.44	9.58	54.00	9.56	190	56	Vertical
3	4924.00	30.44	-17.72	54.00	23.56	245	318	Vertical
4	4924.00	42.10	-17.72	74.00	31.90	155	360	Vertical
5	7386.00	48.85	-9.55	74.00	25.15	202	42	Vertical
6	7386.00	37.43	-9.55	54.00	16.57	221	92	Vertical
7	17911.4	47.26	0.69	54.00	6.74	261	92	Vertical

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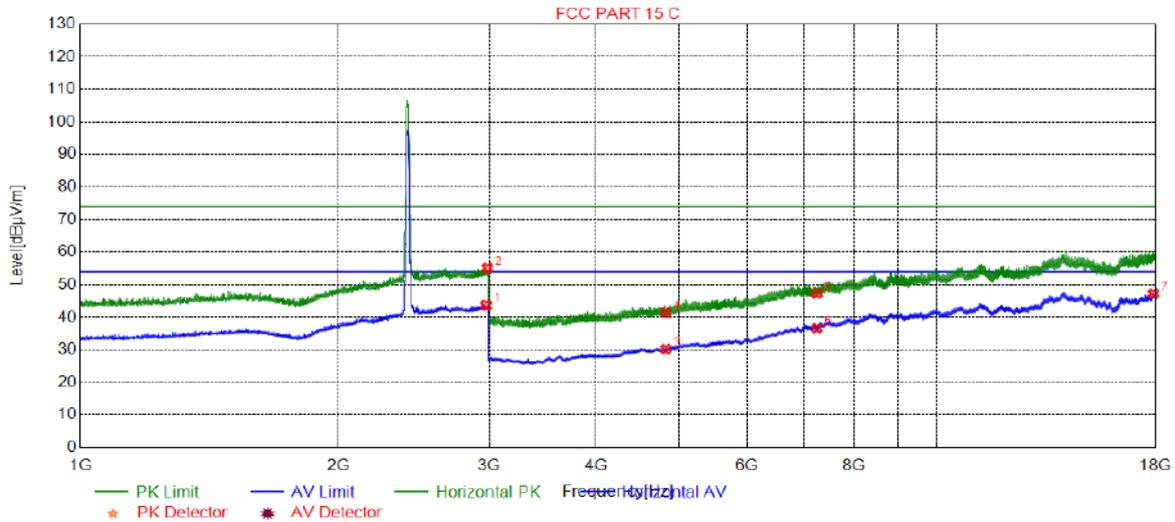
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4.9.2.7 **802.11G_Channel 1**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2975.49	43.73	9.56	54.00	10.27	215	140	Horizontal
2	2986.49	55.11	9.51	74.00	18.89	226	127	Horizontal
3	4824.00	30.27	-18.21	54.00	23.73	106	153	Horizontal
4	4824.00	41.51	-18.21	74.00	32.49	171	126	Horizontal
5	7236.00	36.60	-9.99	54.00	17.40	113	342	Horizontal
6	7236.00	47.30	-9.99	74.00	26.70	243	0	Horizontal
7	17889.9	47.27	0.56	54.00	6.73	126	292	Horizontal

Final Data List

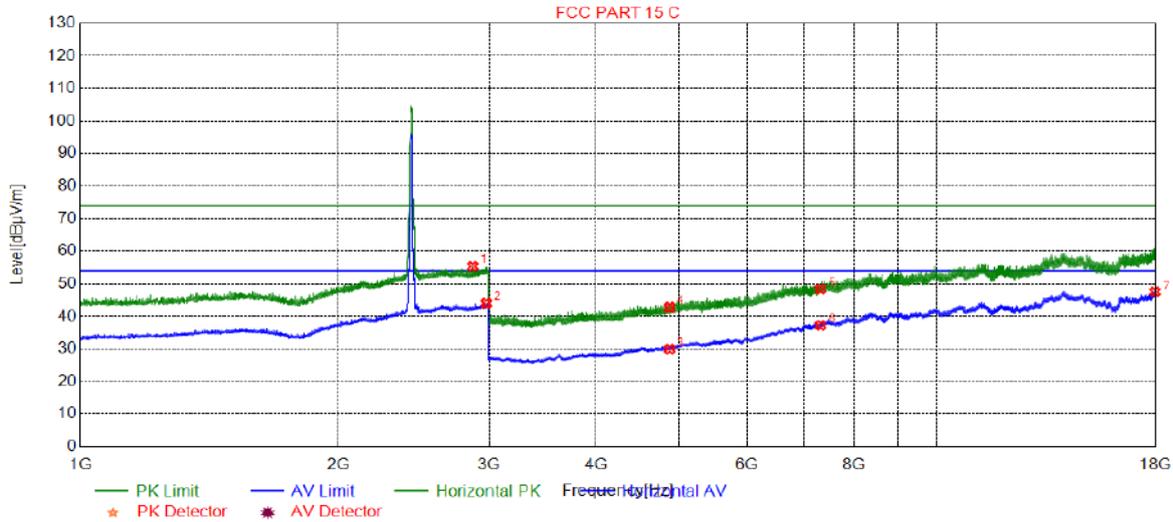


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4.9.2.9 **802.11G_Channel 6**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2870.46	55.36	9.20	74.00	18.64	200	236	Horizontal
2	2976.99	44.04	9.56	54.00	9.96	249	128	Horizontal
3	4874.00	29.98	-17.99	54.00	24.02	219	47	Horizontal
4	4874.00	42.83	-17.99	74.00	31.17	232	47	Horizontal
5	7311.00	48.38	-9.74	74.00	25.62	241	292	Horizontal
6	7311.00	37.26	-9.74	54.00	16.74	143	41	Horizontal
7	17956.5	47.55	0.71	54.00	6.45	171	0	Horizontal

Final Data List

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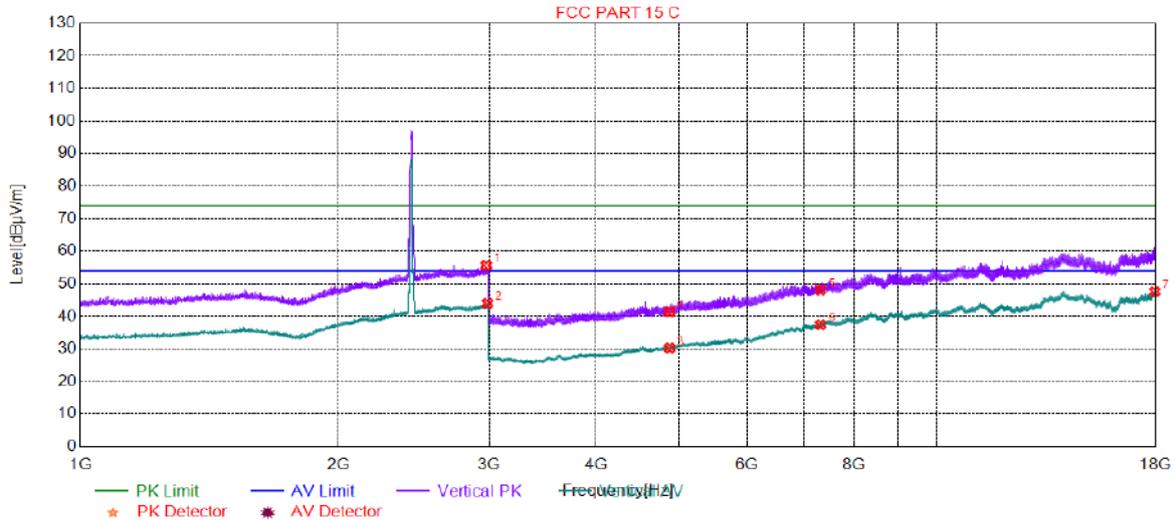
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4.9.2.10 **802.11G_Channel 6**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2976.49	55.64	9.56	74.00	18.36	293	97	Vertical
2	2987.49	44.03	9.51	54.00	9.97	213	138	Vertical
3	4874.00	30.31	-17.99	54.00	23.69	254	326	Vertical
4	4874.00	41.45	-17.99	74.00	32.55	192	46	Vertical
5	7311.00	48.06	-9.74	74.00	25.94	257	242	Vertical
6	7311.00	37.46	-9.74	54.00	16.54	158	242	Vertical
7	17950.4	47.61	0.71	54.00	6.39	285	192	Vertical

Final Data List

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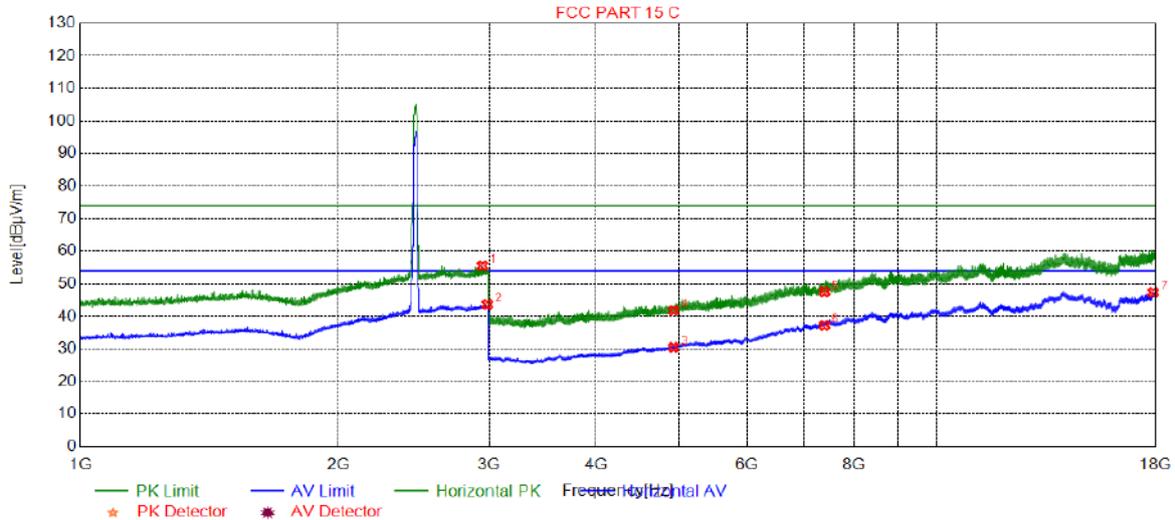
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4.9.2.11 **802.11G_Channel 11**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2946.98	55.52	9.65	74.00	18.48	109	305	Horizontal
2	2985.99	43.69	9.51	54.00	10.31	184	358	Horizontal
3	4924.00	30.52	-17.72	54.00	23.48	180	296	Horizontal
4	4924.00	41.84	-17.72	74.00	32.16	168	46	Horizontal
5	7386.00	47.53	-9.55	74.00	26.47	114	140	Horizontal
6	7386.00	37.25	-9.55	54.00	16.75	236	90	Horizontal
7	17872.9	47.35	0.33	54.00	6.65	189	90	Horizontal

Final Data List



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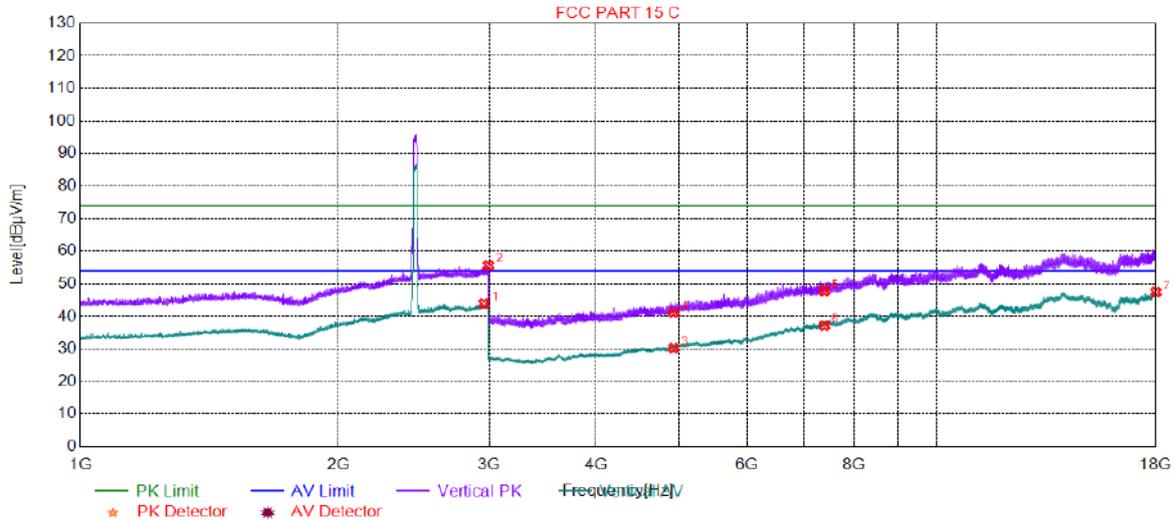
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4.9.2.12 802.11G_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2956.98	43.94	9.65	54.00	10.06	243	72	Vertical
2	2994.49	55.65	9.48	74.00	18.35	282	342	Vertical
3	4924.00	30.30	-17.72	54.00	23.70	150	292	Vertical
4	4924.00	41.20	-17.72	74.00	32.80	160	237	Vertical
5	7386.00	47.82	-9.55	74.00	26.18	181	192	Vertical
6	7386.00	37.20	-9.55	54.00	16.80	293	242	Vertical
7	18000.0	47.47	0.72	54.00	6.53	250	42	Vertical

Final Data List



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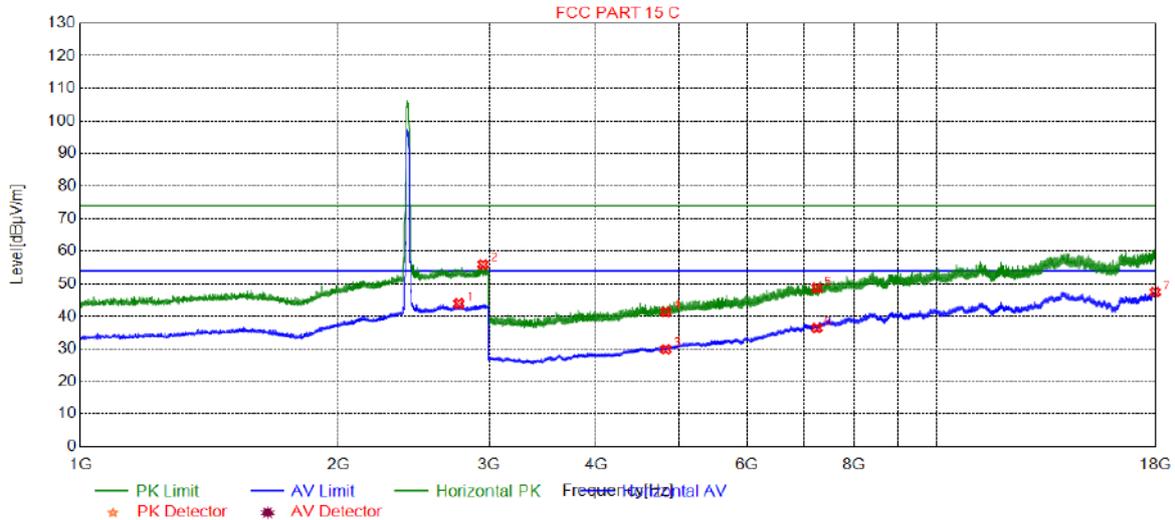
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4.9.2.13 **802.11N20_Channel 1**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2764.94	43.96	9.07	54.00	10.04	196	73	Horizontal
2	2950.98	55.94	9.68	74.00	18.06	124	236	Horizontal
3	4824.00	29.91	-18.21	54.00	24.09	172	350	Horizontal
4	4824.00	41.40	-18.21	74.00	32.60	135	18	Horizontal
5	7236.00	48.72	-9.99	74.00	25.28	240	292	Horizontal
6	7236.00	36.43	-9.99	54.00	17.57	173	141	Horizontal
7	17966.4	47.45	0.71	54.00	6.55	206	91	Horizontal

Final Data List



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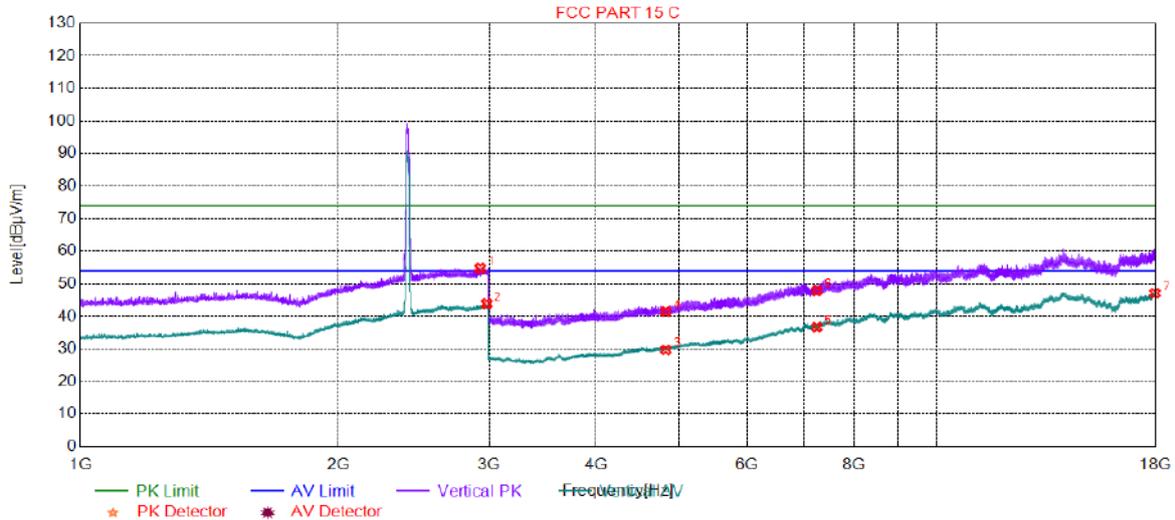
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4.9.2.14 **802.11N20_Channel 1**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2929.48	54.79	9.46	74.00	19.21	246	82	Vertical
2	2980.49	43.93	9.54	54.00	10.07	207	342	Vertical
3	4824.00	29.74	-18.21	54.00	24.26	150	297	Vertical
4	4824.00	41.55	-18.21	74.00	32.45	216	264	Vertical
5	7236.00	36.68	-9.99	54.00	17.32	266	241	Vertical
6	7236.00	47.87	-9.99	74.00	26.13	261	91	Vertical
7	17956.5	47.11	0.71	54.00	6.89	263	241	Vertical

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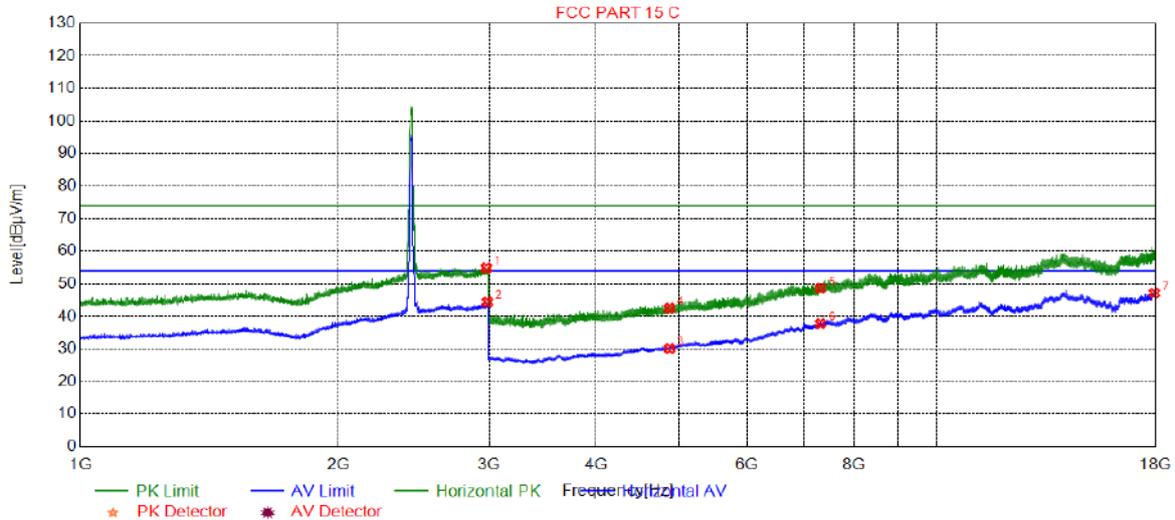
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4.9.2.15 **802.11N20_Channel 6**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2977.49	54.87	9.55	74.00	19.13	209	72	Horizontal
2	2986.49	44.41	9.51	54.00	9.59	198	31	Horizontal
3	4874.00	30.15	-17.99	54.00	23.85	233	235	Horizontal
4	4874.00	42.56	-17.99	74.00	31.44	131	98	Horizontal
5	7311.00	48.64	-9.74	74.00	25.36	168	193	Horizontal
6	7311.00	37.80	-9.74	54.00	16.20	160	342	Horizontal
7	17930.1	47.16	0.70	54.00	6.84	135	142	Horizontal

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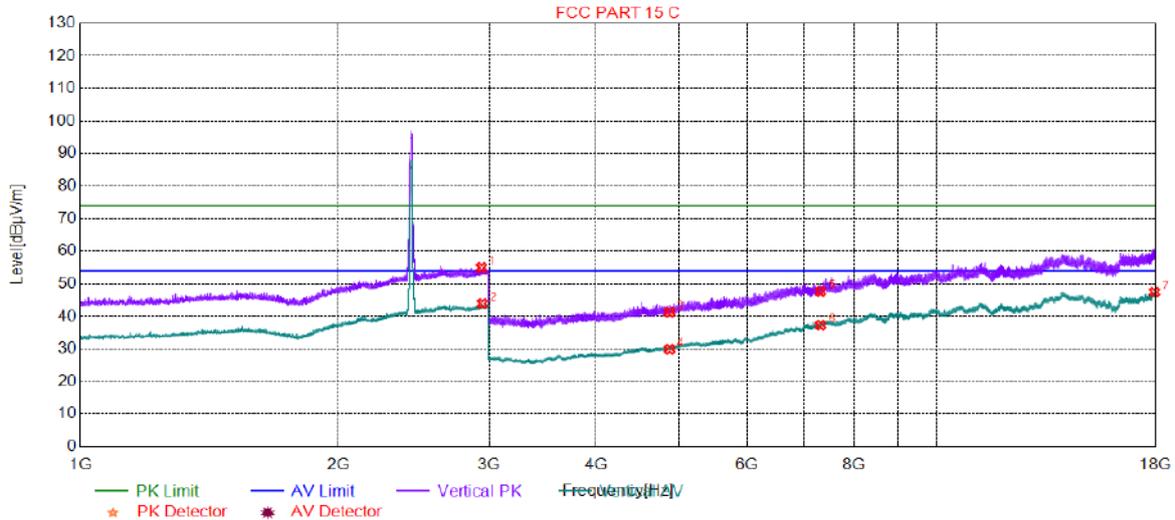
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4.9.2.16 **802.11N20_Channel 6**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2939.48	54.99	9.57	74.00	19.01	230	29	Vertical
2	2946.48	43.97	9.64	54.00	10.03	156	275	Vertical
3	4874.00	41.27	-17.99	74.00	32.73	158	18	Vertical
4	4874.00	29.93	-17.99	54.00	24.07	174	321	Vertical
5	7311.00	47.62	-9.74	74.00	26.38	217	0	Vertical
6	7311.00	37.31	-9.74	54.00	16.69	208	142	Vertical
7	17937.8	47.46	0.70	54.00	6.54	296	0	Vertical

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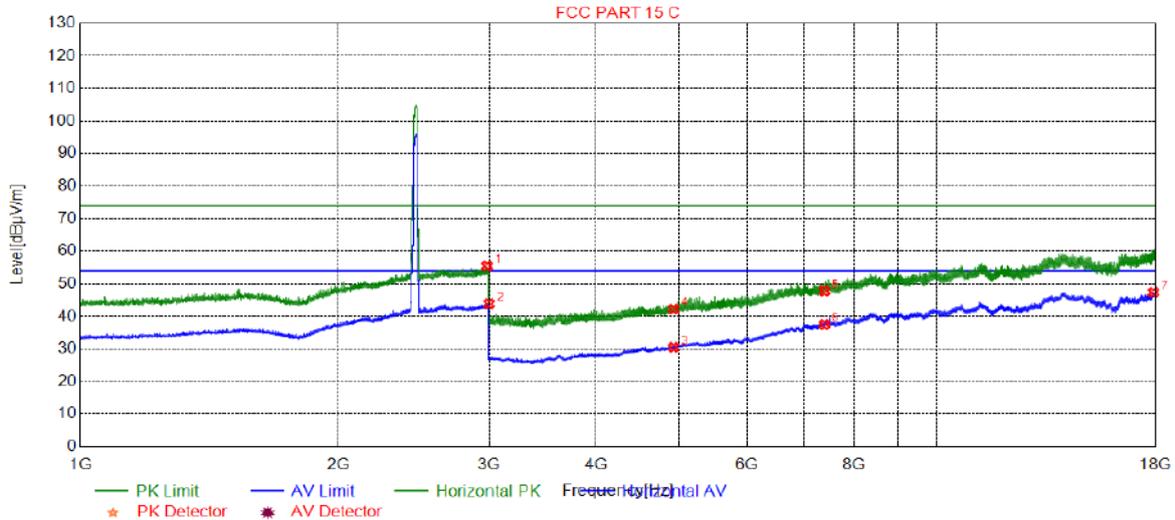
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4.9.2.17 **802.11N20_Channel 11**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2983.99	55.46	9.52	74.00	18.54	123	277	Horizontal
2	2999.49	43.90	9.45	54.00	10.10	232	277	Horizontal
3	4924.00	30.53	-17.72	54.00	23.47	210	360	Horizontal
4	4924.00	42.27	-17.72	74.00	31.73	203	18	Horizontal
5	7386.00	47.78	-9.55	74.00	26.22	228	292	Horizontal
6	7386.00	37.50	-9.55	54.00	16.50	193	342	Horizontal
7	17887.7	47.38	0.53	54.00	6.62	210	0	Horizontal

Final Data List



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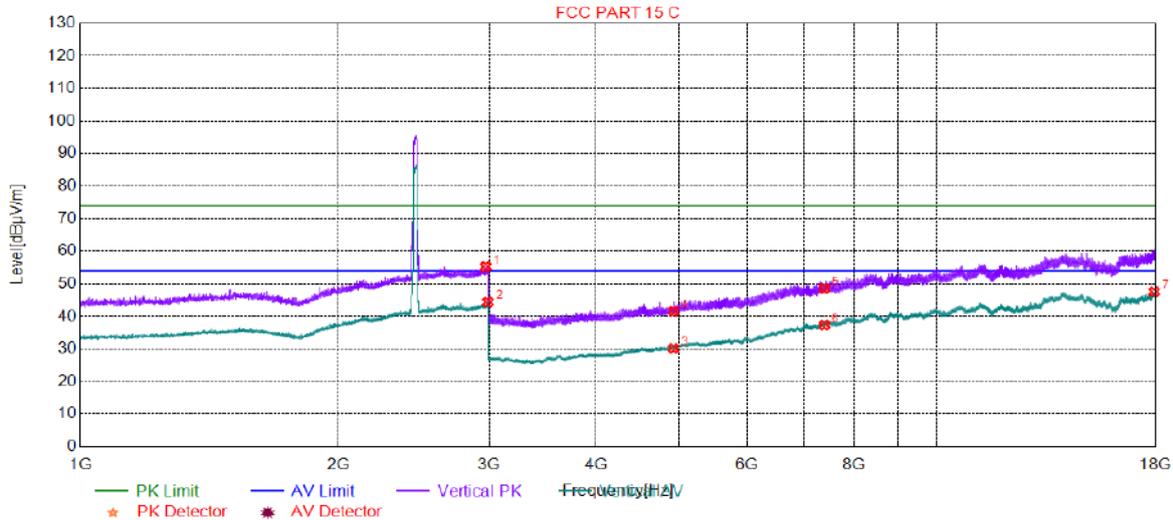
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4.9.2.18

802.11N20_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2971.99	55.26	9.58	74.00	18.74	251	232	Vertical
2	2990.49	44.41	9.49	54.00	9.59	254	315	Vertical
3	4924.00	30.21	-17.72	54.00	23.79	179	181	Vertical
4	4924.00	41.61	-17.72	74.00	32.39	231	100	Vertical
5	7386.00	48.58	-9.55	74.00	25.42	173	142	Vertical
6	7386.00	37.35	-9.55	54.00	16.65	229	292	Vertical
7	17921.8	47.56	0.70	54.00	6.44	275	39	Vertical

Final Data List

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor
- 2) Scan from 9kHz to 25GHz, the disturbance between 9KHz to 30MHz and 18GHz to 25GHz was very low, and the above harmonics were the highest point could be found when testing, The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
- 3) As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.
- 4) All Modes had been tested, but only the worst case data displayed in this report.



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4.10 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205		
Test Method:	ANSI C63.10: 2013 Section 11.12		
Test Site:	Measurement Distance: 3m or 10m (Semi-Anechoic Chamber)		
Limit:	Frequency	Limit (dBuV/m @3m)	Remark
	30MHz-88MHz	40.0	Quasi-peak Value
	88MHz-216MHz	43.5	Quasi-peak Value
	216MHz-960MHz	46.0	Quasi-peak Value
	960MHz-1GHz	54.0	Quasi-peak Value
	Above 1GHz	54.0	Average Value
		74.0	Peak Value
Test Setup:			

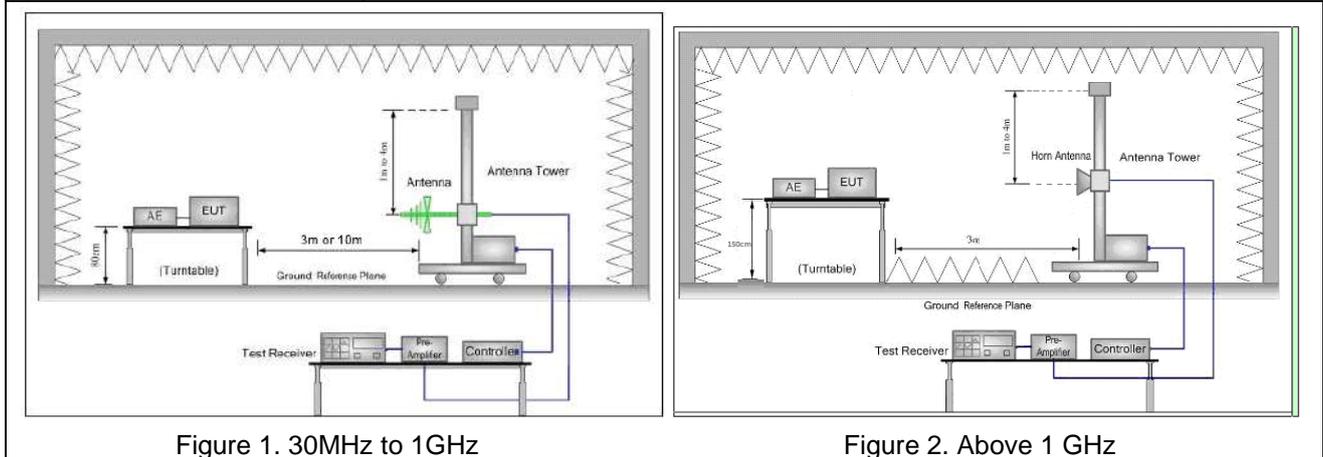


Figure 1. 30MHz to 1GHz

Figure 2. Above 1 GHz



<p>Test Procedure:</p>	<ol style="list-style-type: none"> a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. g. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel h. Test the EUT in the lowest channel , the Highest channel i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the X axis positioning which it is worse case. j. Repeat above procedures until all frequencies measured was complete.
<p>Exploratory Test Mode:</p>	<p>Transmitting with all kind of modulations, data rates. Charge + Transmitting mode.</p>
<p>Final Test Mode:</p>	<p>Pretest the EUT at Charge +Transmitting mode. Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G ; 6.5Mbps of rate is the worst case of 802.11N(HT20); Only the worst case is recorded in the report.</p>
<p>Instruments Used:</p>	<p>Refer to section 5.10 for details</p>
<p>Test Results:</p>	<p>Pass</p>

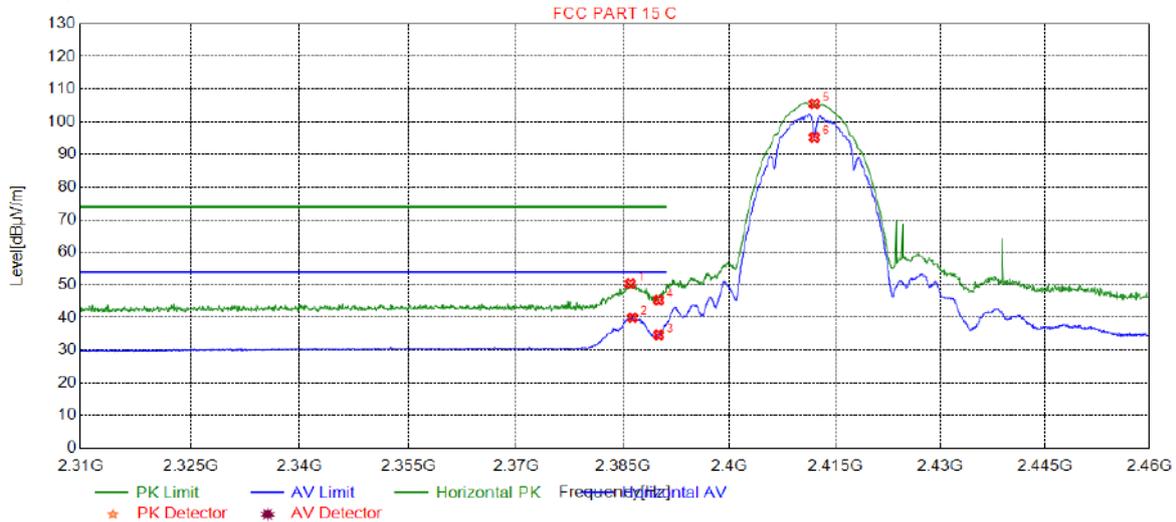


Test plot as follows:

4.10.1 ANT1

4.10.1.1 802.11B_Channel 1

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2386.01	50.39	7.77	74.00	23.61	137	214	Horizontal
2	2386.31	39.96	7.77	54.00	14.04	207	214	Horizontal
3	2390.00	34.74	7.77	54.00	19.26	248	214	Horizontal
4	2390.00	45.41	7.77	74.00	28.59	246	224	Horizontal
5	2412.00	105.49	7.81	0.00	-105.49	219	214	Horizontal
6	2412.00	95.22	7.81	0.00	-95.22	140	208	Horizontal

Final Data List



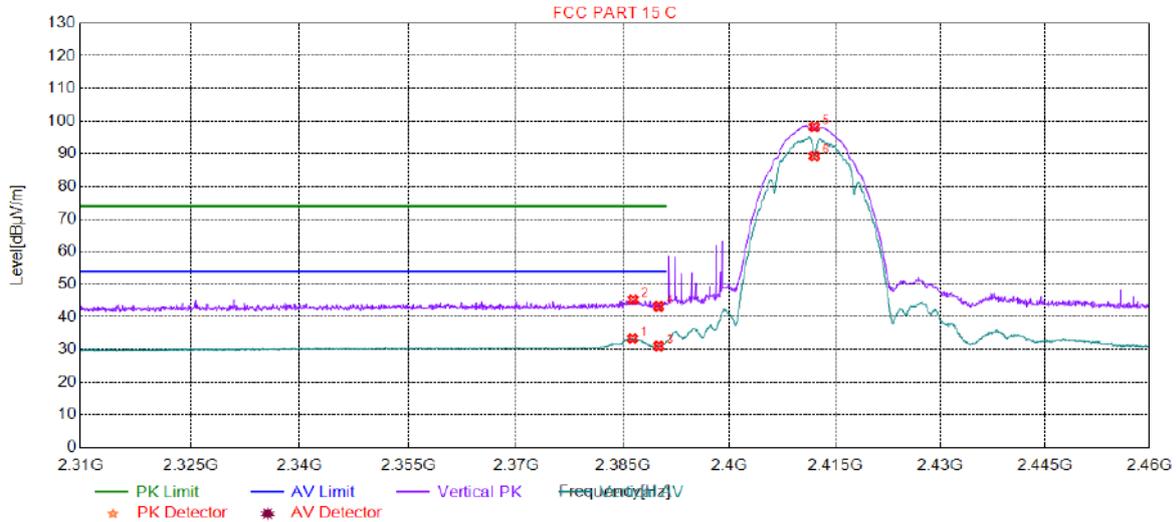
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4.10.1.2 **802.11B_Channel 1**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2386.31	33.42	7.77	54.00	20.58	292	222	Vertical
2	2386.38	45.37	7.77	74.00	28.63	268	216	Vertical
3	2390.00	31.07	7.77	54.00	22.93	152	216	Vertical
4	2390.00	43.26	7.77	74.00	30.74	195	314	Vertical
5	2412.00	98.29	7.81	0.00	-98.29	245	216	Vertical
6	2412.00	89.34	7.81	0.00	-89.34	170	222	Vertical

Final Data List



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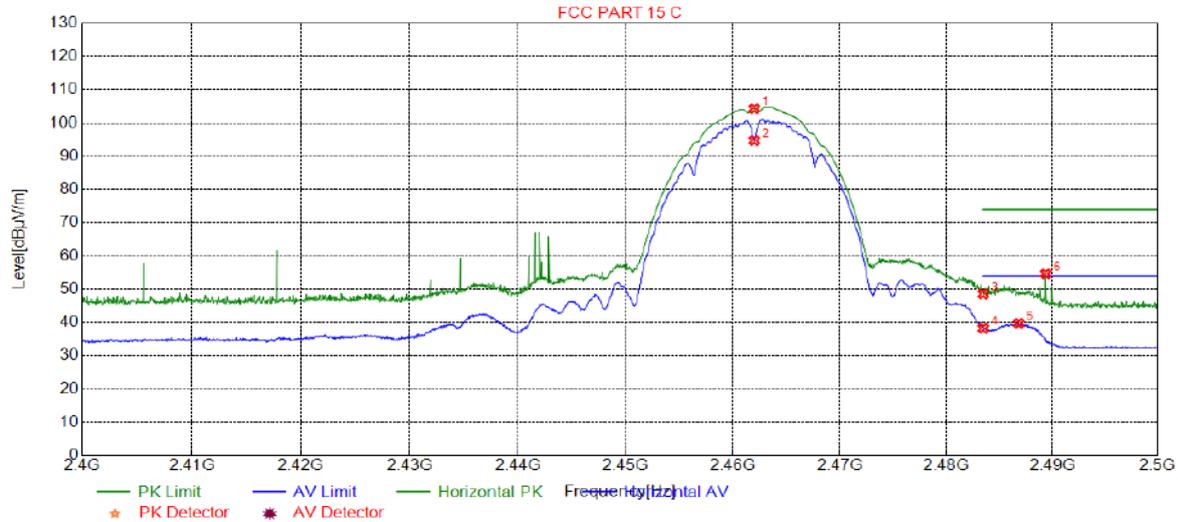
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4.10.1.3 802.11B_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	104.31	7.98	0.00	-104.31	112	215	Horizontal
2	2462.00	94.72	7.98	0.00	-94.72	184	215	Horizontal
3	2483.50	48.61	8.01	74.00	25.39	195	215	Horizontal
4	2483.50	38.26	8.01	54.00	15.74	213	210	Horizontal
5	2486.84	39.75	8.01	54.00	14.25	240	215	Horizontal
6	2489.39	54.68	8.02	74.00	19.32	240	96	Horizontal

Final Data List



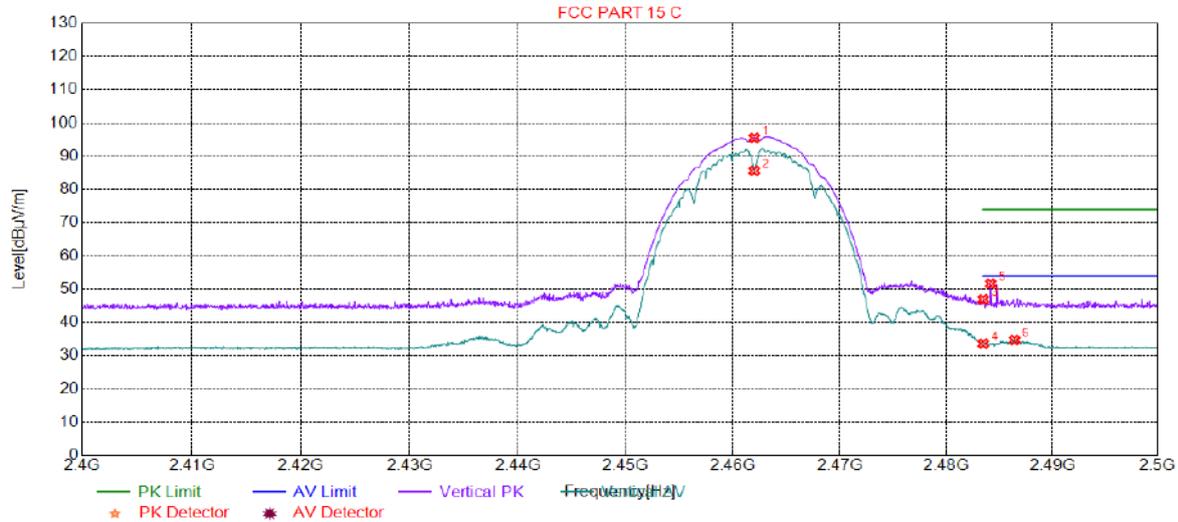
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4.10.1.4 **802.11B_Channel 11**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	95.51	7.98	0.00	-95.51	151	320	Vertical
2	2462.00	85.60	7.98	0.00	-85.60	150	326	Vertical
3	2483.50	46.99	8.01	74.00	27.01	186	320	Vertical
4	2483.50	33.62	8.01	54.00	20.38	273	326	Vertical
5	2484.19	51.69	8.01	74.00	22.31	168	81	Vertical
6	2486.44	34.73	8.01	54.00	19.27	192	326	Vertical

Final Data List



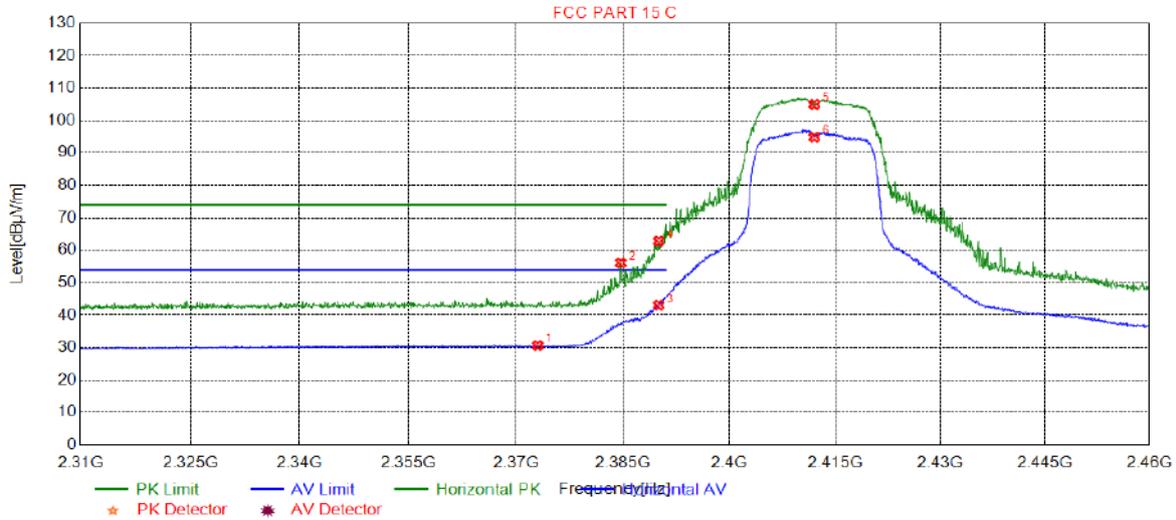
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4.10.1.5 **802.11G_Channel 1**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2373.03	30.67	7.79	54.00	23.33	187	216	Horizontal
2	2384.66	56.15	7.78	74.00	17.85	216	216	Horizontal
3	2390.00	43.08	7.77	54.00	10.92	214	210	Horizontal
4	2390.00	62.85	7.77	74.00	11.15	183	156	Horizontal
5	2412.00	104.96	7.81	0.00	-104.96	130	216	Horizontal
6	2412.00	94.85	7.81	0.00	-94.85	108	216	Horizontal

Final Data List



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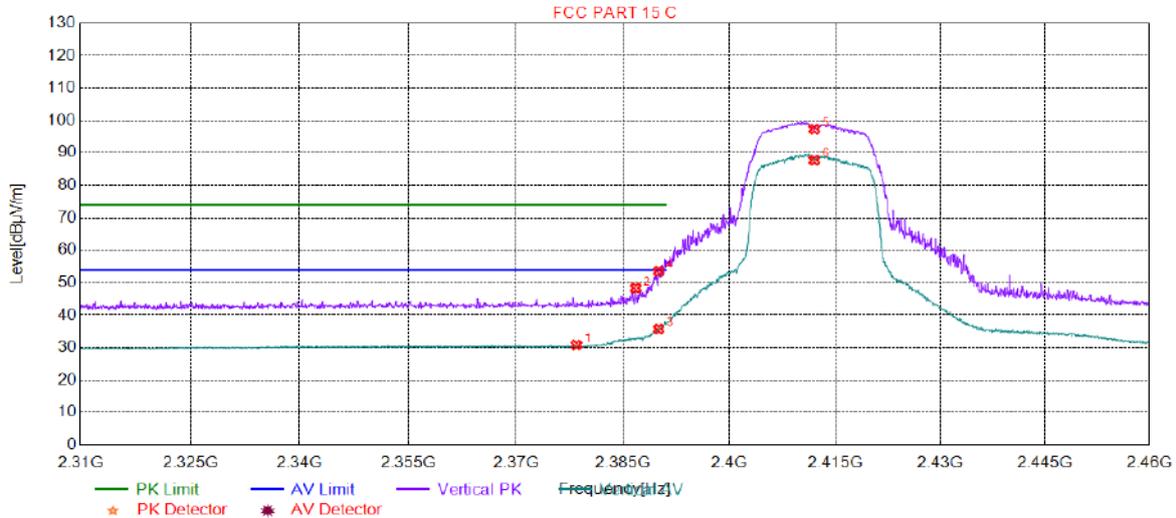
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4.10.1.6 **802.11G_Channel 1**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2378.43	30.82	7.78	54.00	23.18	158	233	Vertical
2	2386.76	48.38	7.77	74.00	25.62	284	12	Vertical
3	2390.00	35.76	7.77	54.00	18.24	199	222	Vertical
4	2390.00	53.60	7.77	74.00	20.40	196	189	Vertical
5	2412.00	97.35	7.81	0.00	-97.35	274	216	Vertical
6	2412.00	87.79	7.81	0.00	-87.79	233	216	Vertical

Final Data List



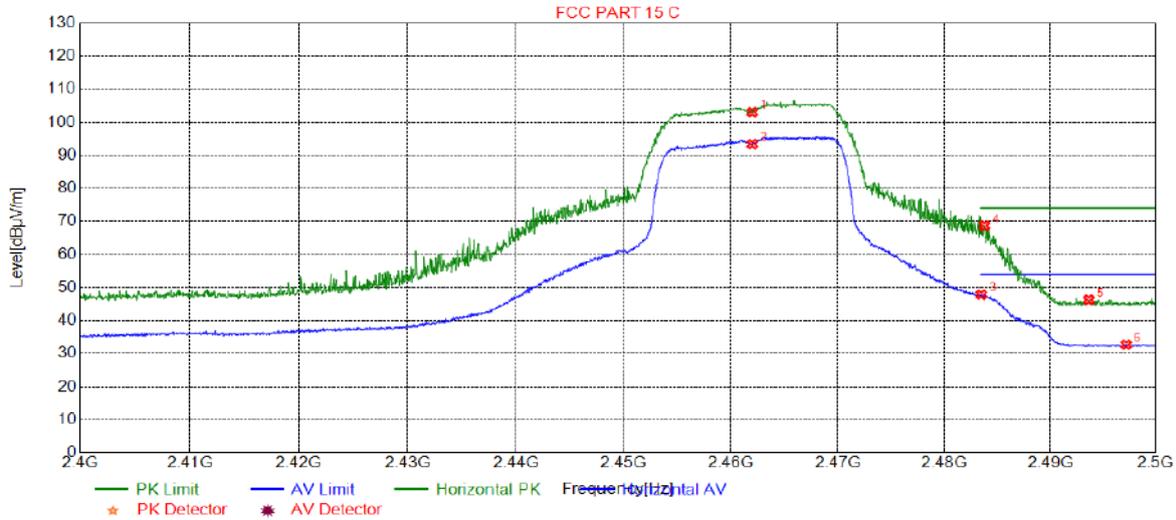
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4.10.1.7 **802.11G_Channel 11**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	103.11	7.98	0.00	-103.11	240	210	Horizontal
2	2462.00	93.38	7.98	0.00	-93.38	217	214	Horizontal
3	2483.50	47.88	8.01	54.00	6.12	182	214	Horizontal
4	2483.79	68.77	8.01	74.00	5.23	201	214	Horizontal
5	2493.64	46.30	8.02	74.00	27.70	201	270	Horizontal
6	2497.19	32.76	8.03	54.00	21.24	133	360	Horizontal

Final Data List



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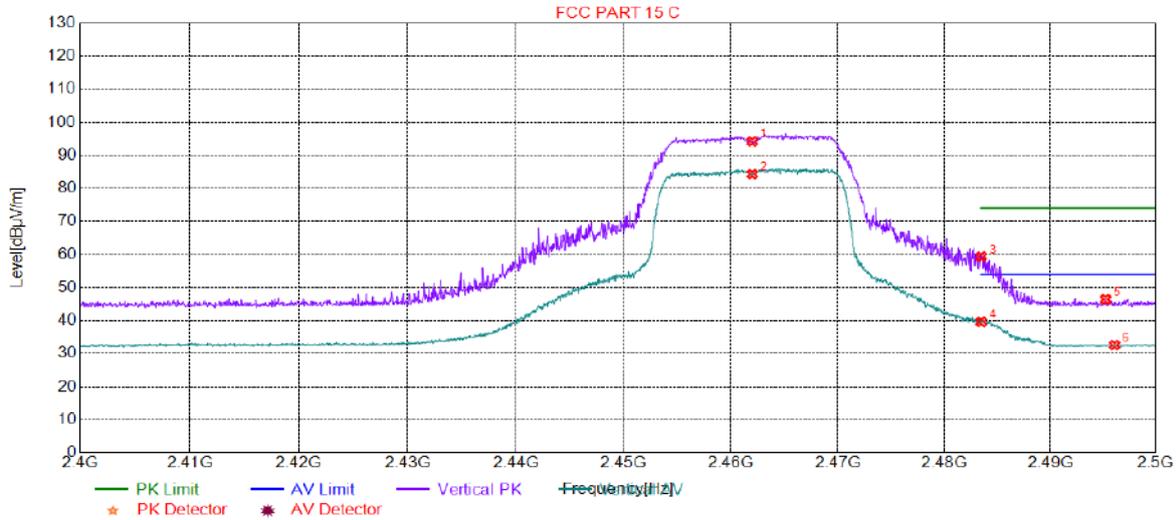
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4.10.1.8 **802.11G_Channel 11**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	94.23	7.98	0.00	-94.23	245	320	Vertical
2	2462.00	84.37	7.98	0.00	-84.37	224	326	Vertical
3	2483.50	59.37	8.01	74.00	14.63	278	320	Vertical
4	2483.50	39.66	8.01	54.00	14.34	153	320	Vertical
5	2495.24	46.45	8.02	74.00	27.55	217	253	Vertical
6	2496.09	32.63	8.03	54.00	21.37	271	137	Vertical

Final Data List



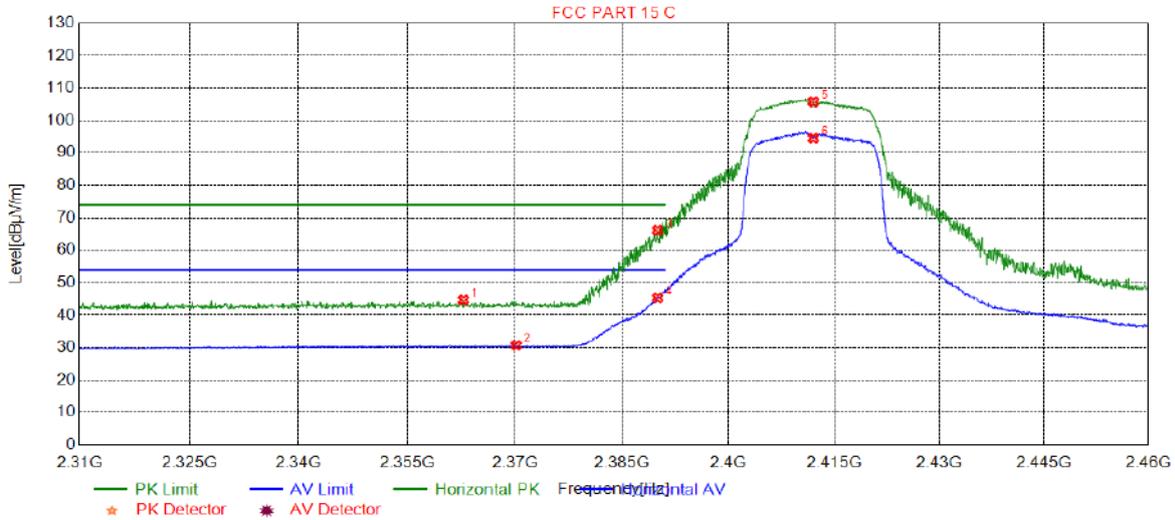
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4.10.1.9 **802.11N20_Channel 1**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2362.82	44.71	7.80	74.00	29.29	132	162	Horizontal
2	2370.18	30.73	7.79	54.00	23.27	151	156	Horizontal
3	2389.99	66.19	7.77	74.00	7.81	149	211	Horizontal
4	2390.00	45.34	7.77	54.00	8.66	184	211	Horizontal
5	2412.00	105.70	7.81	0.00	-105.70	141	211	Horizontal
6	2412.00	94.56	7.81	0.00	-94.56	172	216	Horizontal

Final Data List



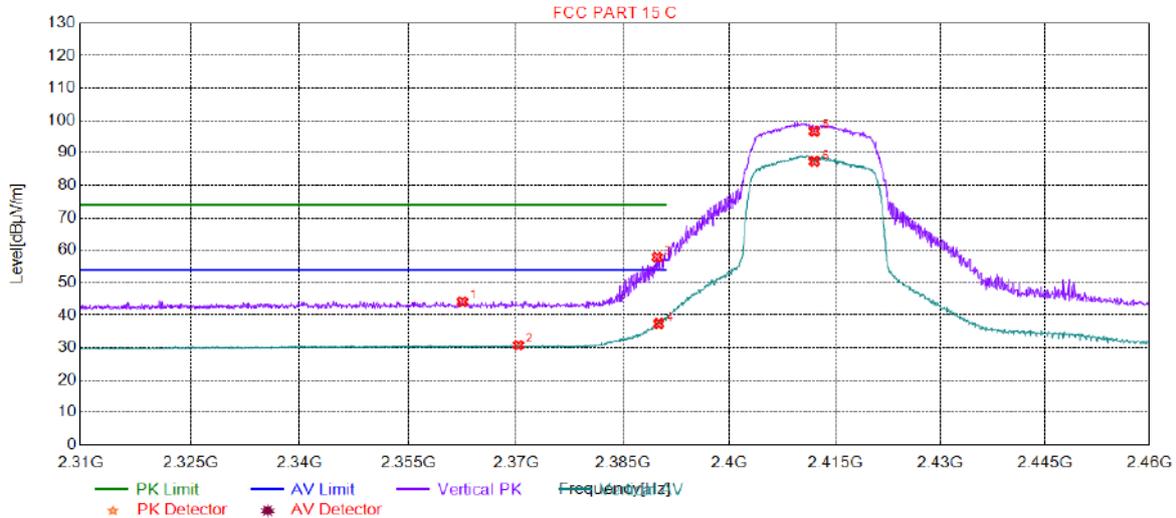
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4.10.1.10 **802.11N20_Channel 1**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2362.52	44.12	7.80	74.00	29.88	223	22	Vertical
2	2370.33	30.76	7.79	54.00	23.24	277	71	Vertical
3	2389.76	57.86	7.77	74.00	16.14	214	211	Vertical
4	2390.00	37.44	7.77	54.00	16.56	170	216	Vertical
5	2412.00	96.67	7.81	0.00	-96.67	260	216	Vertical
6	2412.00	87.41	7.81	0.00	-87.41	261	221	Vertical

Final Data List



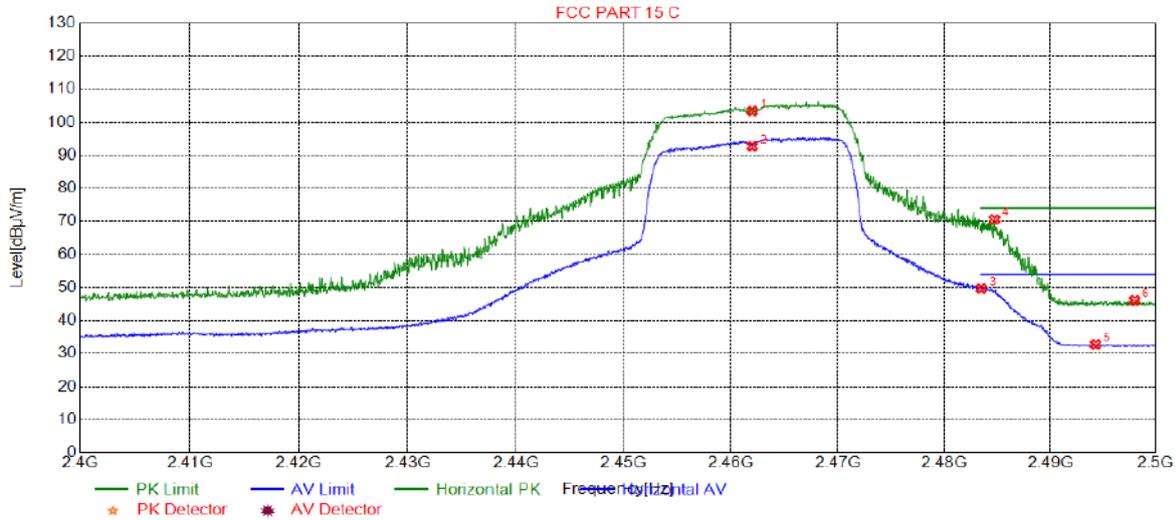
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4.10.1.11 **802.11N20_Channel 11**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	103.41	7.98	0.00	-103.41	162	221	Horizontal
2	2462.00	92.74	7.98	0.00	-92.74	221	215	Horizontal
3	2483.50	49.74	8.01	54.00	4.26	127	215	Horizontal
4	2484.74	70.66	8.01	74.00	3.34	195	221	Horizontal
5	2494.29	32.80	8.02	54.00	21.20	203	242	Horizontal
6	2497.99	46.10	8.03	74.00	27.90	159	149	Horizontal

Final Data List



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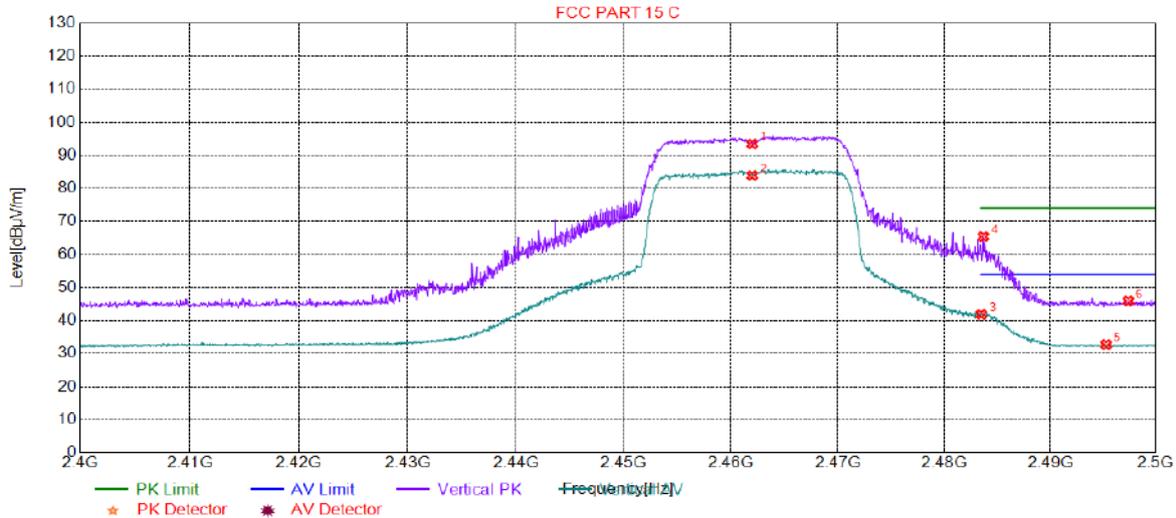
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4.10.1.12 **802.11N20_Channel 11**

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	93.45	7.98	0.00	-93.45	192	320	Vertical
2	2462.00	83.92	7.98	0.00	-83.92	217	326	Vertical
3	2483.50	41.88	8.01	54.00	12.12	185	320	Vertical
4	2483.69	65.47	8.01	74.00	8.53	195	326	Vertical
5	2495.29	32.76	8.02	54.00	21.24	168	315	Vertical
6	2497.39	45.95	8.03	74.00	28.05	277	123	Vertical

Final Data List

Remark:

The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

$$\text{Final Test Level} = \text{Receiver Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Preamplifier Factor}$$

All Modes have been tested, but only the worst case data displayed in this report.



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5 Measurement Uncertainty (95% confidence levels, k=2)

Lab A:

No.	Item	Measurement Uncertainty
1	Total RF power, conducted	±0.75dB
2	RF power density, conducted	±2.84dB
3	Spurious emissions, conducted	±0.75dB
4	Temperature test	±1°C
5	Humidity test	±3%
6	DC and low frequency voltages	±0.5%

Lab B:

No.	Item	Measurement Uncertainty
1	Conduction Emission	± 3.0dB (150kHz to 30MHz)
2	Radiated Emission	± 4.8dB (Below 1GHz)
		± 4.8dB (1GHz to 6GHz)
		± 4.5dB (6GHz to 18GHz)
		± 5.02dB (Above 18GHz)



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6 Equipment List

RF conducted test					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date	Cal. Due date
				(yyyy-mm-dd)	(yyyy-mm-dd)
DC Power Supply	Agilent Technologies Inc	66311B	W009-09	2020/7/15	2021/7/15
Signal Analyzer	Rohde & Schwarz	FSV	W025-05	2020/1/3	2021/1/2
Coaxial Cable	SGS	N/A	SEM031-01	2020/6/12	2021/6/11
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2020/7/14	2021/7/14
Temperature Chamber	GIANT FORCE	ICT-150-40-CP-AR	W027-03	2019/10/27	2020/10/27
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2020/7/14	2021/7/14

CE Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Shielding Room	Brilliant-emc	N/A	XAW03-35-01	2019-09-11	2022-09-10
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2019-09-07	2020-09-06
Artificial network	ROHDE&SCHWARZ	ENV216	XAW01-04-03	2019-12-11	2020-12-10
Temperature and humidity meter	MingGao	TH101B	XAW01-01-01	2019-12-06	2020-12-05
Measurement Software	Tonscend	TS+ CE V2.5	XAW02-05-02	NCR	NCR



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RSE Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Semi-Anechoic Chamber	Brilliant-emc	N/A	XAW03-35-01	2019-09-11	2022-09-10
MXA signal analyzer	Keysight	N9020A	XAW01-06-01	2020-04-02	2021-04-01
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2019-09-07	2020-09-06
Receiving antenna (30MHz~3GHz)	Schwarzbeck	VULB 9163	XAW01-09-01	2019-10-13	2021-10-12
Receiving antenna (1GHz~18GHz)	Schwarzbeck	BBHA 9120D	XAW01-09-02	2019-10-13	2021-10-12
Receiving antenna (15GHz~40GHz)	Schwarzbeck	BBHA 9170	XAW01-09-03	2019-10-13	2021-10-12
Directional antenna rack controller	Max-Full	MF-7802BS	XAW03-03-01	NCR	NCR
High-speed antenna rack controller	Max-Full	MF-7802	XAW03-04-01	NCR	NCR
Filter bank	Tonscend	JS0806-F	XAW03-05-01	NCR	NCR
Filter bank	Tonscend	JS0806s	XAW03-05-02	NCR	NCR
Amplifier	Tonscend	TAP00903040	XAW01-41-01	2019-11-18	2020-11-17
Amplifier	Tonscend	TAP01018048	XAW01-41-02	2019-11-18	2020-11-17
Amplifier	Tonscend	TAP18040048	XAW01-41-03	2019-12-03	2020-12-02
Amplifier	Shanghai Steed	YX28980930	XAW01-41-06	2019-11-18	2020-11-17
Temperature and humidity meter	MingGao	TH101B	XAW01-01-01	2019-12-06	2020-12-05
Measurement Software	Tonscend	TS+ RSE V3.0.0.2	XAW02-05-01	NCR	NCR

7 Photographs - EUT Constructional Details

Refer to Appendix A - Photographs of Set-Up for ZR/2020/70002.

The End



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