



FCC TEST REPORT

Application No.: ZR/202070004
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-K520EMW
Trade Mark: LG
FCC ID: ZNFK520EMW
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: 2020/7/2
Date of Test: 2020/7/3 to 2020/7/23
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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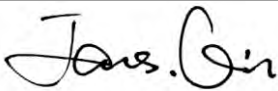
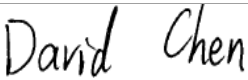
SGS-CSTC Standards Technical Services Co., Ltd.
Shenzhen Branch (Wujiang) FCC Laboratory

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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2020/7/31		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





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

Applicant:	LG Electronics USA, Inc.
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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-K520EMW
Trade Mark:	LG
IEEE 802.11 WLAN Mode Supported	☒ 802.11B (20 MHz channel bandwidth), ☒ 802.11G (20 MHz channel bandwidth) ☒ 802.11N (20 MHz channel bandwidth), ☐ 802.11N (40 MHz channel bandwidth)
Operation Frequency:	2400 MHz -2483.5MHz $fc = 2407 \text{ MHz} + N * 5 \text{ MHz}$, 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:	☒ Portable Device, ☐ Module
Antenna Type:	☐ External, ☒ Integrated
Antenna Ports	☒ Ant 1, ☐ Ant 2, ☐ Ant 3
Smart System	☒ SISO (for 802.11B/G/N), ☐ MIMO (for 802.11N): 2 Tx & 2 Rx, ☐ Diversity (for 802.11B/G) : Tx & Rx
Antenna Gain:	-5.56dBi
Power Supply	☒ AC/DC Adapter; ☒ Battery ☐ PoE;; ☐ 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						

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



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CH 12	2467MHz
CH 13	2472MHz

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 in low power mode) 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 in low power mode) 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 country 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 country 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)
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. 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.	
The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -5.56dBi.	



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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:	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 $50\Omega/50\mu\text{H} + 5\Omega$ 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.		

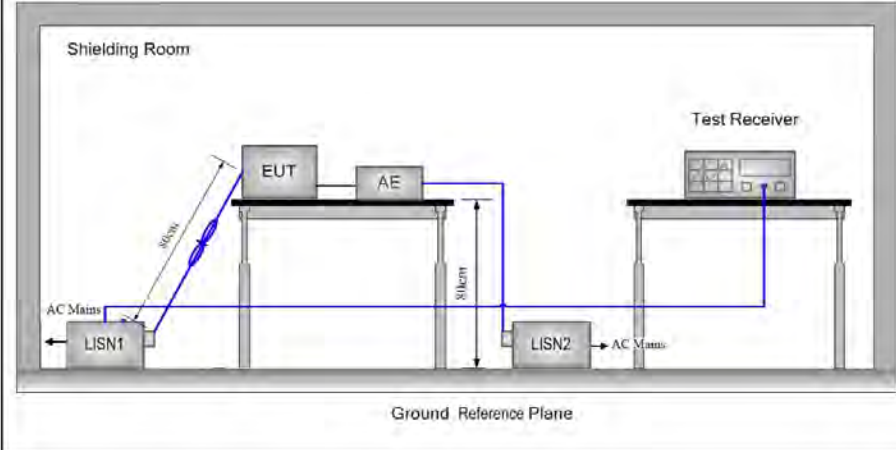


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Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates at lowest, middle and highest channel. Charge + Transmitting mode.
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate of 802.11B at lowest channel is the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



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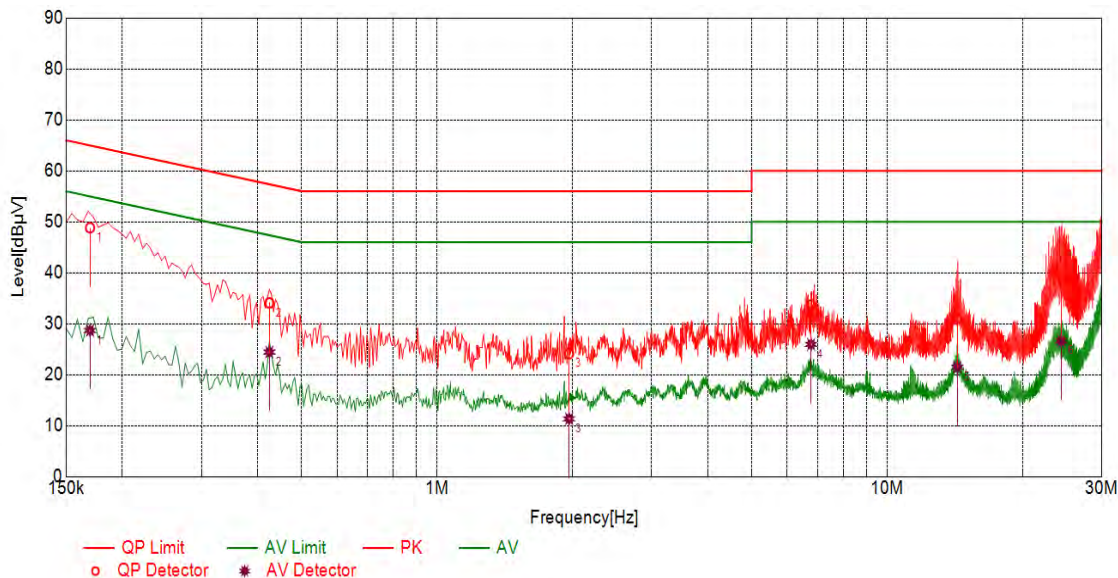


Measurement Data

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	0.1696	10.10	48.83	64.98	16.15	28.68	54.98	26.30	L
2	0.4244	10.10	34.08	57.36	23.28	24.44	47.36	22.92	L
3	1.9660	10.10	24.14	56.00	31.86	11.34	46.00	34.66	L
4	6.7800	10.10	33.68	60.00	26.32	25.95	50.00	24.05	L
5	14.3251	10.11	30.89	60.00	29.11	21.48	50.00	28.52	L
6	24.3634	10.11	39.33	60.00	20.67	26.63	50.00	23.37	L

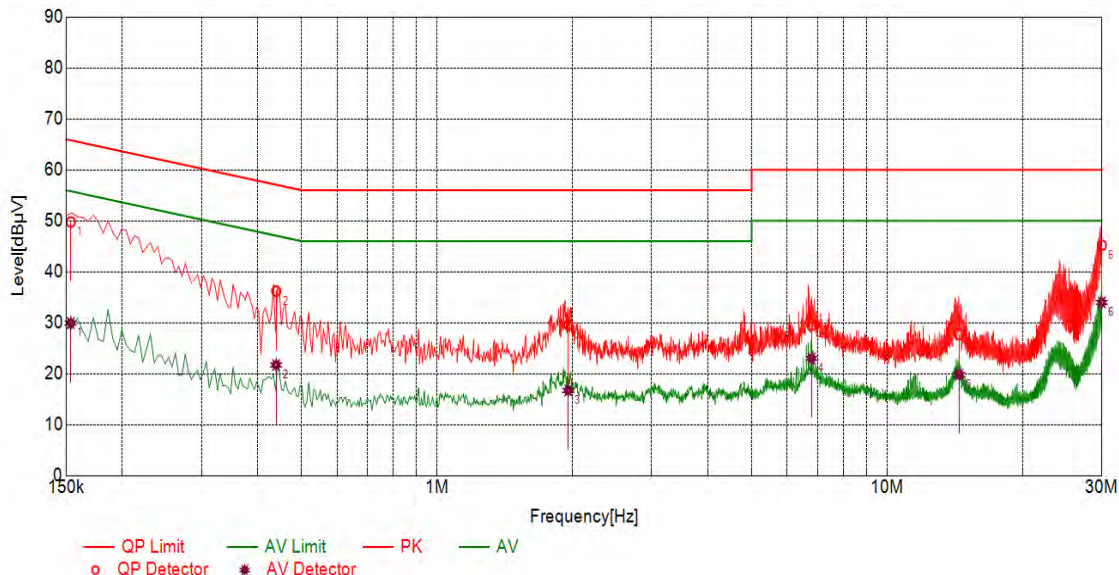


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Neutral Line:



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	0.1537	10.10	49.77	65.80	16.03	29.94	55.80	25.86	N
2	0.4395	10.10	36.20	57.07	20.87	21.70	47.07	25.37	N
3	1.9573	10.10	29.61	56.00	26.39	16.71	46.00	29.29	N
4	6.7943	10.10	29.48	60.00	30.52	23.00	50.00	27.00	N
5	14.4754	10.11	27.69	60.00	32.31	19.83	50.00	30.17	N
6	29.9946	10.11	45.22	60.00	14.78	33.99	50.00	16.01	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

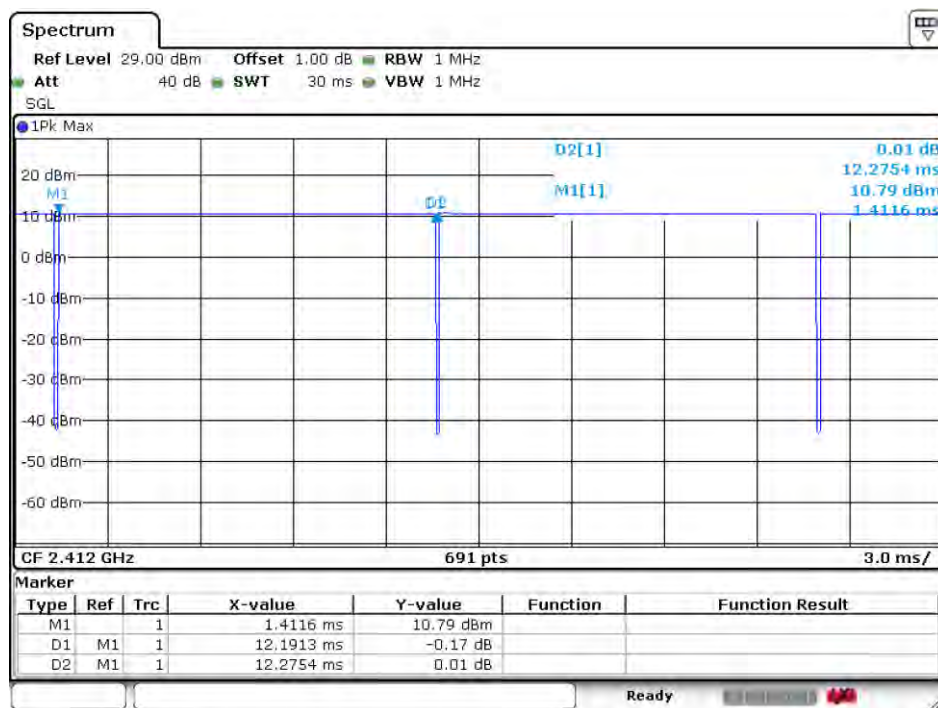
4.3.1 Test Results

Test Mode	TX Freq. [MHz]	Duty cycle [%]
11B	Ant 1: CH1,CH6,CH11	99.31
11G	Ant 1: CH1,CH6,CH11	95.53
11N20	Ant 1: CH1,CH6,CH11	95.22

4.3.1 Test Plots

4.3.1.1 ANT1

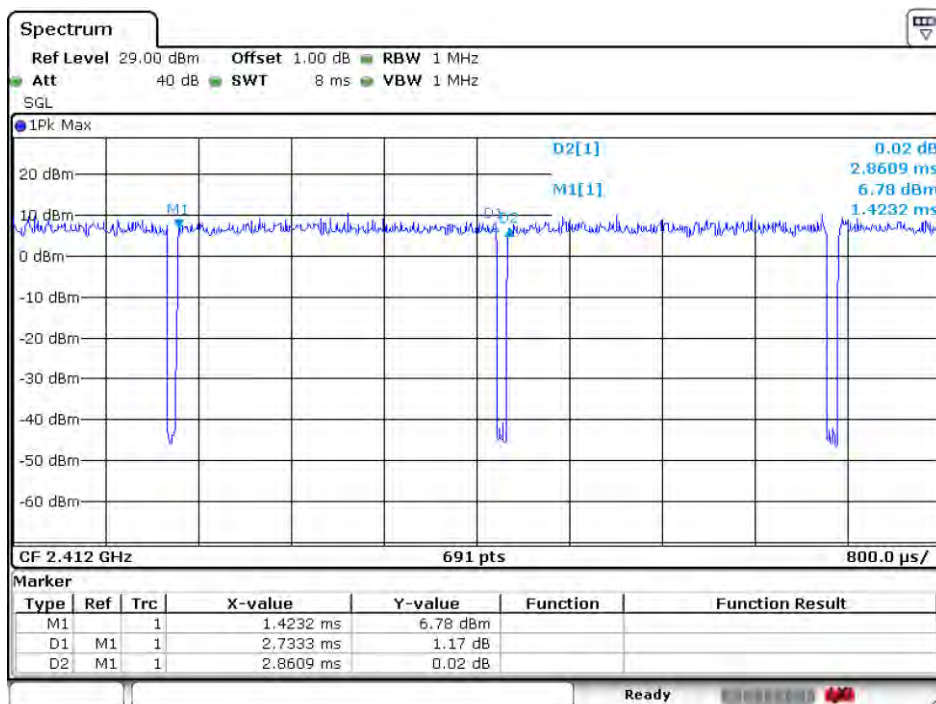
4.3.1.1.1 11B



Date: 7. JUL. 2020 03:29:00

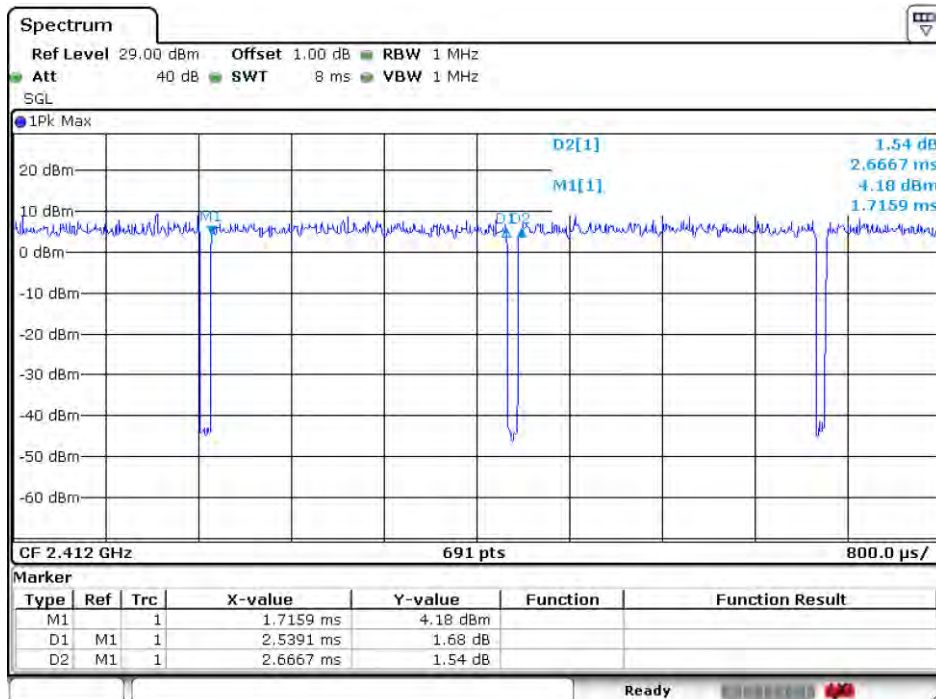


4.3.1.1.2 11G



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4.3.1.1.3 11N20



Date: 7 JUL 2020 03:27:56



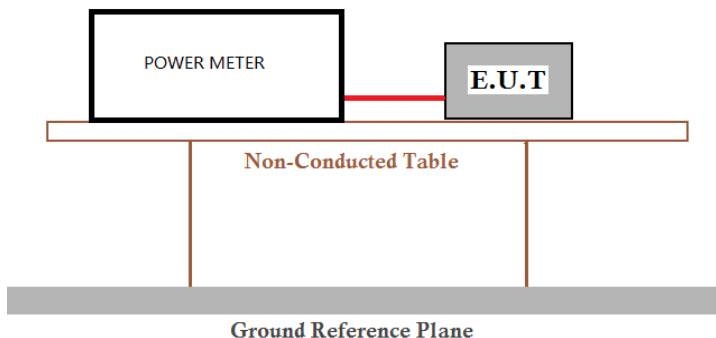
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4.4 Conducted Output Power

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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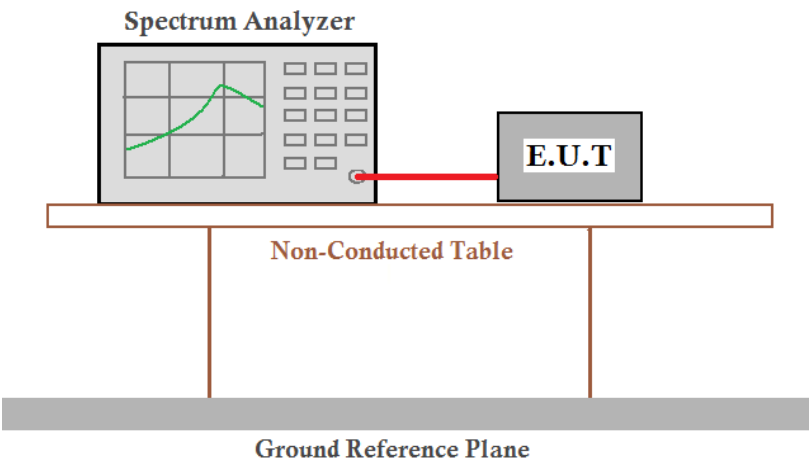
4.4.1 Test Results

Measurement Data of Peak Power:

Mode	Test Channel	Peak Output Power (dBm)	Limit (dBm)	Result
802.11B	CH1	16.96	30.00	Pass
	CH6	17.90	30.00	Pass
	CH11	17.16	30.00	Pass
	CH12	6.34	30.00	Pass
	CH13	6.00	30.00	Pass
802.11G	CH1	14.69	30.00	Pass
	CH6	15.74	30.00	Pass
	CH11	15.06	30.00	Pass
	CH12	5.90	30.00	Pass
	CH13	5.56	30.00	Pass
802.11N20	CH1	13.77	30.00	Pass
	CH6	14.75	30.00	Pass
	CH11	14.02	30.00	Pass
	CH12	5.83	30.00	Pass
	CH13	5.74	30.00	Pass



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:	
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	12.81	9.03	≥500	Pass
	CH6	12.85	9.03	≥500	Pass
	CH11	12.85	8.99	≥500	Pass
	CH12	12.68	8.55	≥500	Pass
	CH13	13.20	8.59	≥500	Pass
802.11G	CH1	16.80	16.06	≥500	Pass
	CH6	16.93	15.72	≥500	Pass
	CH11	16.67	16.06	≥500	Pass
	CH12	17.06	16.41	≥500	Pass
	CH13	17.37	16.45	≥500	Pass
802.11N20	CH1	17.80	16.32	≥500	Pass
	CH6	17.93	16.37	≥500	Pass
	CH11	17.76	16.63	≥500	Pass
	CH12	18.06	17.63	≥500	Pass
	CH13	18.28	17.67	≥500	Pass



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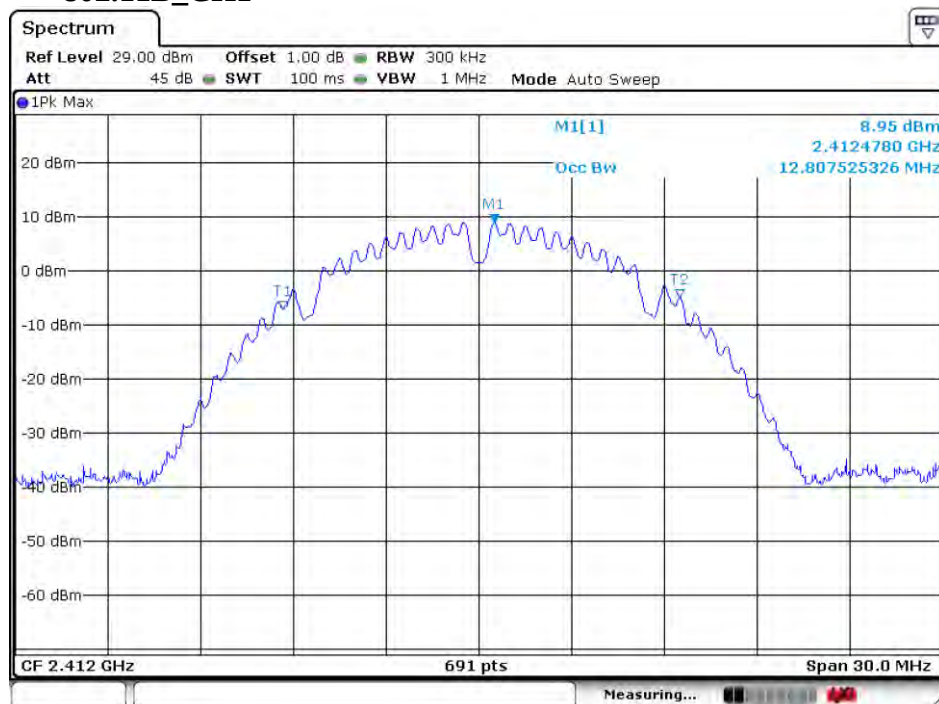
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4.5.2 Test plots

4.5.2.1 802.11B_CH1



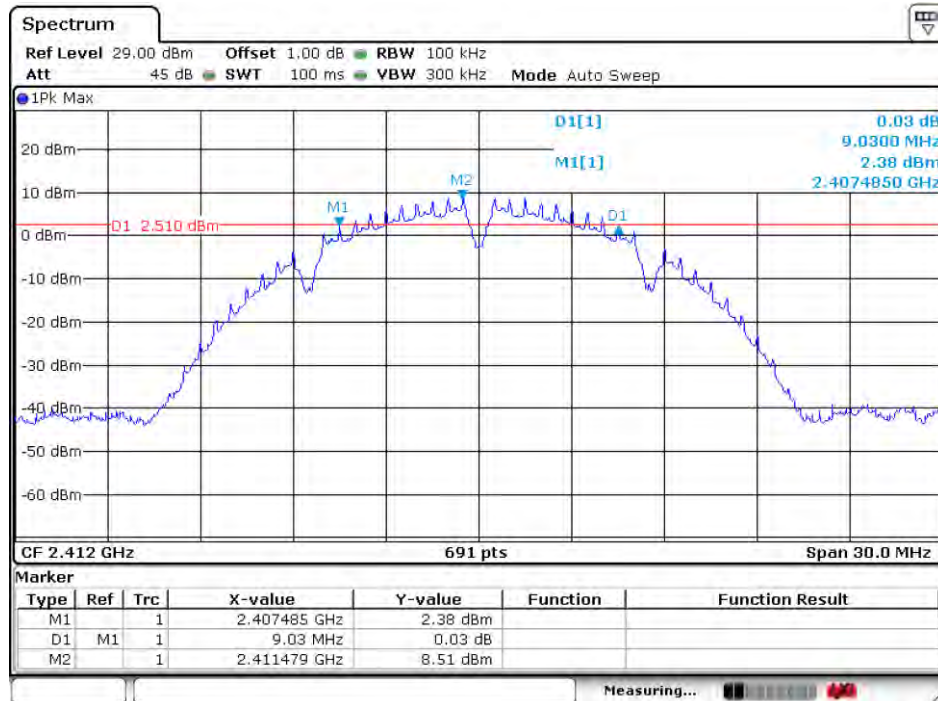
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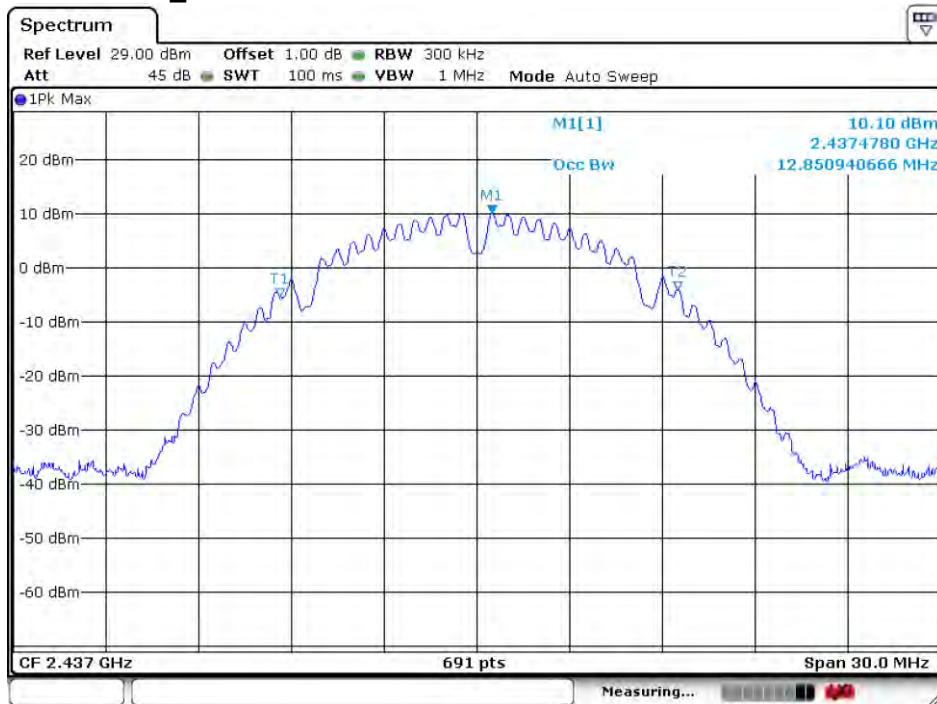
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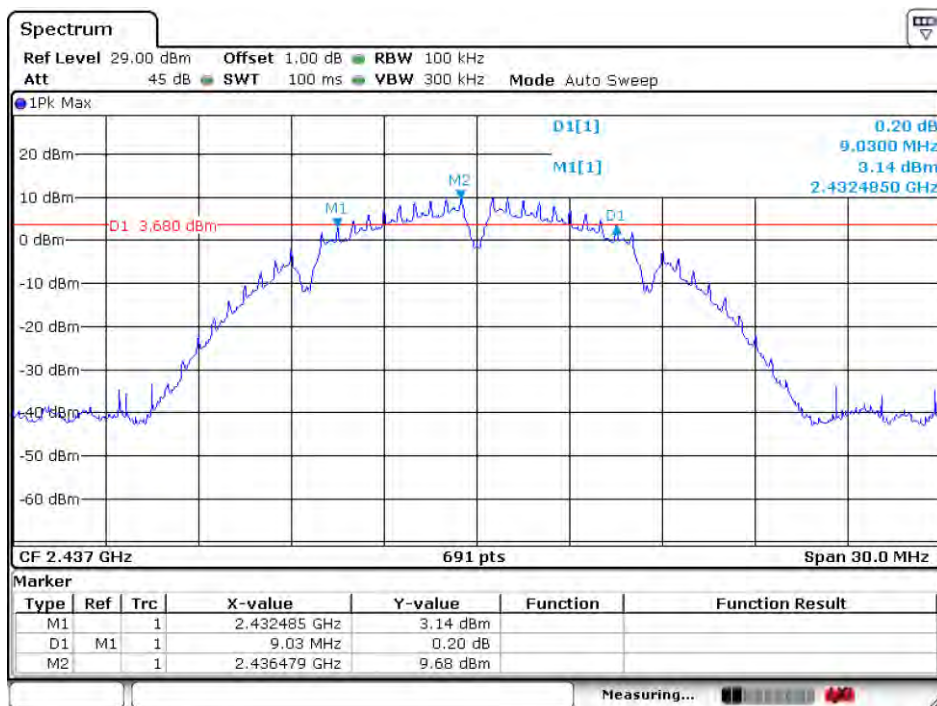
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4.5.2.2

802.11B_CH6



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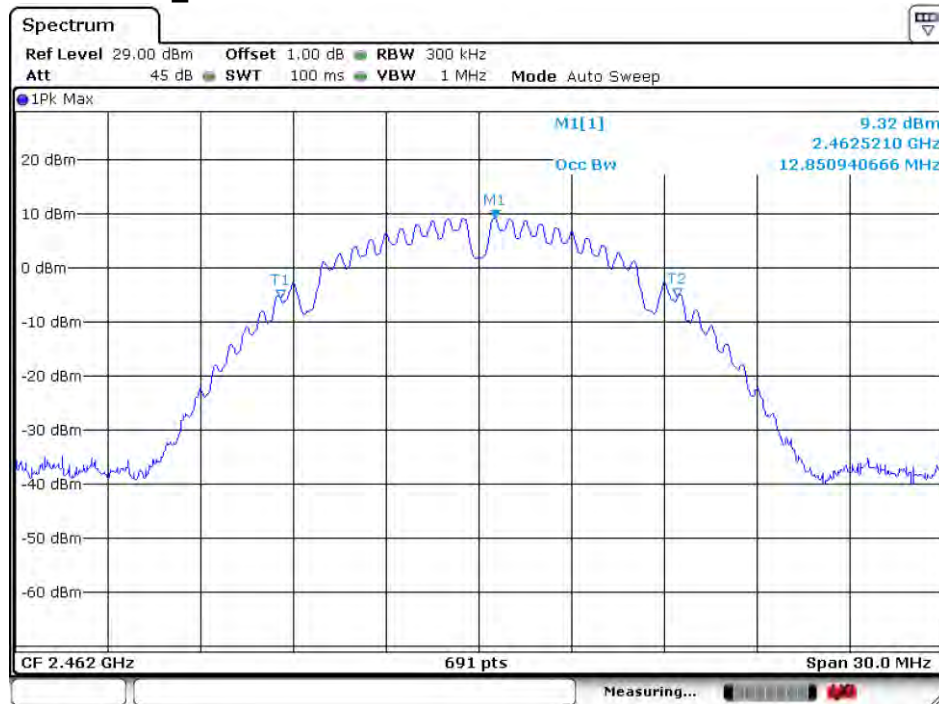


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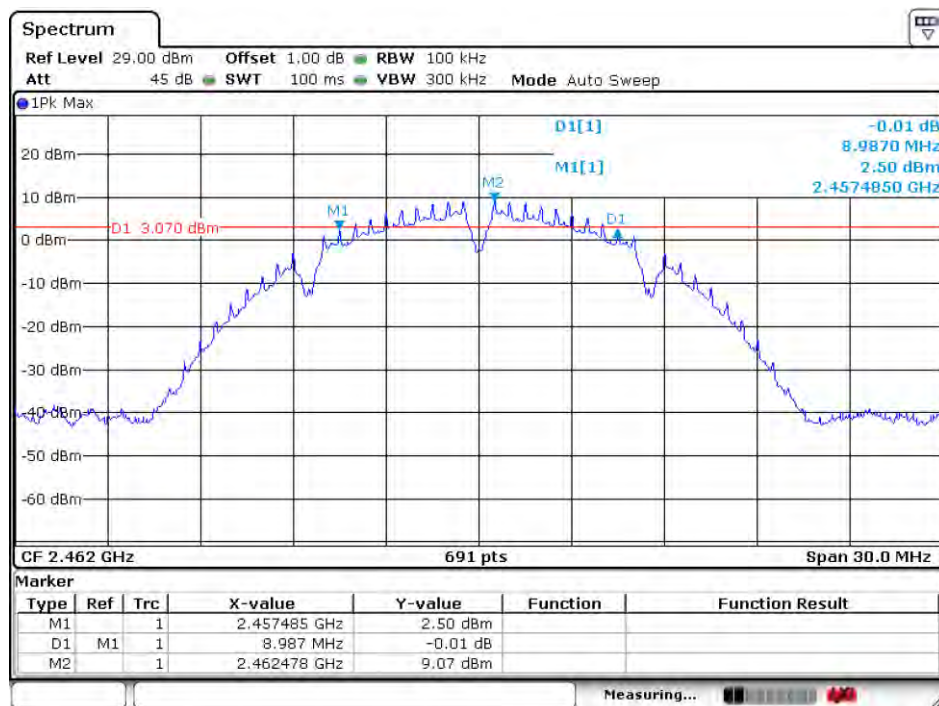


4.5.2.3

802.11B_CH11



Date: 7 JUL 2020 02:52:22



Date: 7 JUL 2020 03:02:41



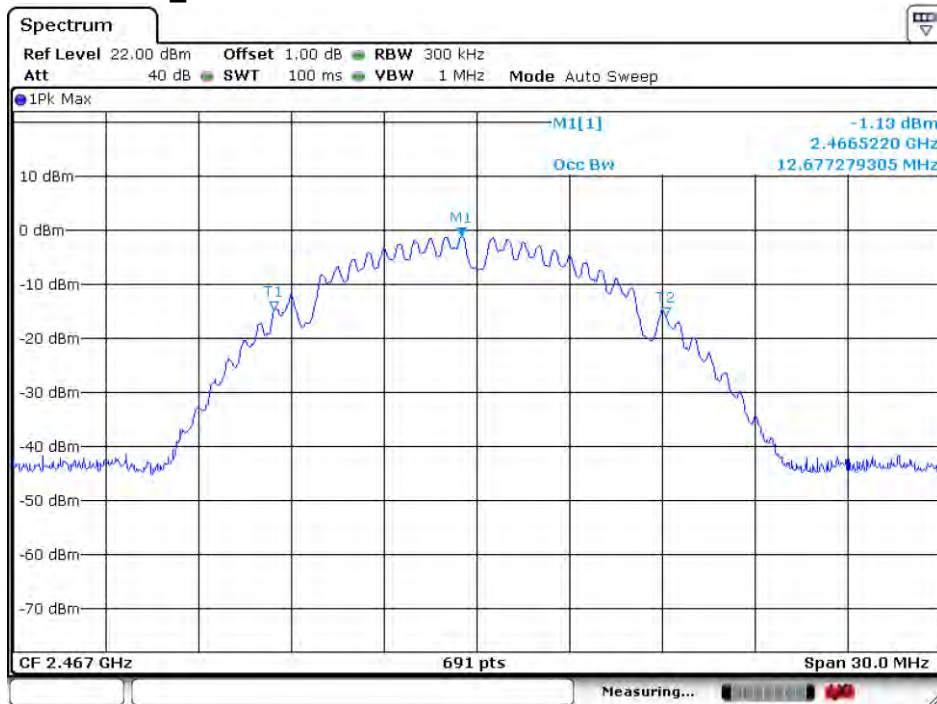
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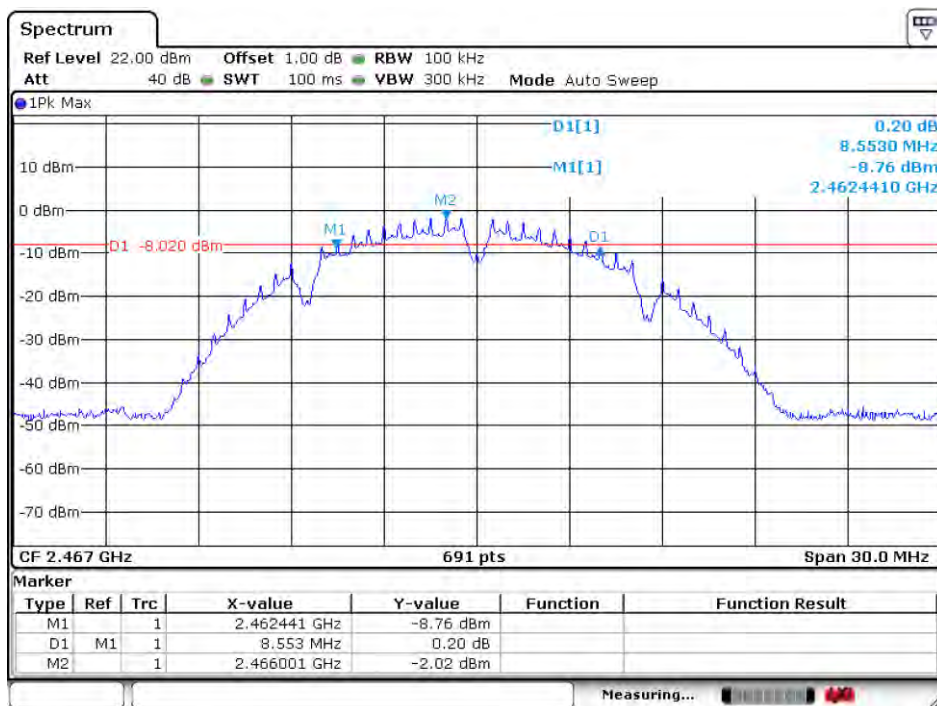
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4.5.2.4

802.11B_CH12



Date: 17.AUG.2020 15:53:48



Date: 17.AUG.2020 15:50:47



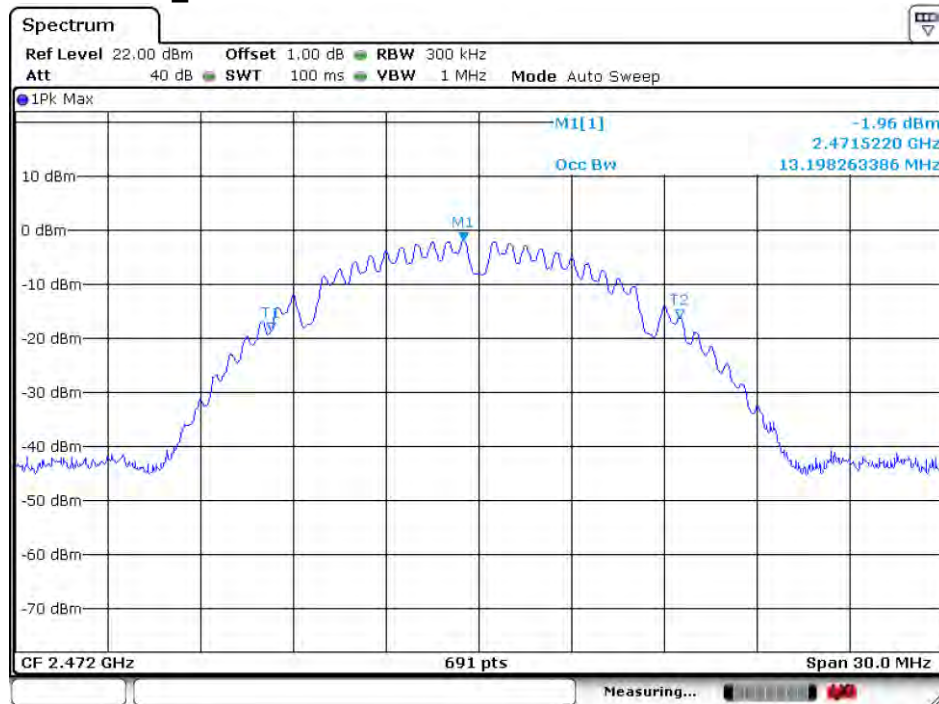
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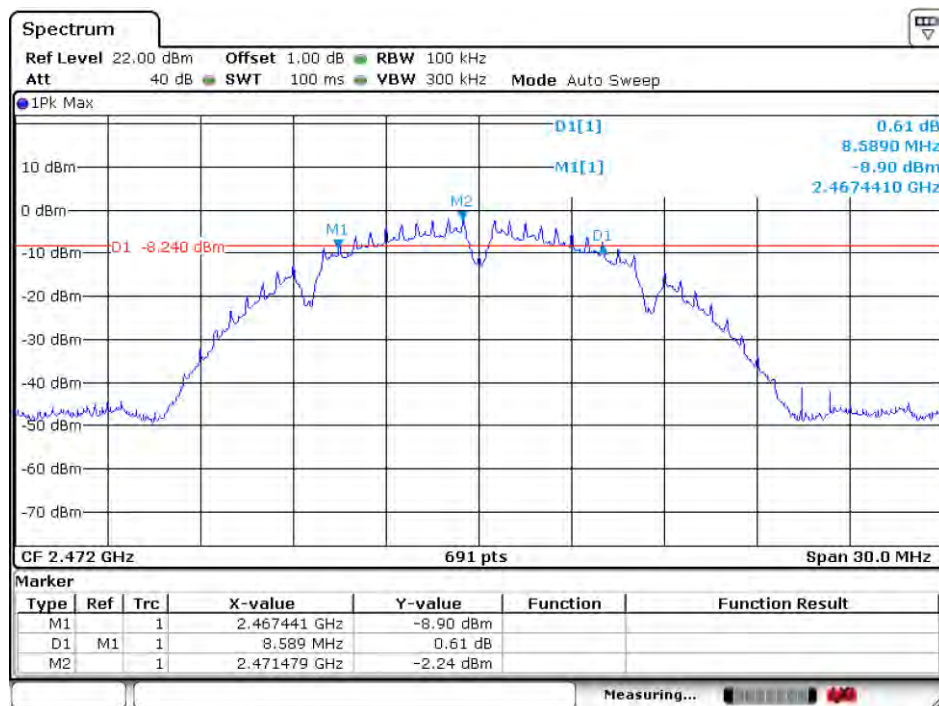
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4.5.2.5

802.11B_CH13



Date: 17.AUG.2020 15:54:02



Date: 17.AUG.2020 15:49:50



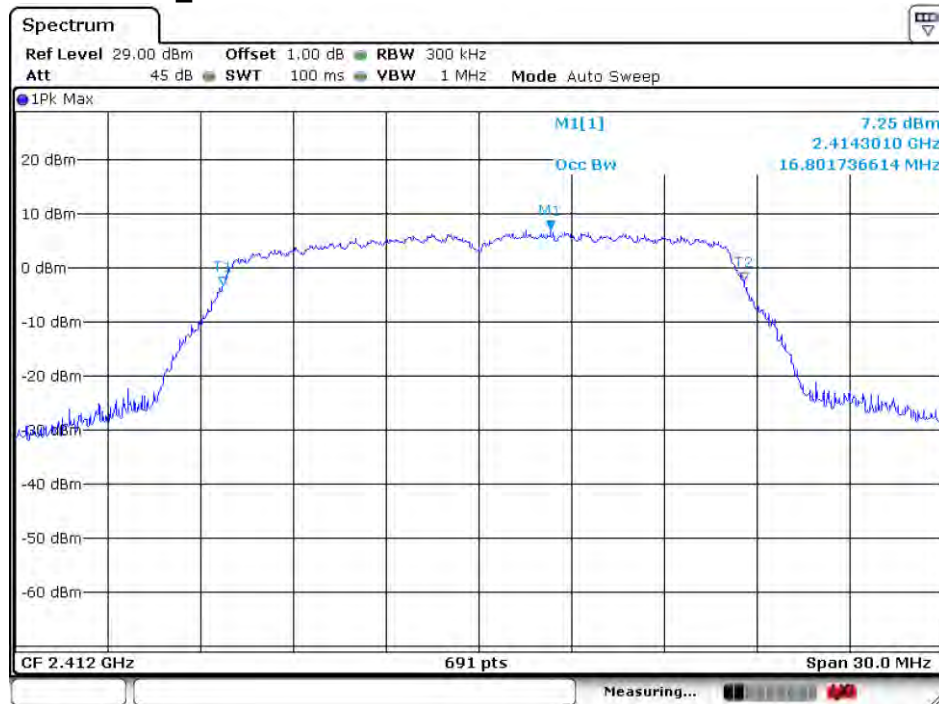
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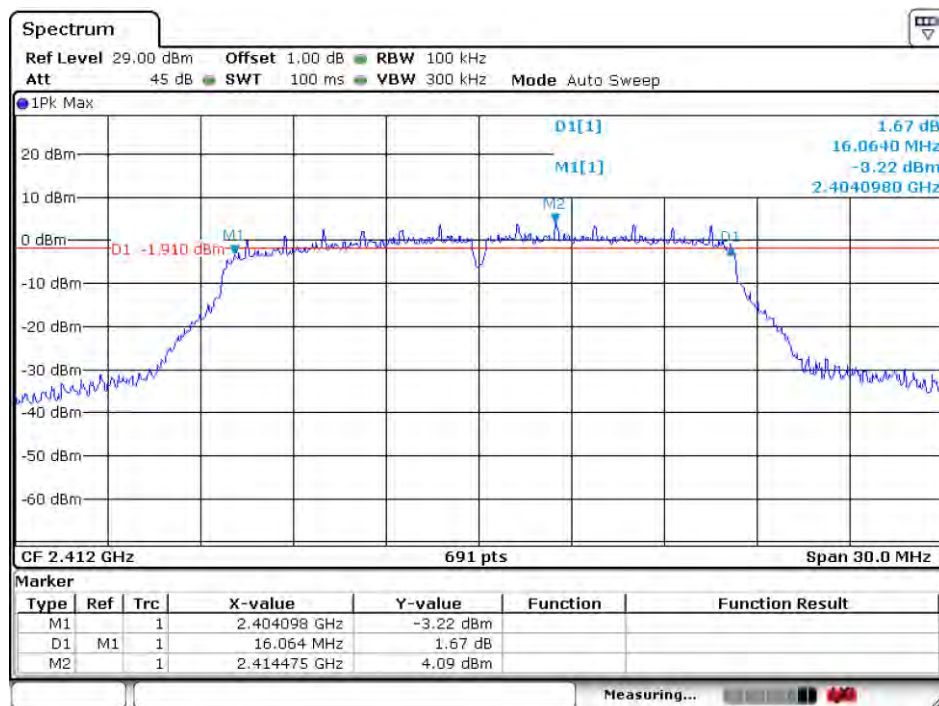
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4.5.2.6

802.11G_CH1



Date: 7 JUL 2020 02:51:32



Date: 7 JUL 2020 03:07:17



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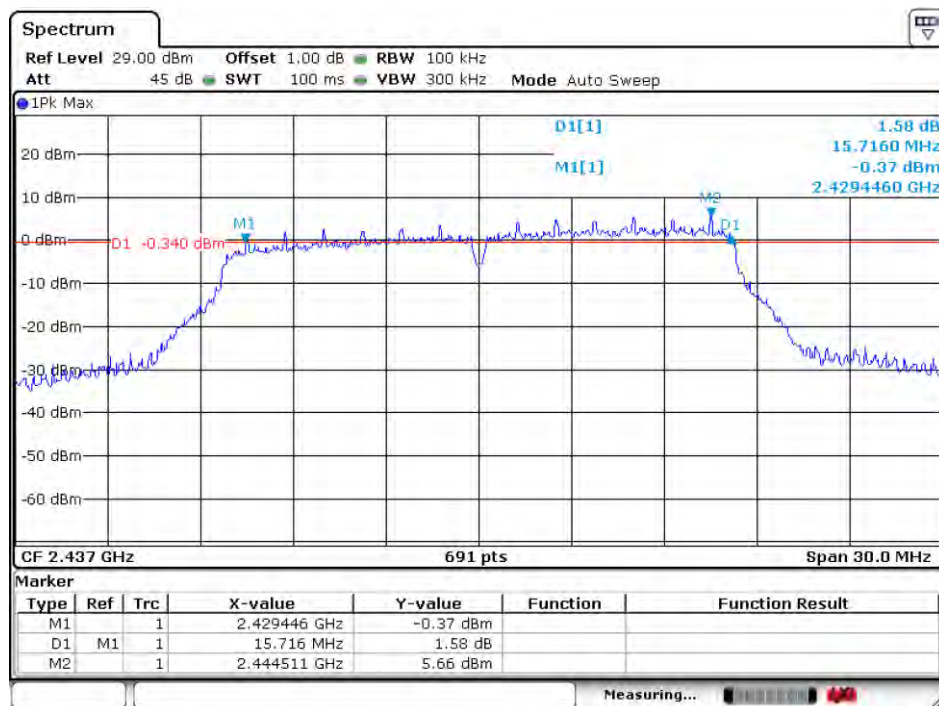
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4.5.2.7

802.11G_CH6



Date: 7 JUL 2020 02:51:53



Date: 7 JUL 2020 03:06:25



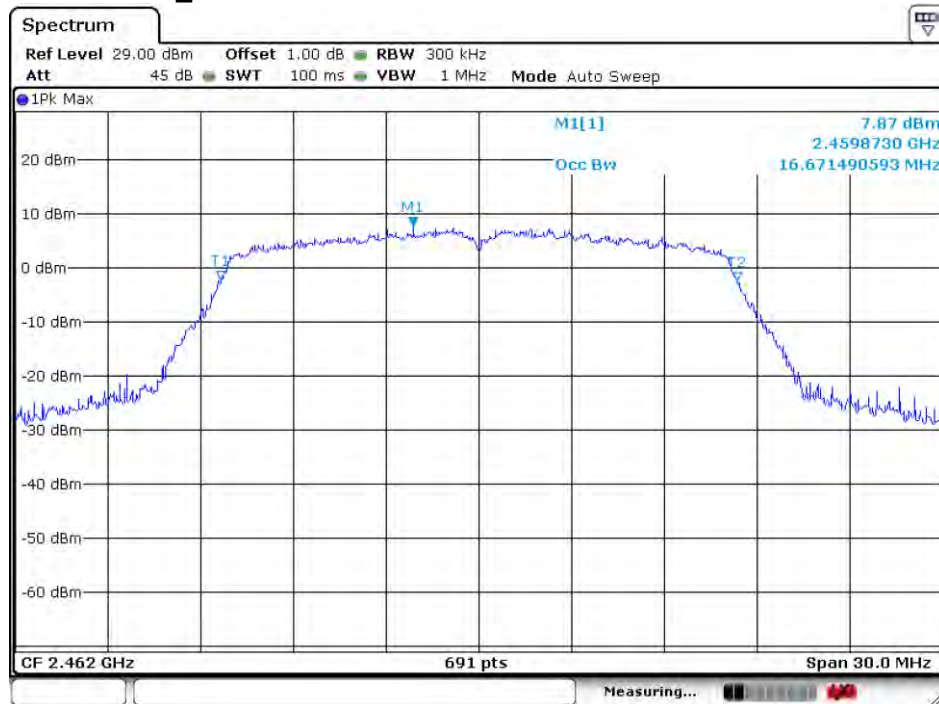
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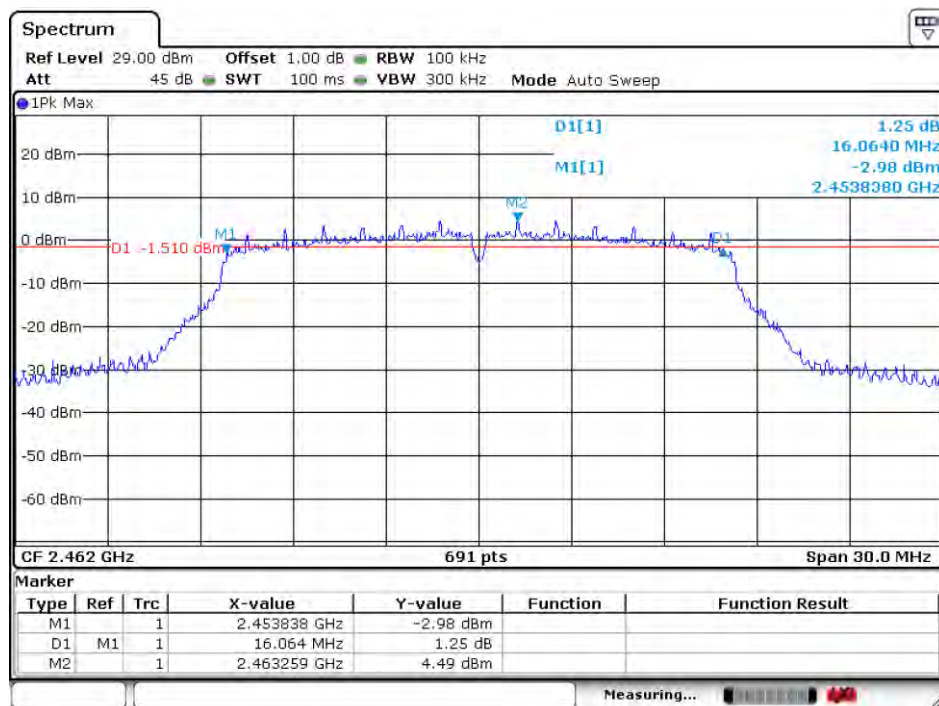
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4.5.2.8

802.11G_CH11



Date: 7 JUL 2020 02:52:09



Date: 7 JUL 2020 03:05:02



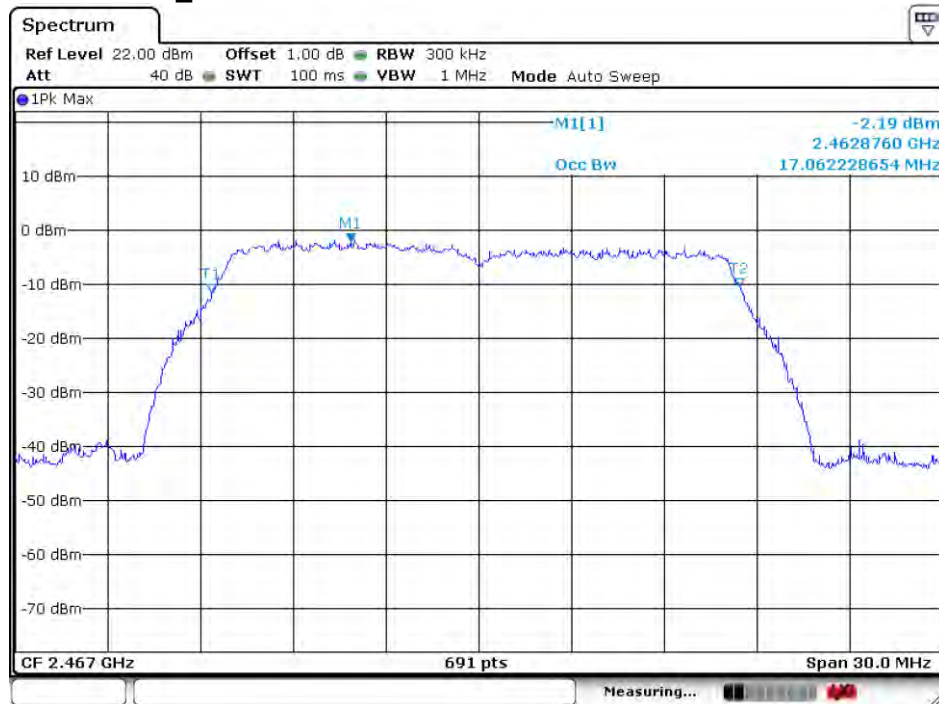
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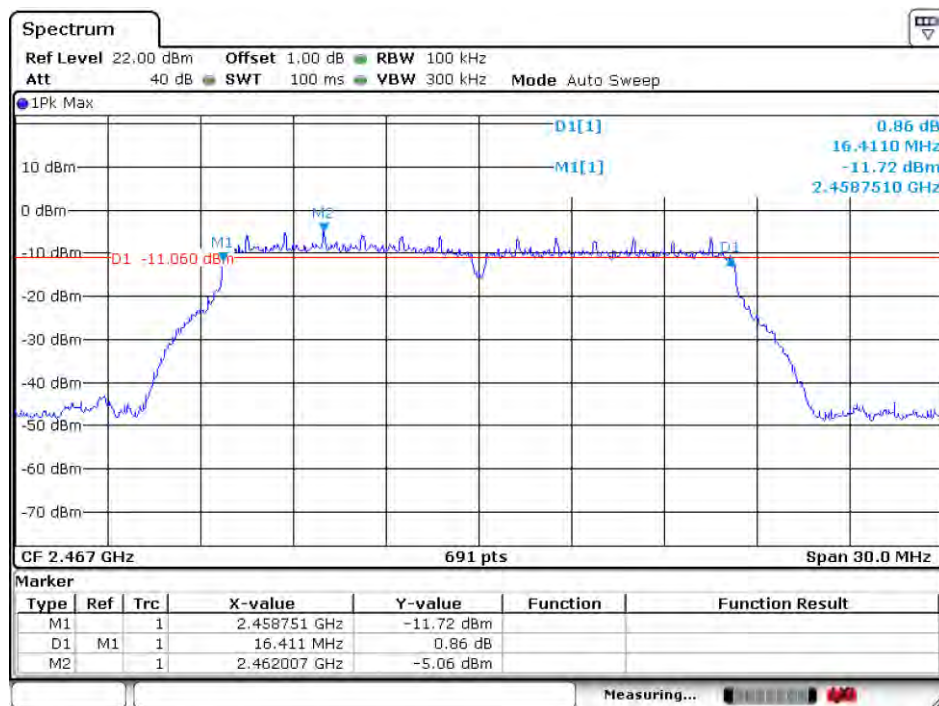
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4.5.2.9

802.11G_CH12



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Date: 17.AUG.2020 15:48:12



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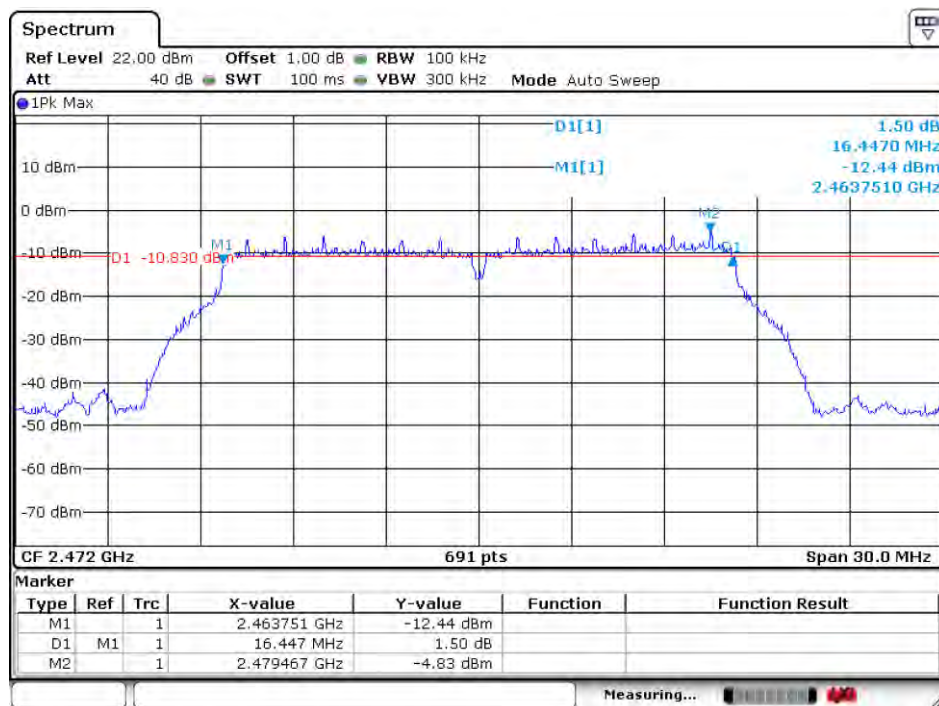
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4.5.2.10

802.11G_CH13



Date: 17.AUG.2020 15:54:15



Date: 17.AUG.2020 15:49:14



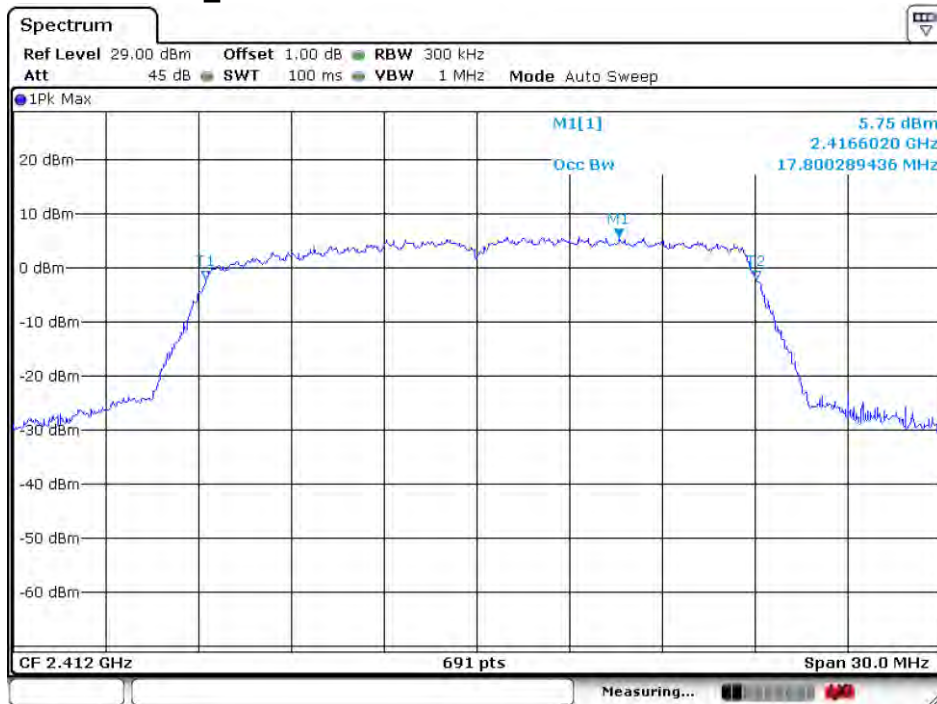
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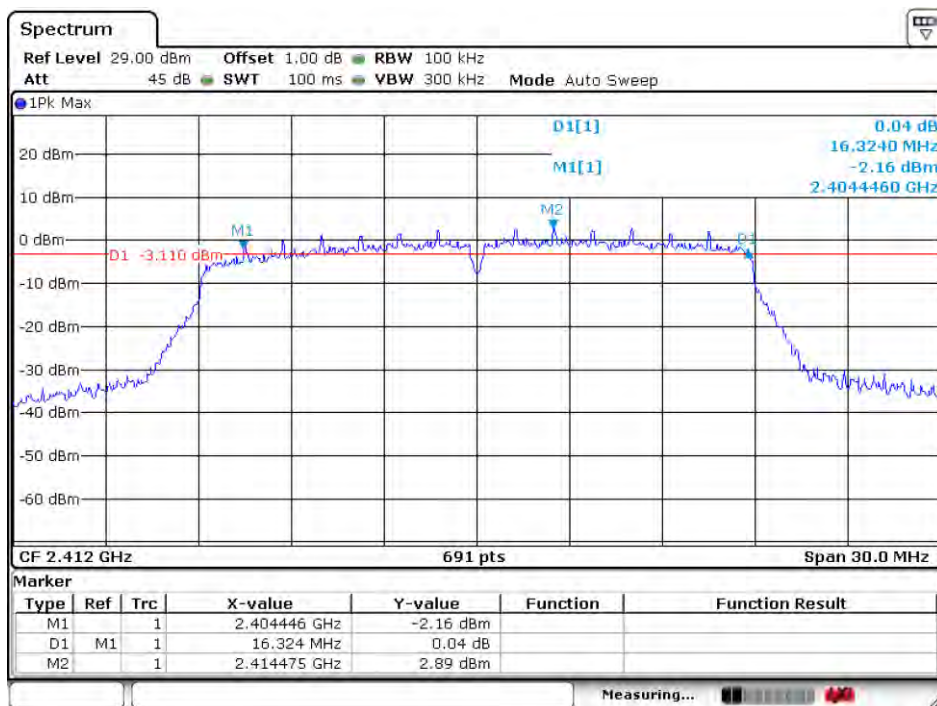
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4.5.2.11

802.11N20_CH1



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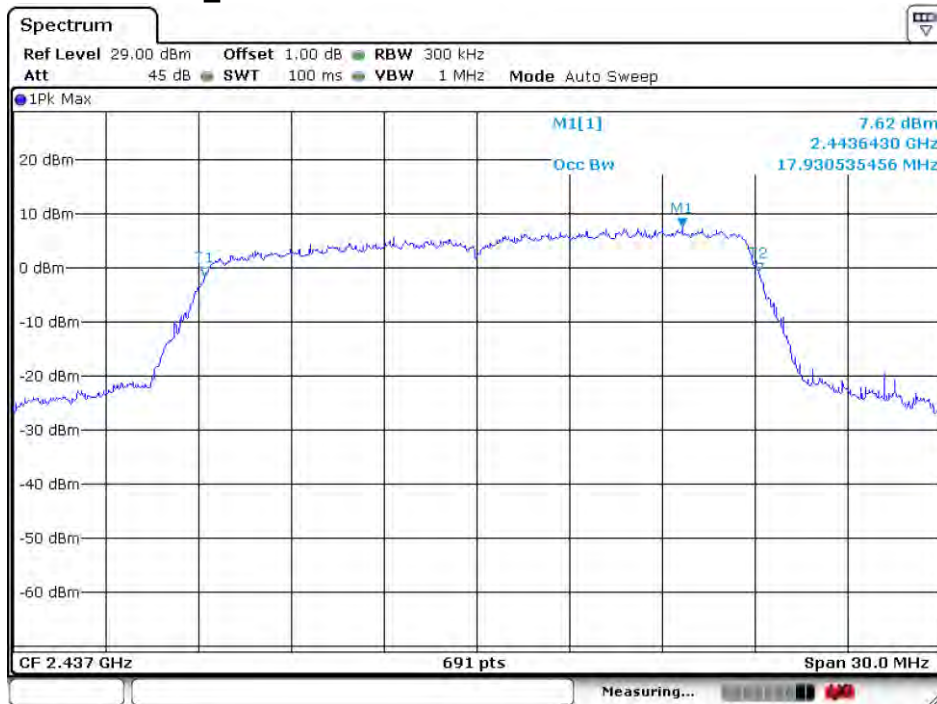


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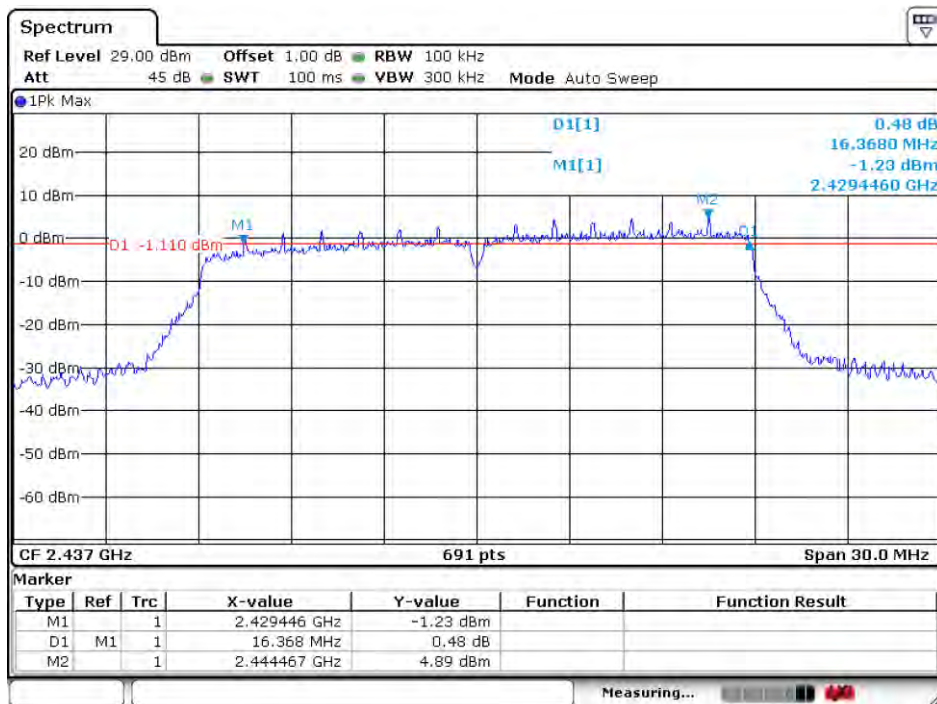


4.5.2.12

802.11N20_CH6



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Date: 7 JUL 2020 02:57:04



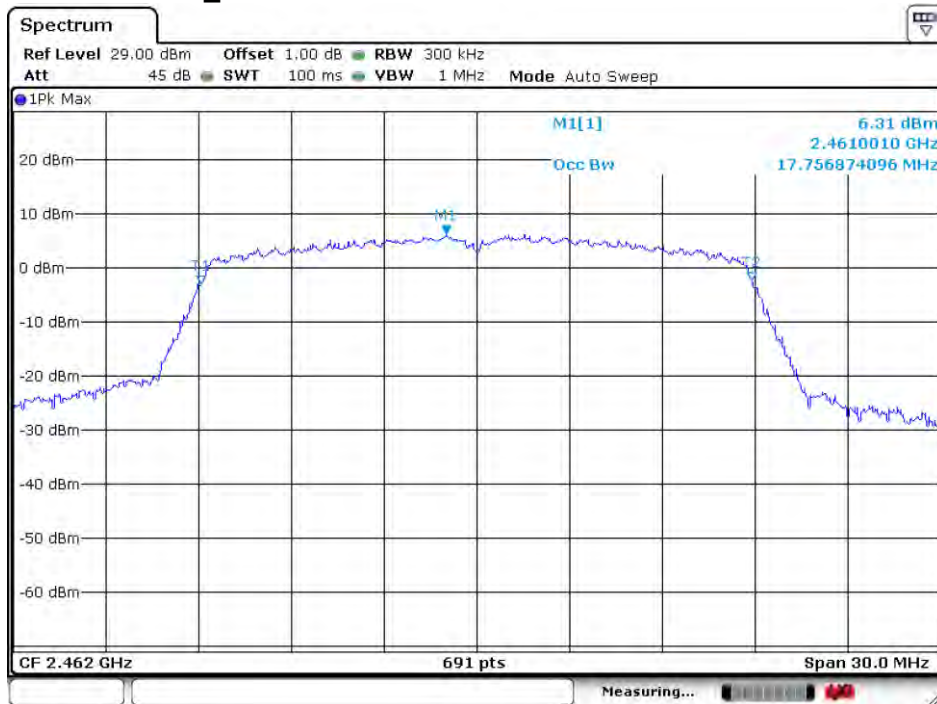
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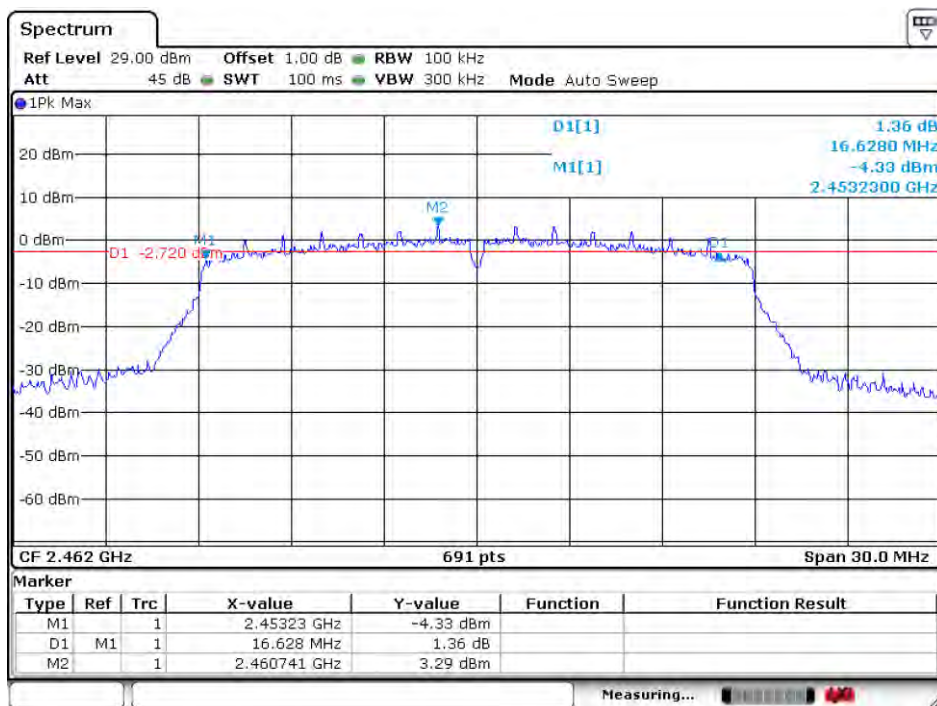
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4.5.2.13

802.11N20_CH11



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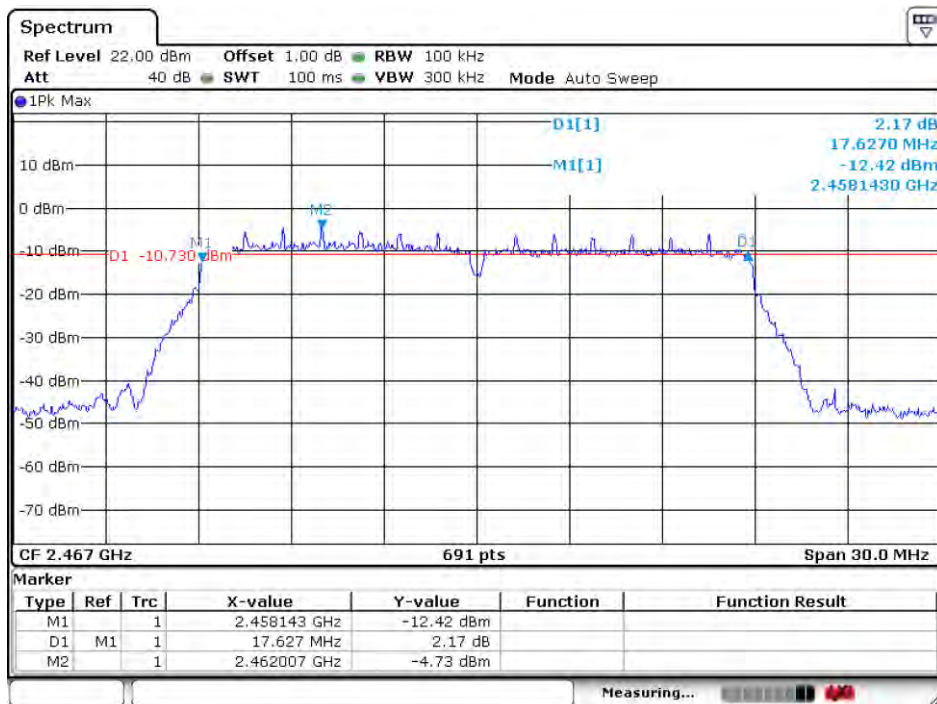


4.5.2.14

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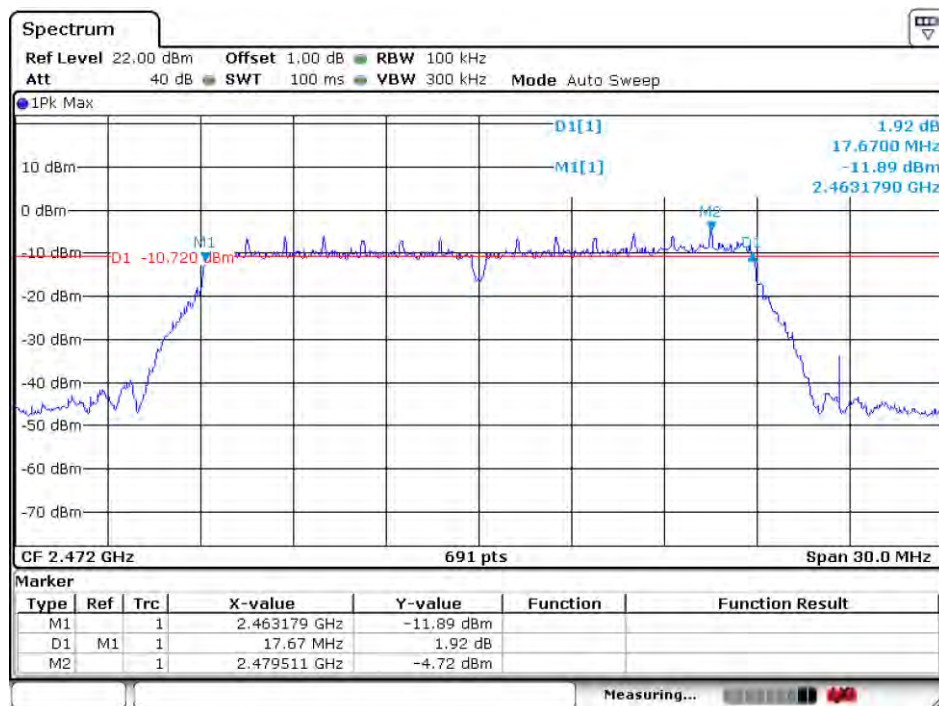
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4.5.2.15

802.11N20_CH13



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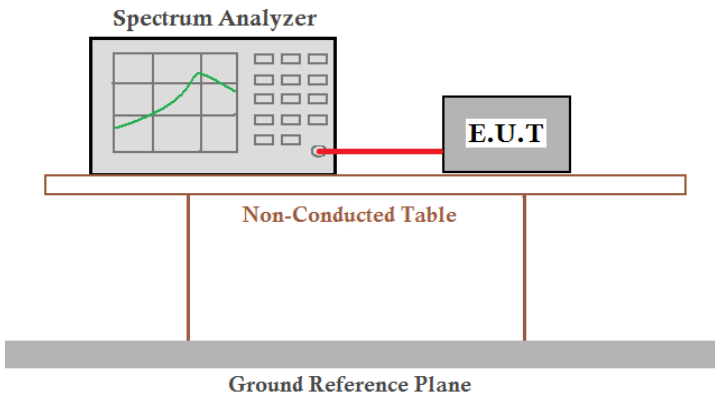


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4.6 Power Spectral Density

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	-4.43	≤8.00	Pass
	CH6	-3.18	≤8.00	Pass
	CH11	-3.80	≤8.00	Pass
	CH12	-14.49	≤8.00	Pass
	CH13	-14.75	≤8.00	Pass
802.11G	CH1	-8.36	≤8.00	Pass
	CH6	-7.50	≤8.00	Pass
	CH11	-7.59	≤8.00	Pass
	CH12	-17.51	≤8.00	Pass
	CH13	-17.28	≤8.00	Pass
802.11N20	CH1	-8.78	≤8.00	Pass
	CH6	-8.31	≤8.00	Pass
	CH11	-8.59	≤8.00	Pass
	CH12	-18.09	≤8.00	Pass
	CH13	-16.94	≤8.00	Pass



4.6.2 Test plots

4.6.2.1 802.11B_CH1



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4.6.2.2

802.11B_CH6



Date: 7 JUL 2020 02:49:37

4.6.2.3

802.11B_CH11



Date: 7 JUL 2020 02:49:54



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4.6.2.4

802.11B_CH12



Date: 17.AUG.2020 15:46:14

4.6.2.5

802.11B_CH13



Date: 17.AUG.2020 15:46:34



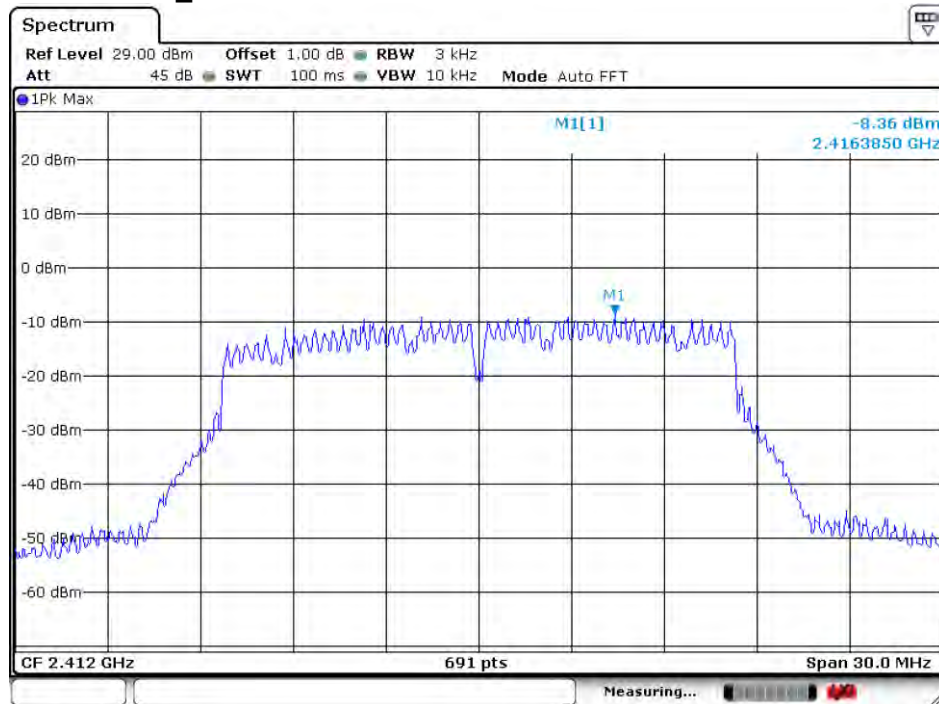
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4.6.2.6

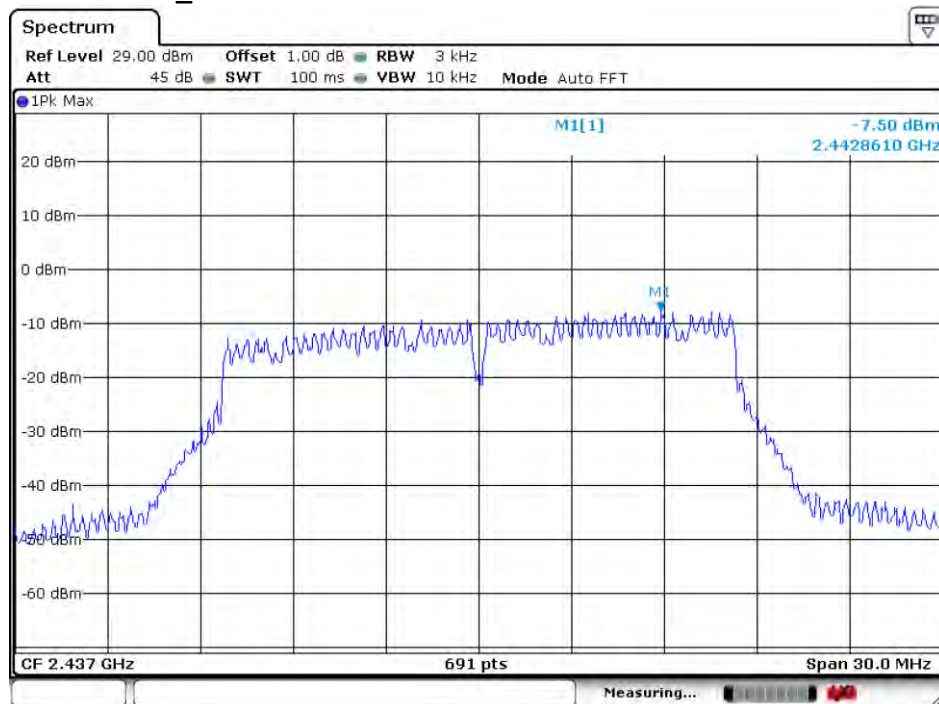
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Date: 7 JUL 2020 02:50:57

4.6.2.7

802.11G_CH6

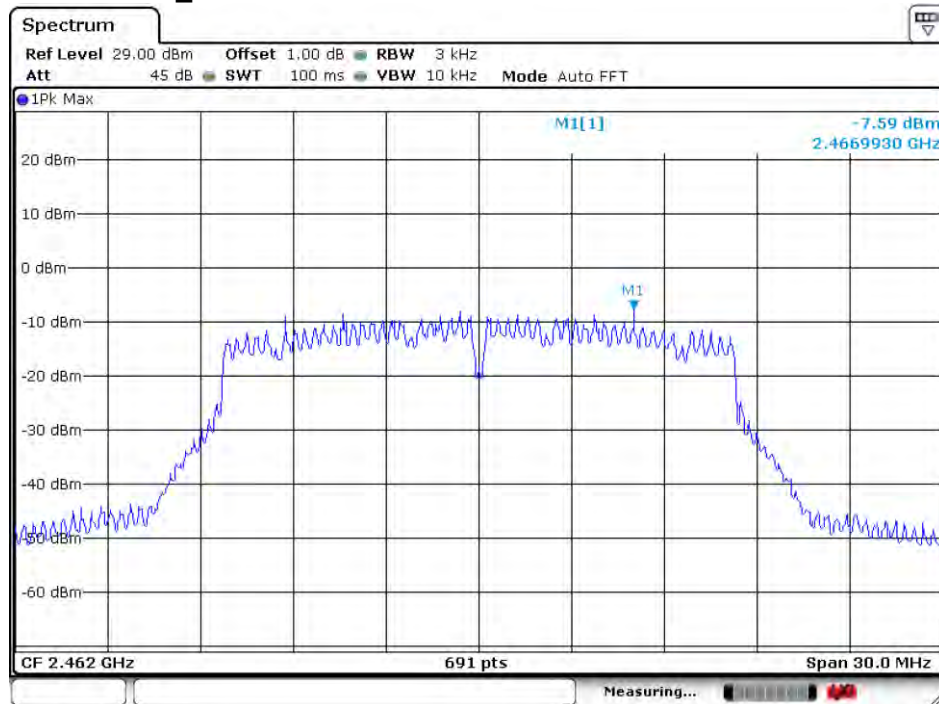


Date: 7 JUL 2020 02:50:40



4.6.2.8

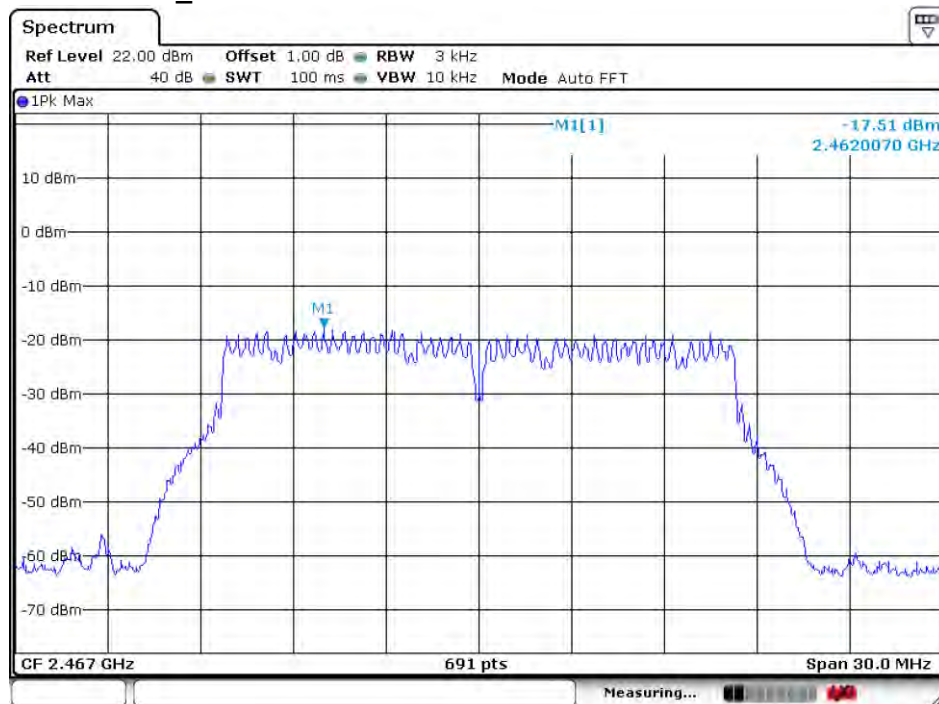
802.11G_CH11



Date: 7.JUL.2020 02:50:23

4.6.2.9

802.11G_CH12



Date: 17.AUG.2020 15:47:31



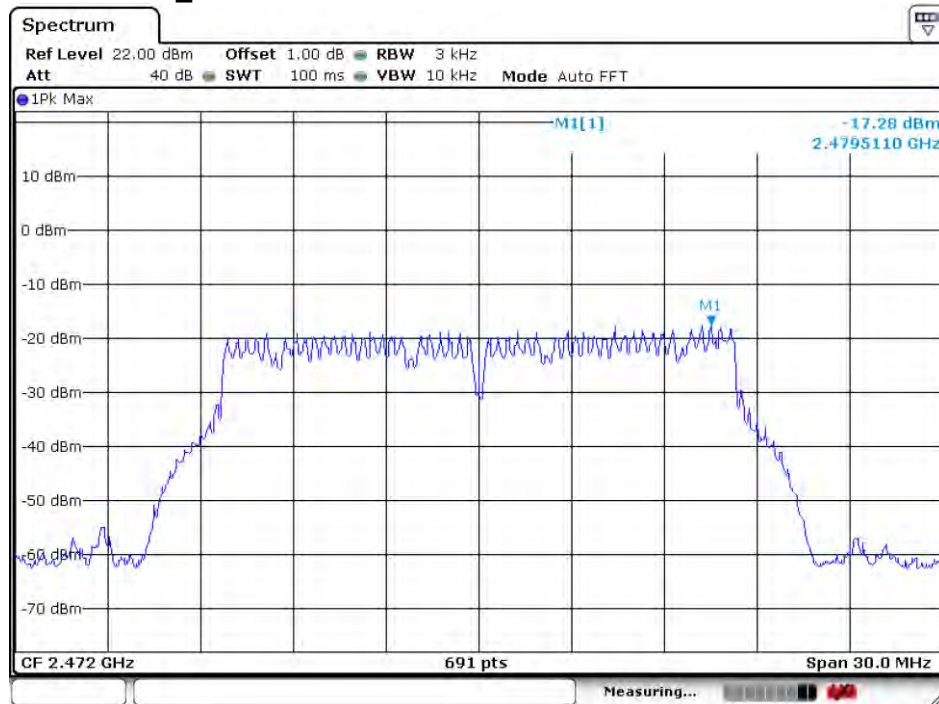
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4.6.2.10

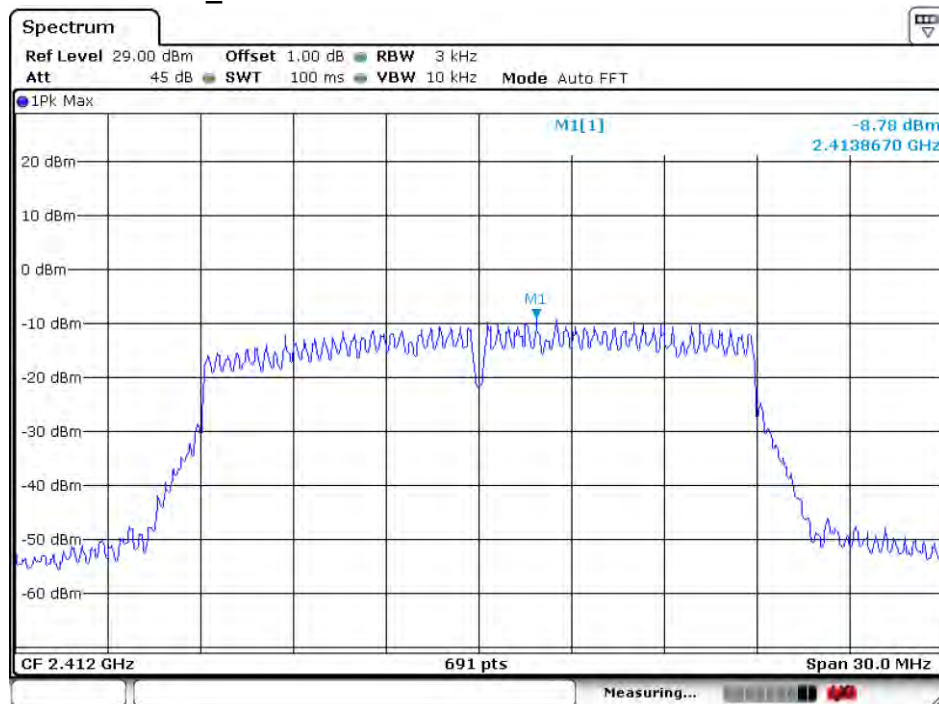
802.11G_CH13



Date: 17.AUG.2020 15:47:15

4.6.2.11

802.11N20_CH1



Date: 7.JUL.2020 02:48:58



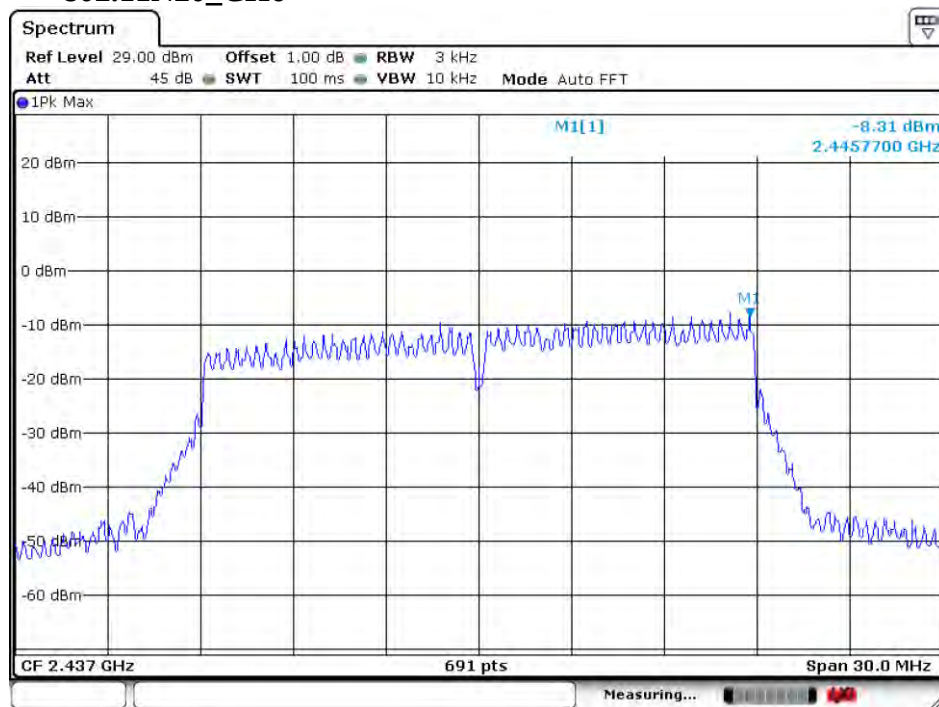
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4.6.2.12

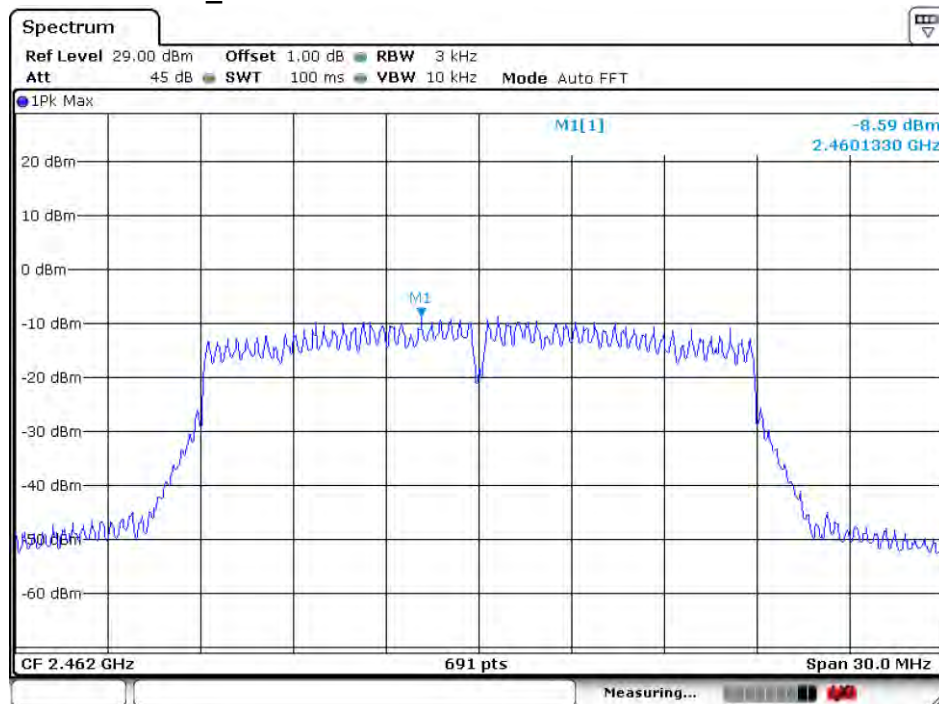
802.11N20_CH6



Date: 7 JUL 2020 02:48:39

4.6.2.13

802.11N20_CH11



Date: 7 JUL 2020 02:48:18



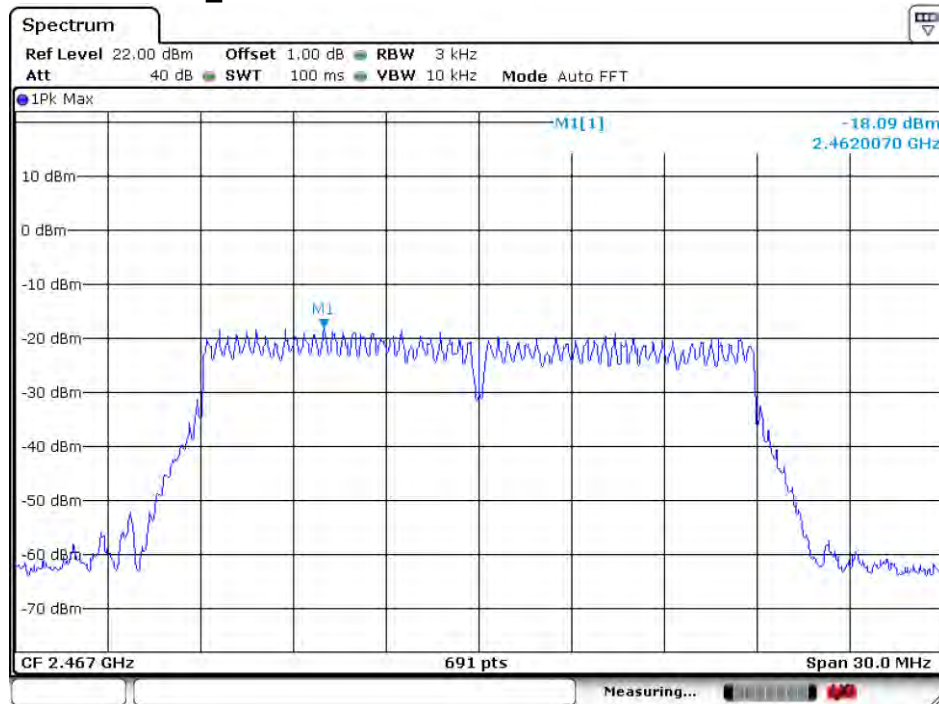
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4.6.2.14

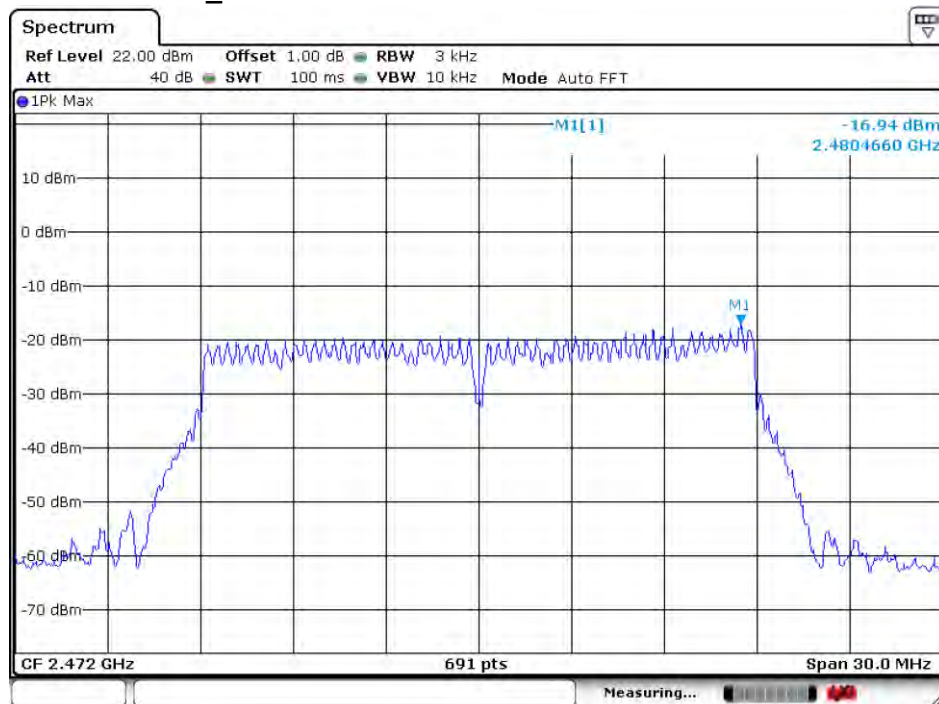
802.11N20_CH12



Date: 17.AUG.2020 15:43:34

4.6.2.15

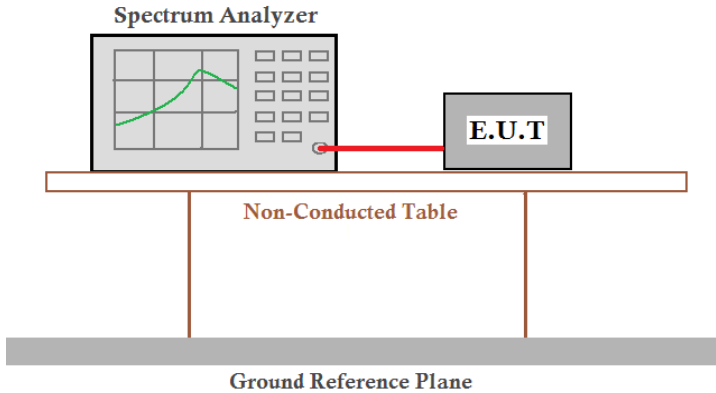
802.11N20_CH13



Date: 17.AUG.2020 15:42:18

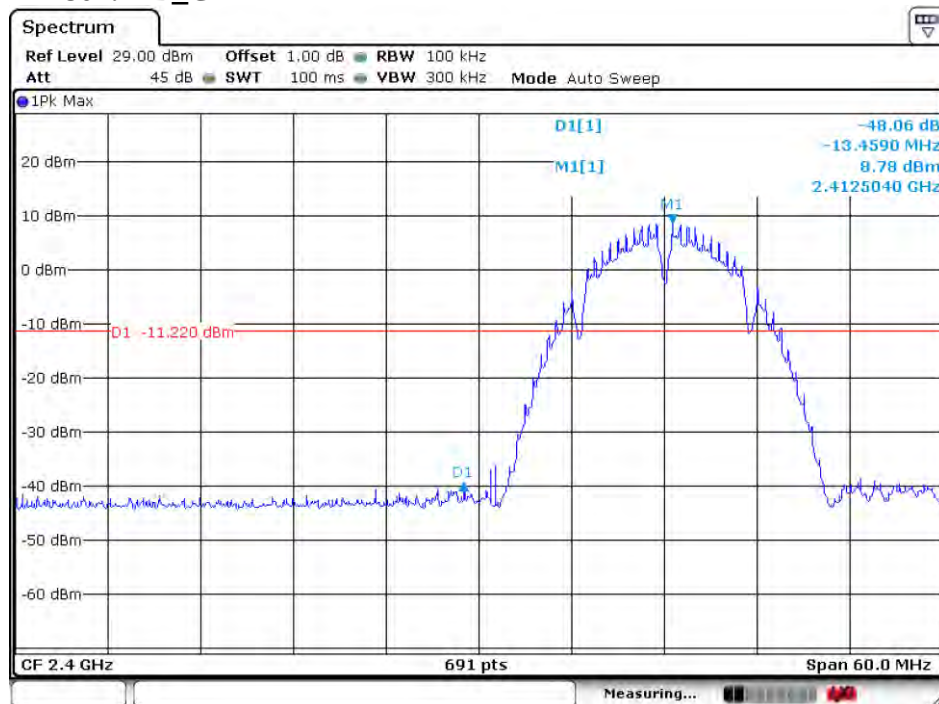


4.7 Band-edge for RF Conducted Emissions

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

4.7.1 Test plots

4.7.1.1 802.11B_CH1



Date: 7 JUL 2020 03:11:23



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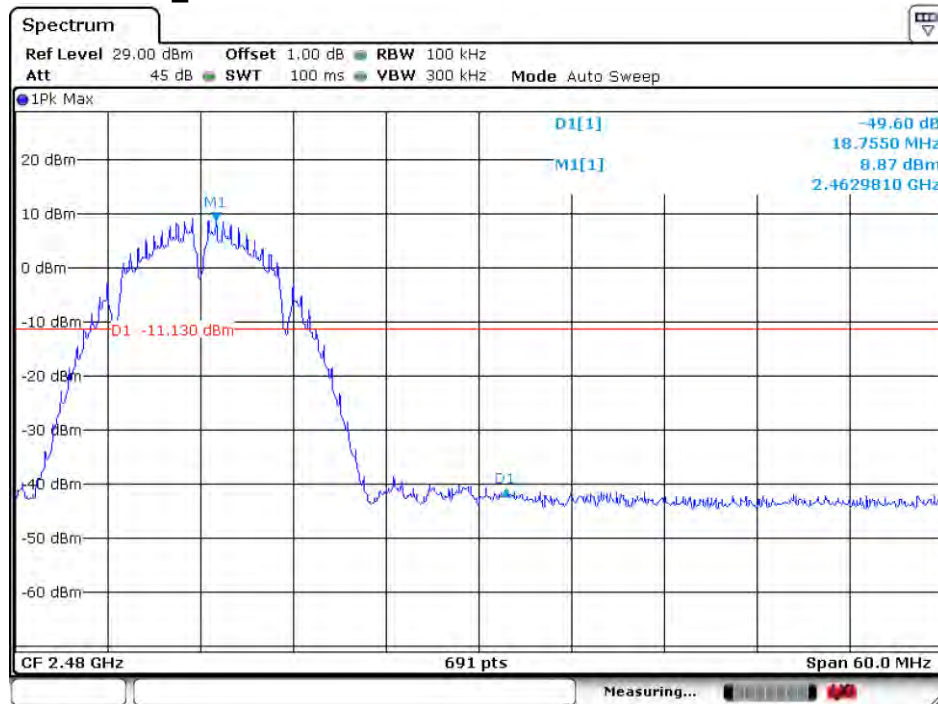
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4.7.1.2

802.11B_CH11



Date: 7.JUL.2020 03:10:39

4.7.1.3

802.11B_CH12

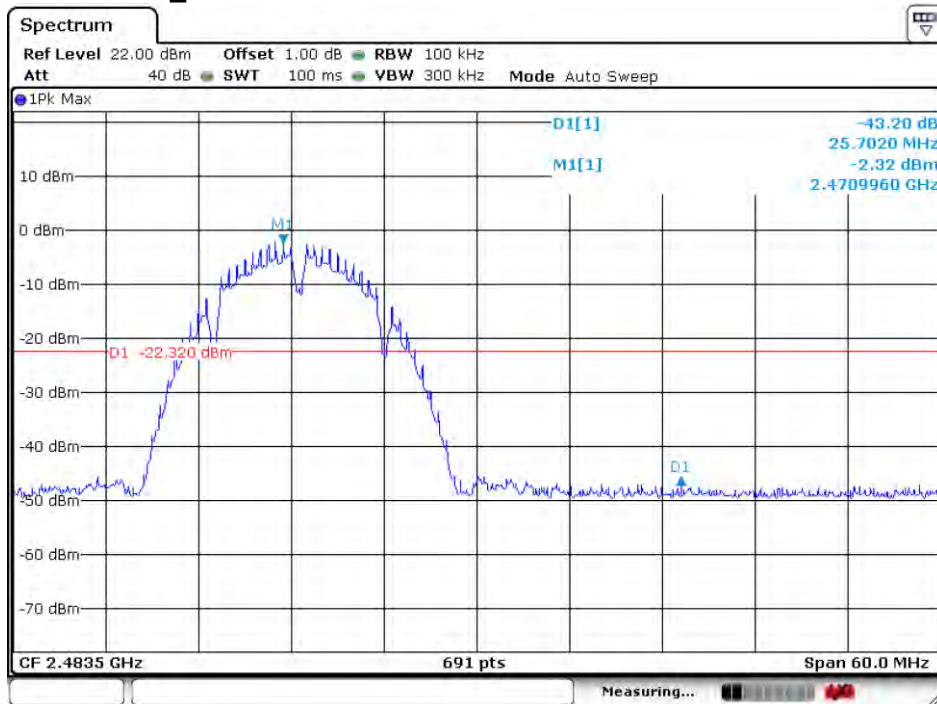


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4.7.1.4

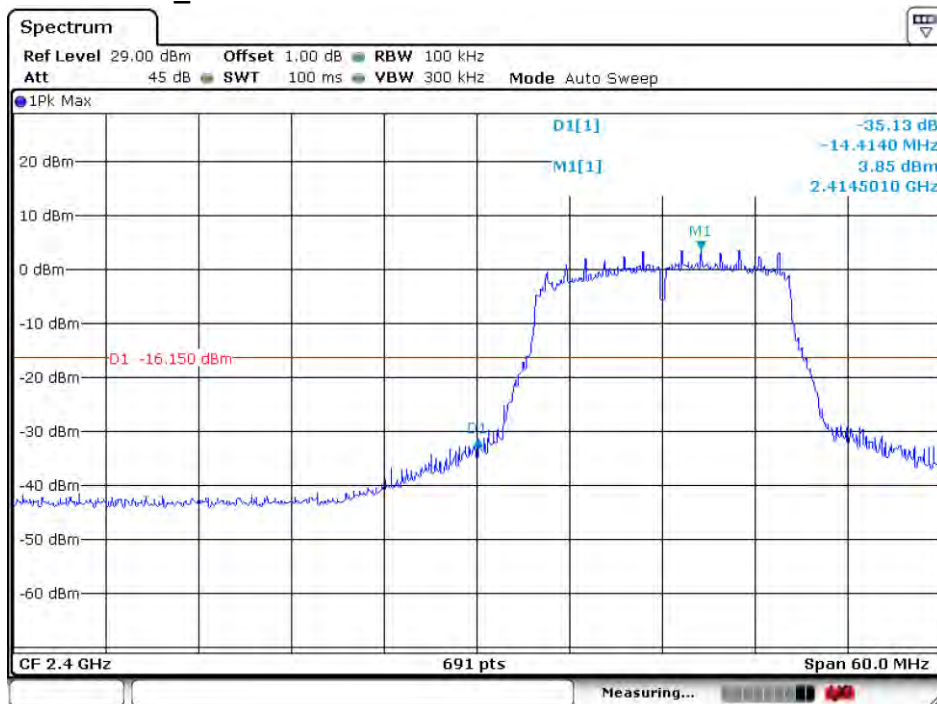
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4.7.1.5

802.11G_CH1

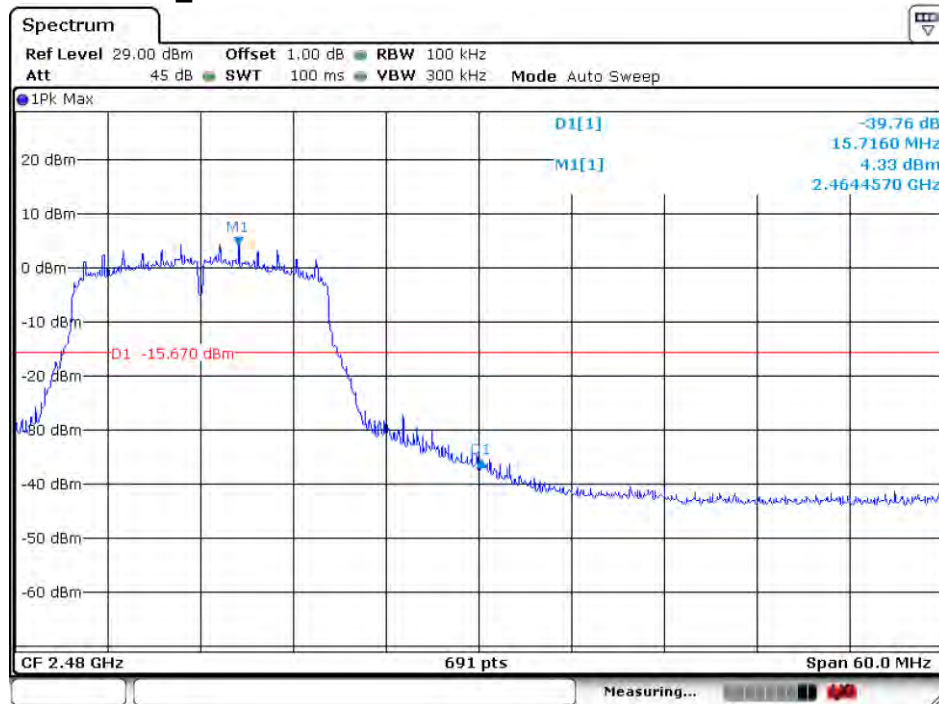


Date: 7.JUL.2020 03:08:42



4.7.1.6

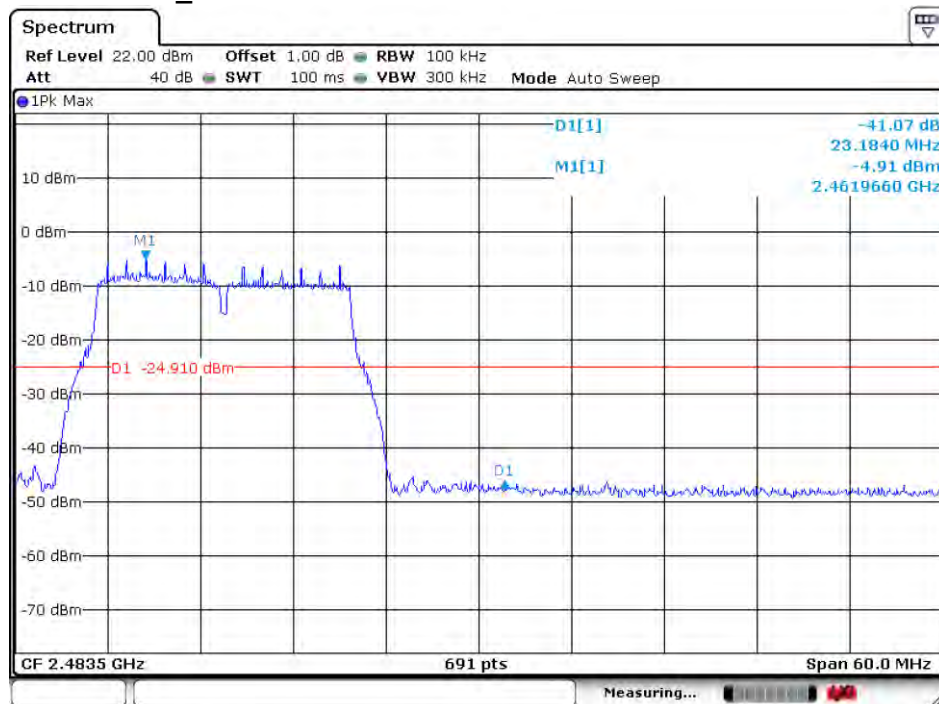
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Date: 7.JUL.2020 03:10:07

4.7.1.7

802.11G_CH12



Date: 17.AUG.2020 15:55:42

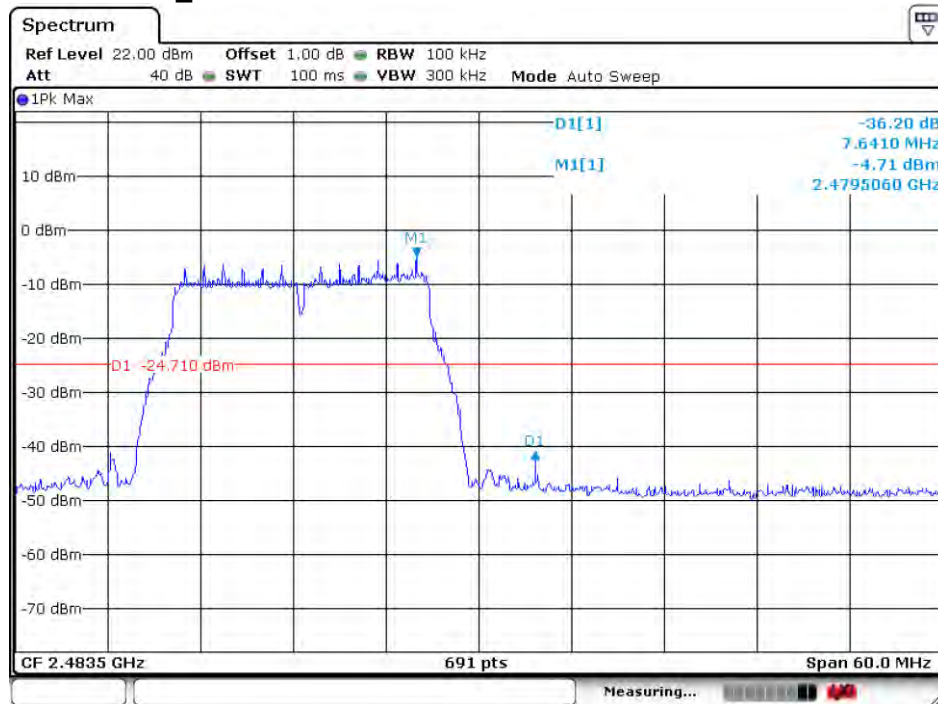


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4.7.1.8

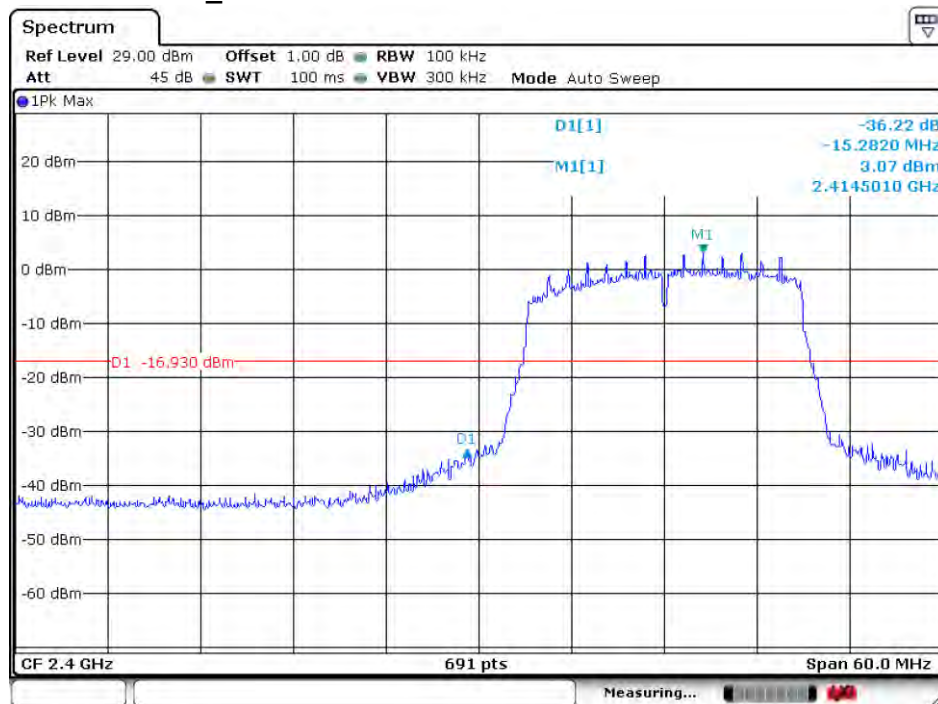
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4.7.1.9

802.11N20_CH1



Date: 7.JUL.2020 03:12:09



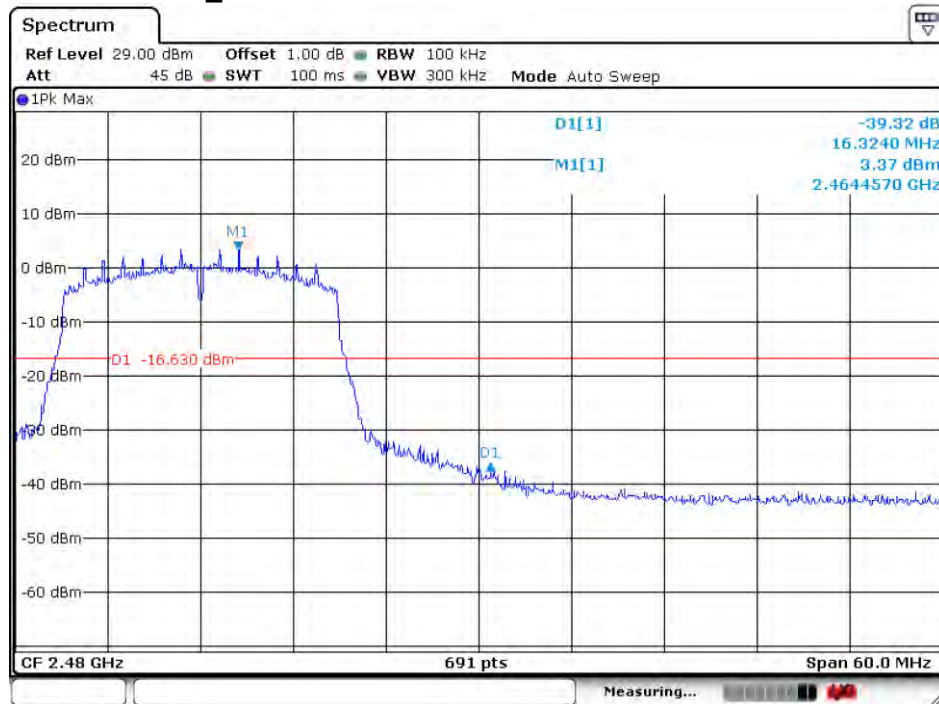
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4.7.1.10

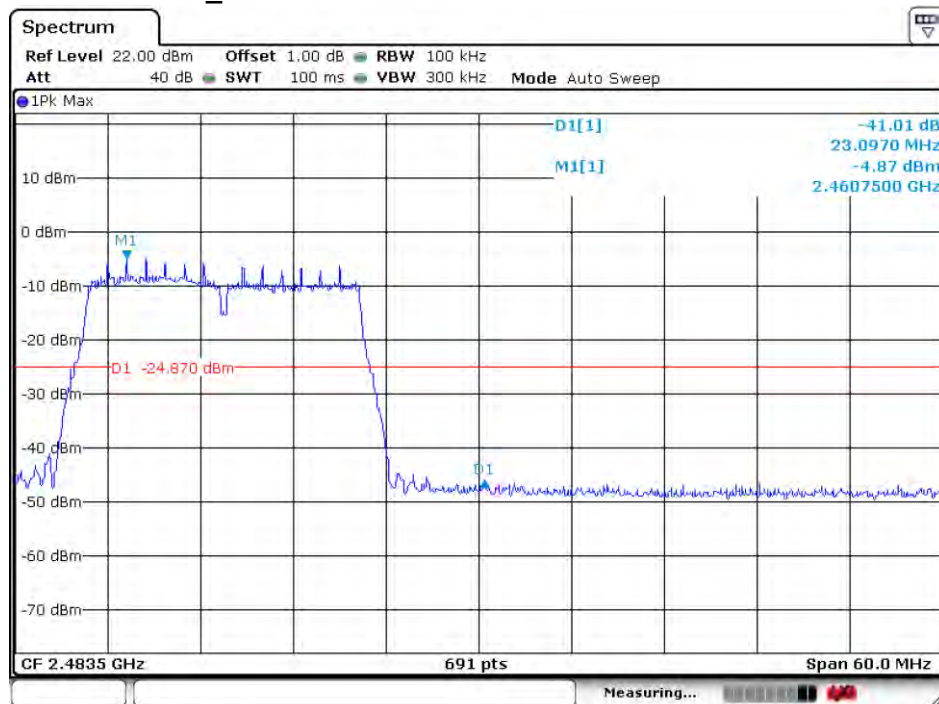
802.11N20_CH11



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4.7.1.11

802.11N20_CH12



Date: 17.AUG.2020 15:59:47

4.7.1.12

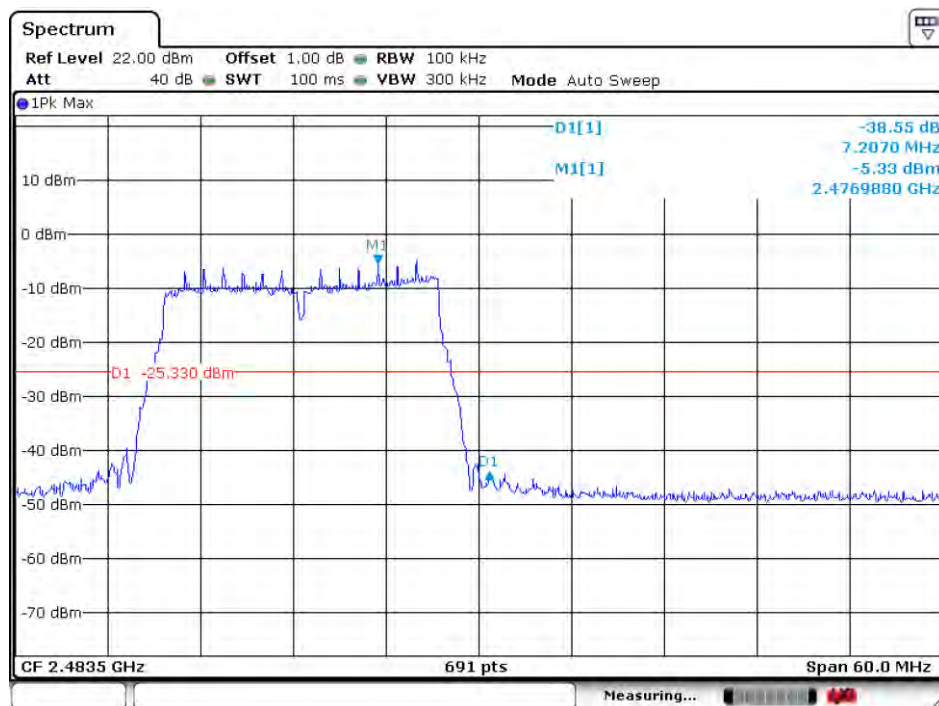
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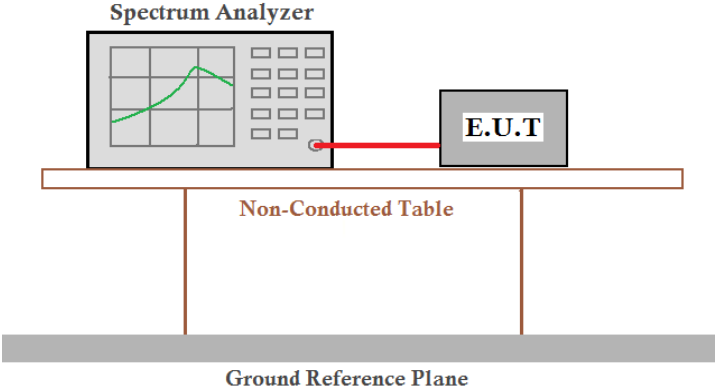
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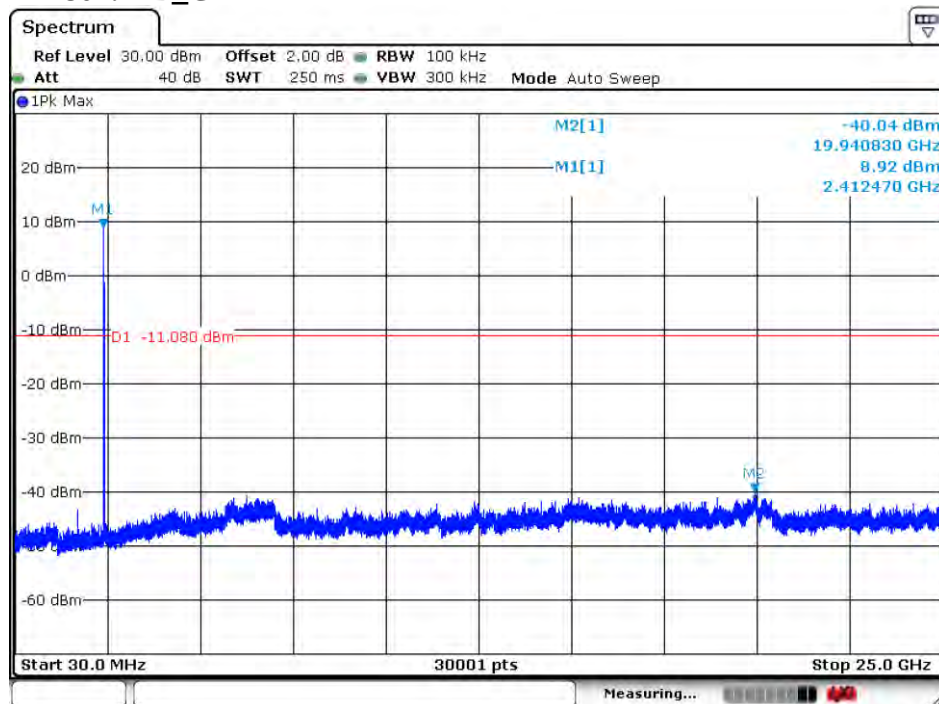
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4.8 RF Conducted Spurious Emissions

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

4.8.1 Test plots

4.8.1.1 802.11B_CH1



Date: 7 JUL 2020 03:17:41

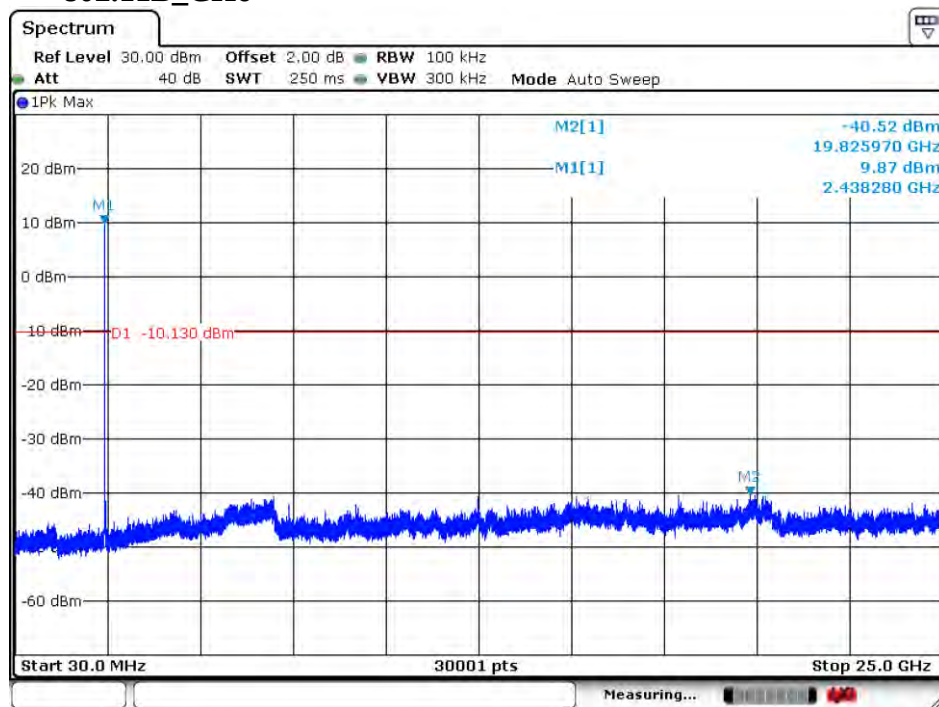


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4.8.1.2

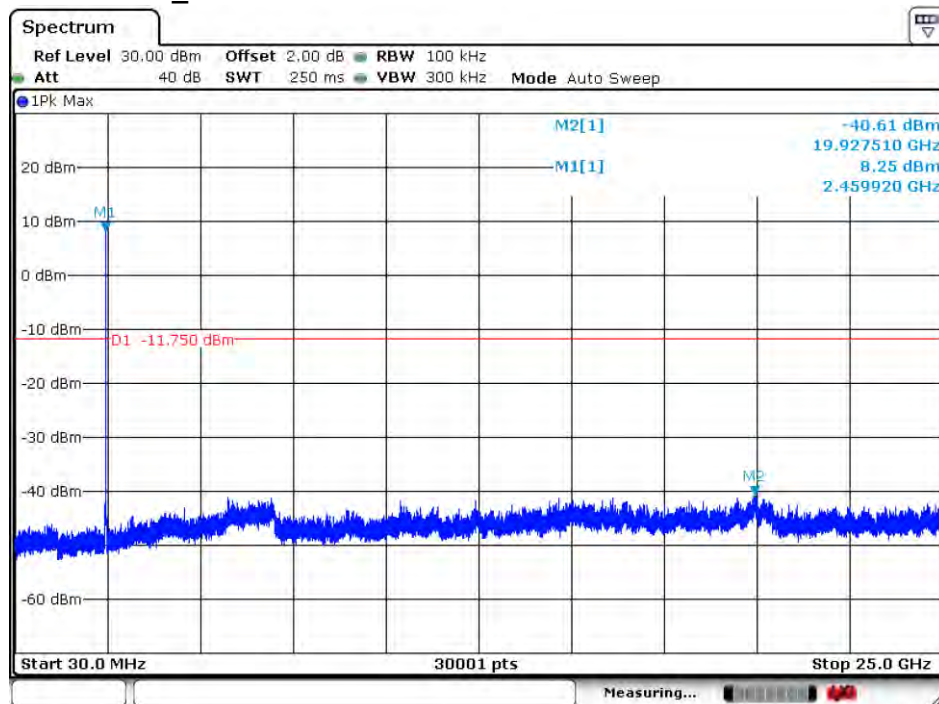
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4.8.1.3

802.11B_CH11



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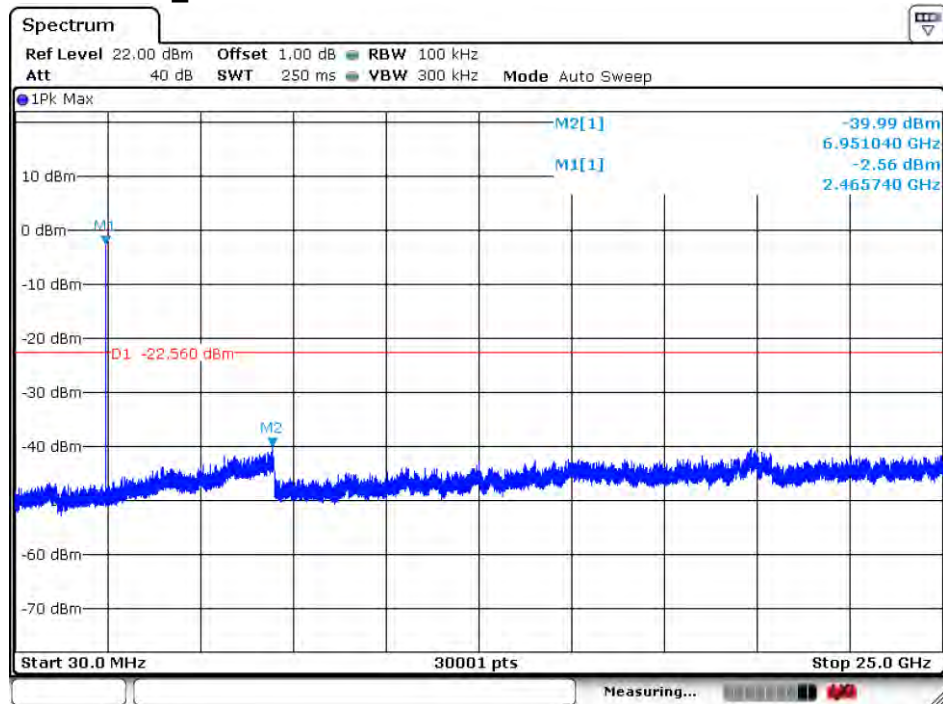
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4.8.1.4

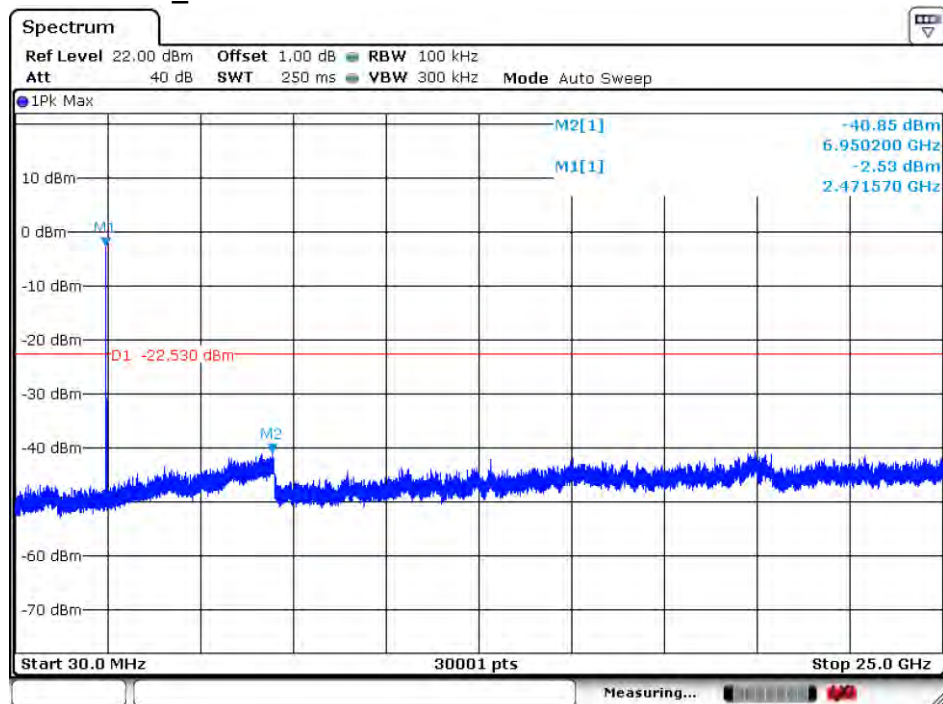
802.11B_CH12



Date: 17.AUG.2020 16:04:39

4.8.1.5

802.11B_CH13



Date: 17.AUG.2020 16:05:36



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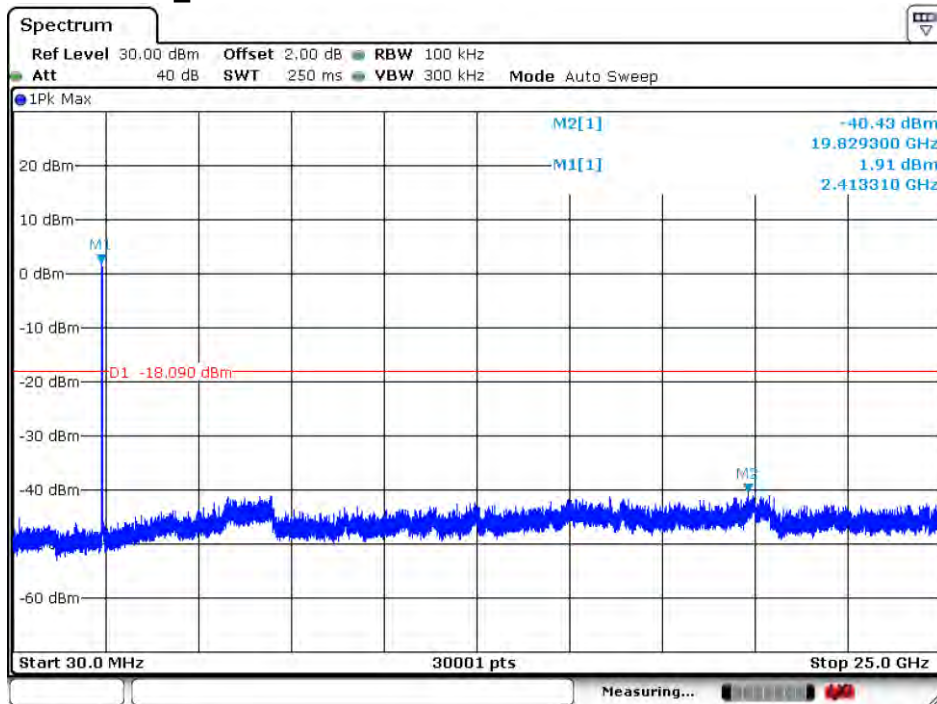
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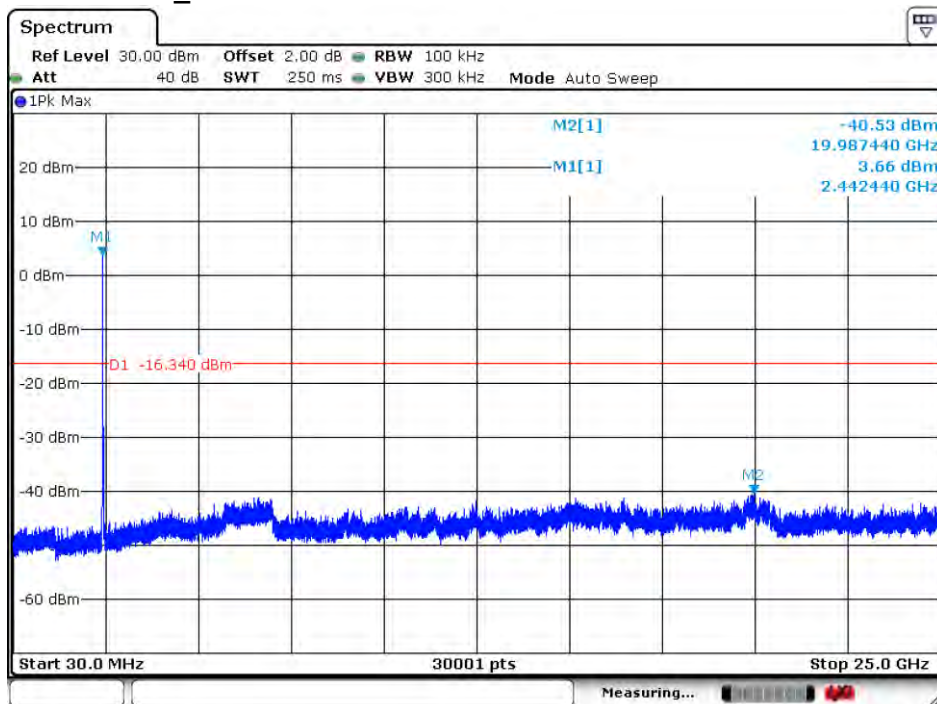
802.11G_CH1



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4.8.1.7

802.11G_CH6



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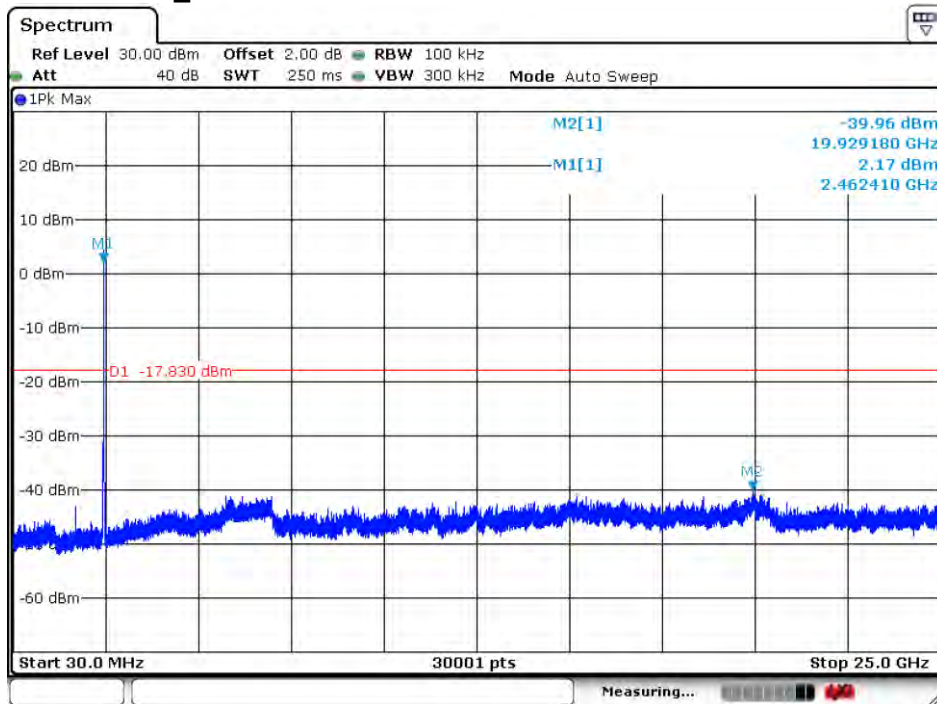


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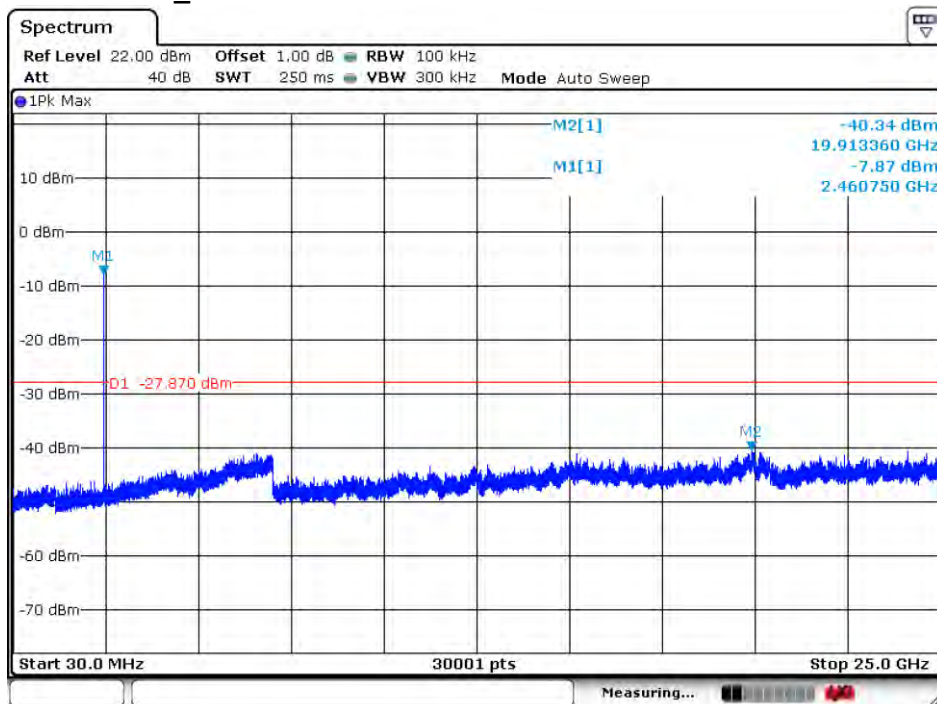
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4.8.1.9

802.11G_CH12

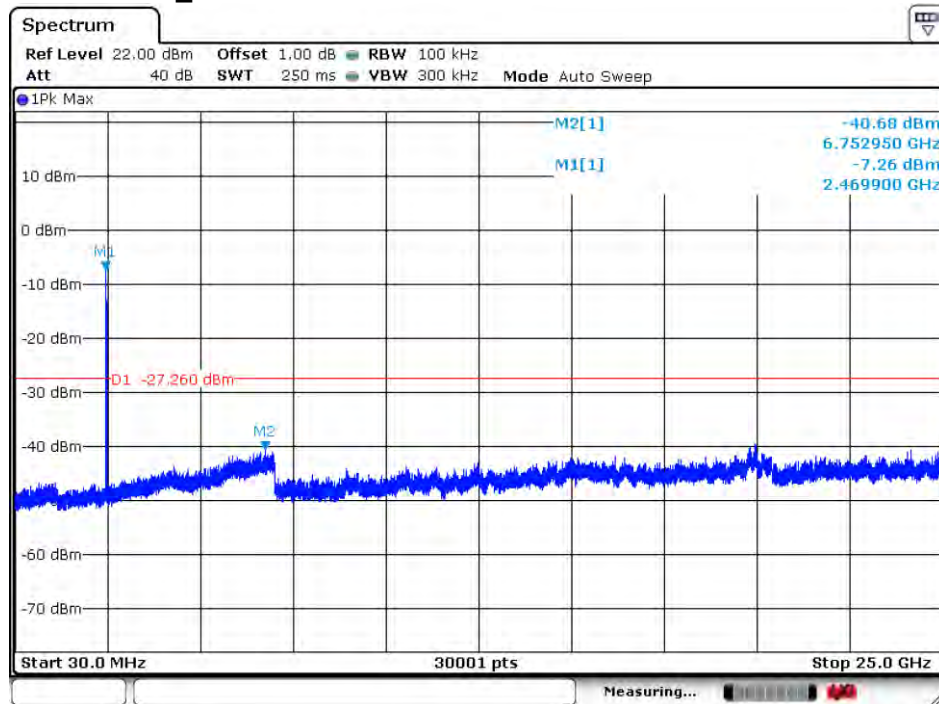


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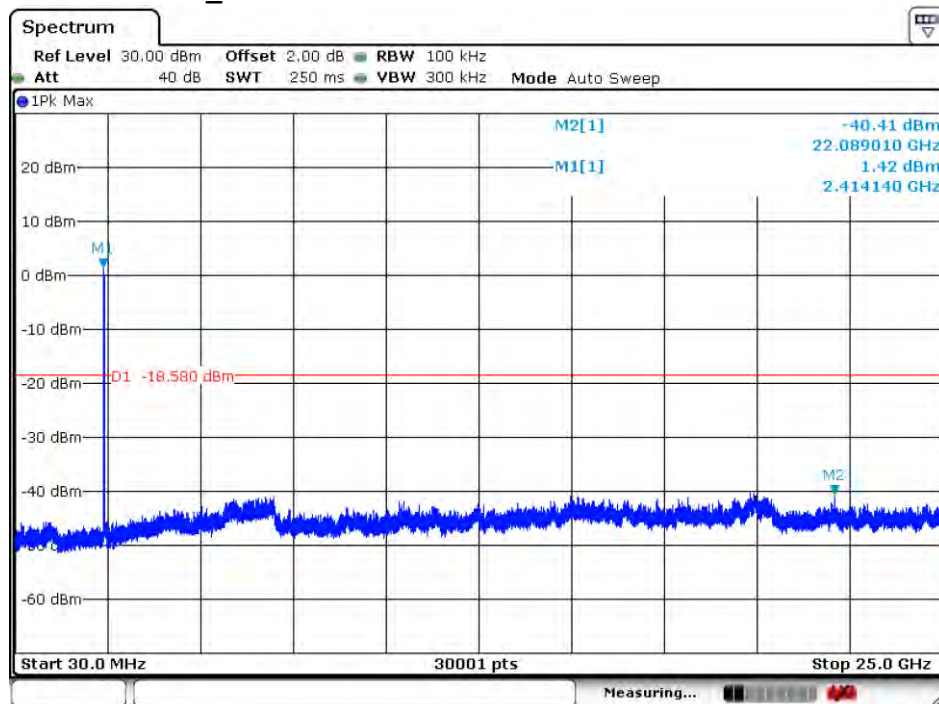
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4.8.1.11

802.11N20_CH1



Date: 7.JUL.2020 03:23:36



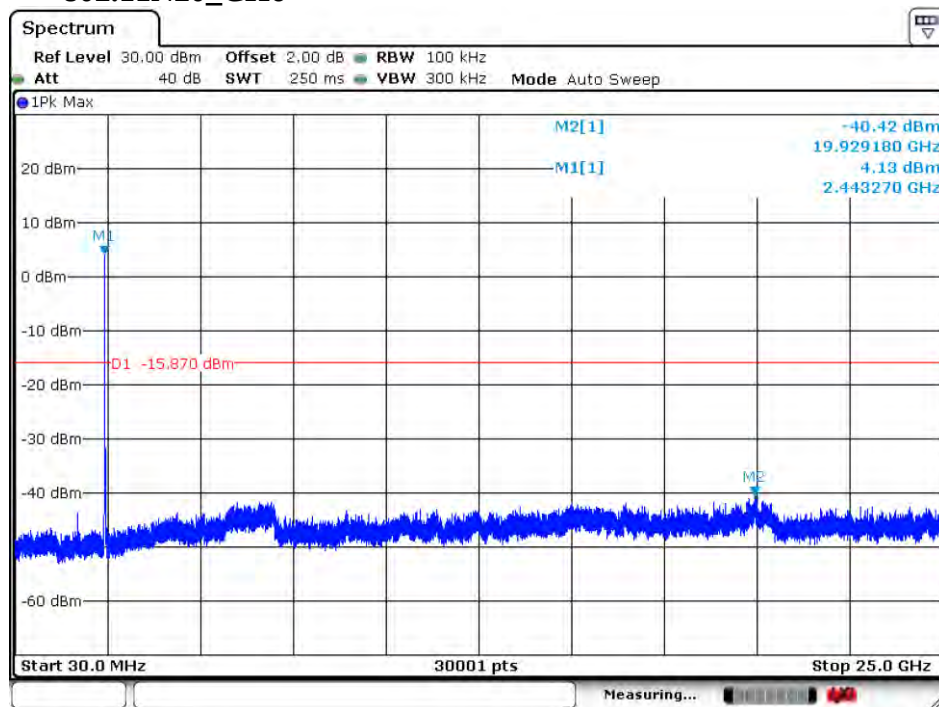
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4.8.1.12

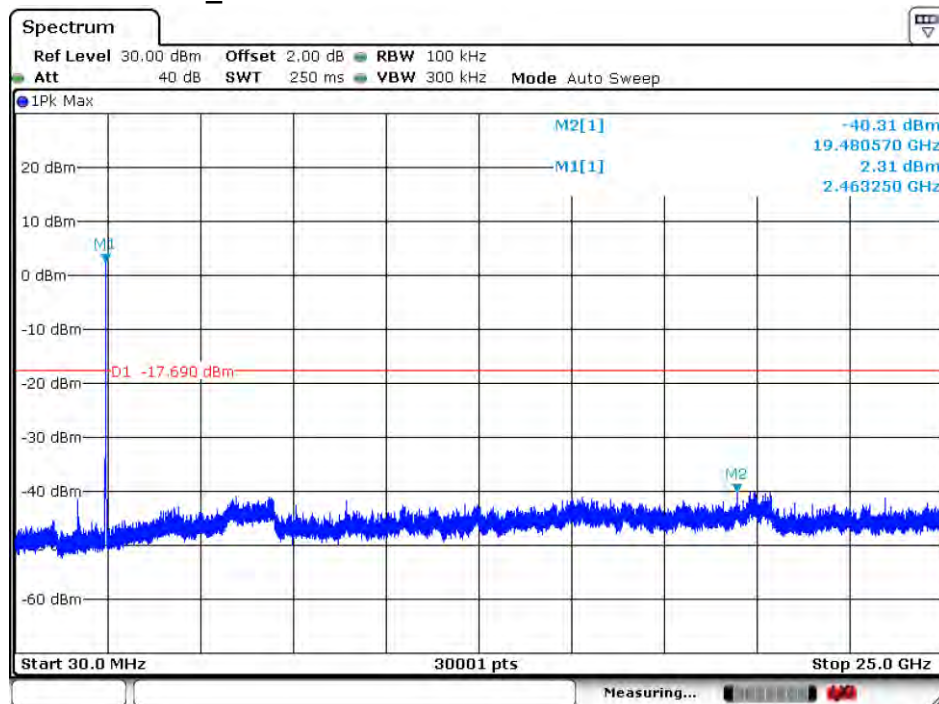
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4.8.1.13

802.11N20_CH11



Date: 7 JUL 2020 03:25:09



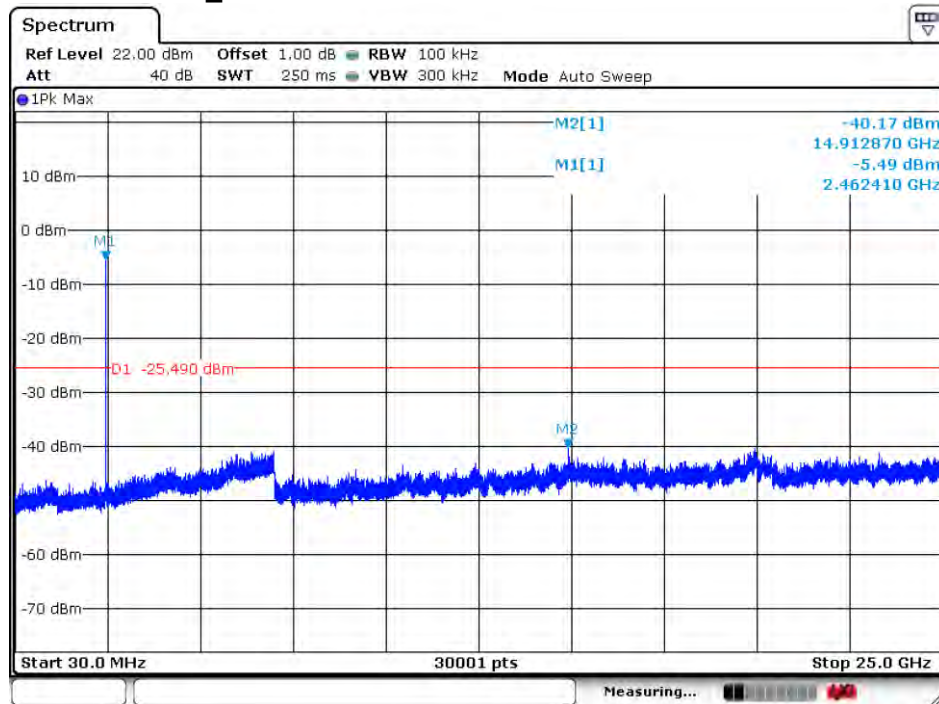
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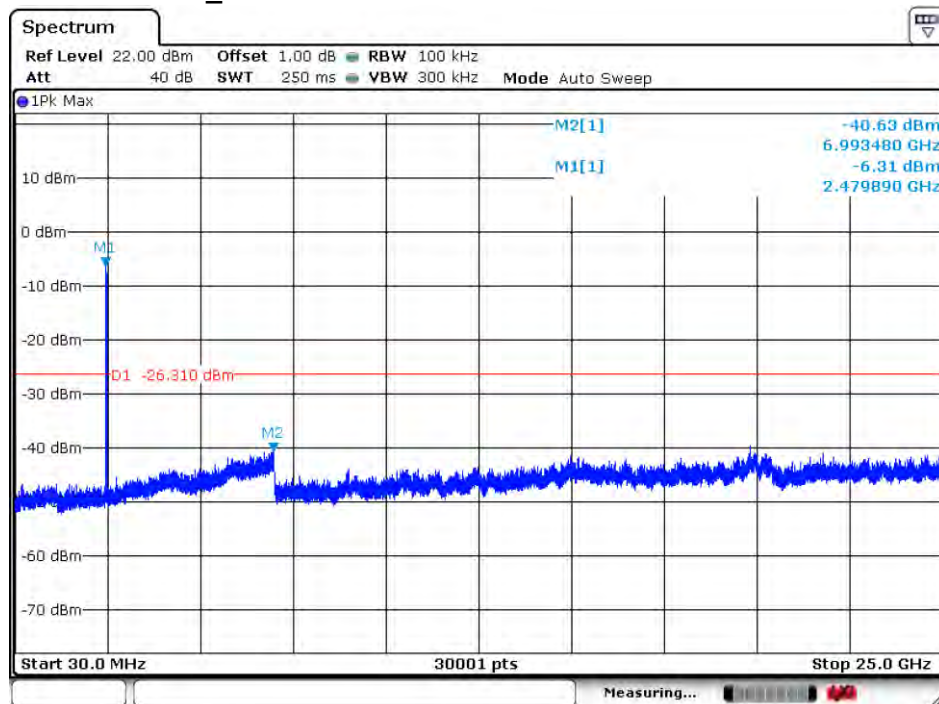
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Date: 17.AUG.2020 16:03:09

4.8.1.15

802.11N20_CH13



Date: 17.AUG.2020 16:02:17

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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 (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
Limit:	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average
	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
Limit:	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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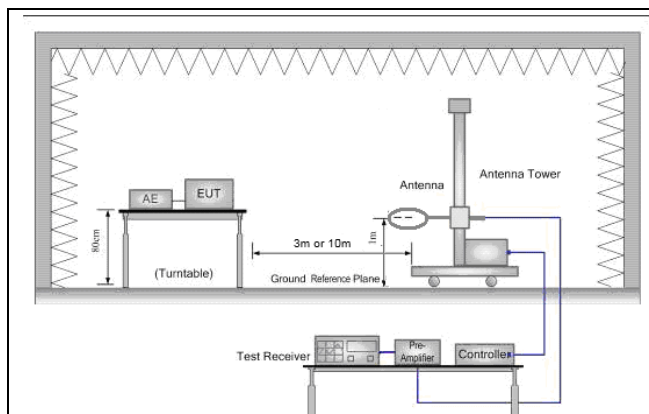


Figure 1. Below 30MHz

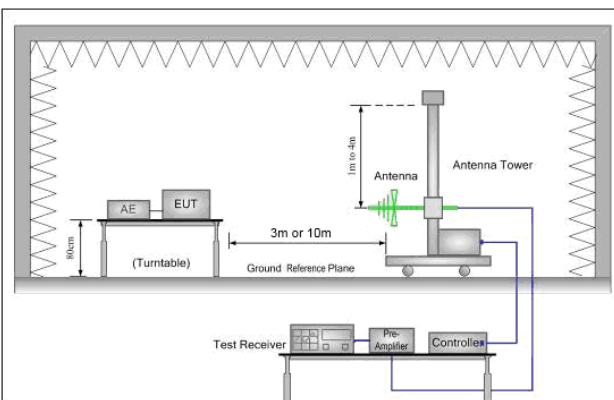


Figure 2. 30MHz to 1GHz

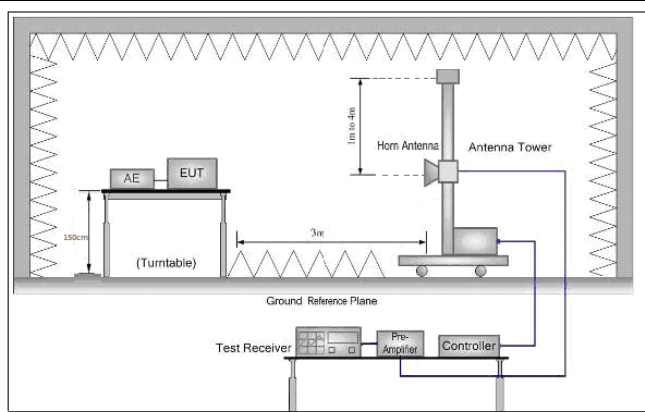


Figure 3. Above 1 GHz

Test Procedure:

- 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.
- 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
- 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.
- 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.
- Use the following spectrum analyzer settings:
 - Span shall wide enough to fully capture the emission being measured;
 - Set RBW=100 kHz for $f < 1$ GHz, RBW=1MHz for $f > 1$ GHz ; VBW $\geq$ RBW; Sweep = auto;
 - Detector function = peak; Trace = max hold for peak
 - For average measurement: use duty cycle correction factor method per 15.35(c).

Duty cycle = On time/100 milliseconds



	On time = $N_1 * L_1 + N_2 * L_2 + \dots + N_{n-1} * L_{n-1} + N_n * L_n$ Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc. Average Emission Level = Peak Emission Level + $20 * \log(\text{Duty cycle})$ 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. g. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 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. i. Test the EUT in the lowest channel, the middle channel, the Highest channel 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. k. Repeat above procedures until all frequencies measured was complete.
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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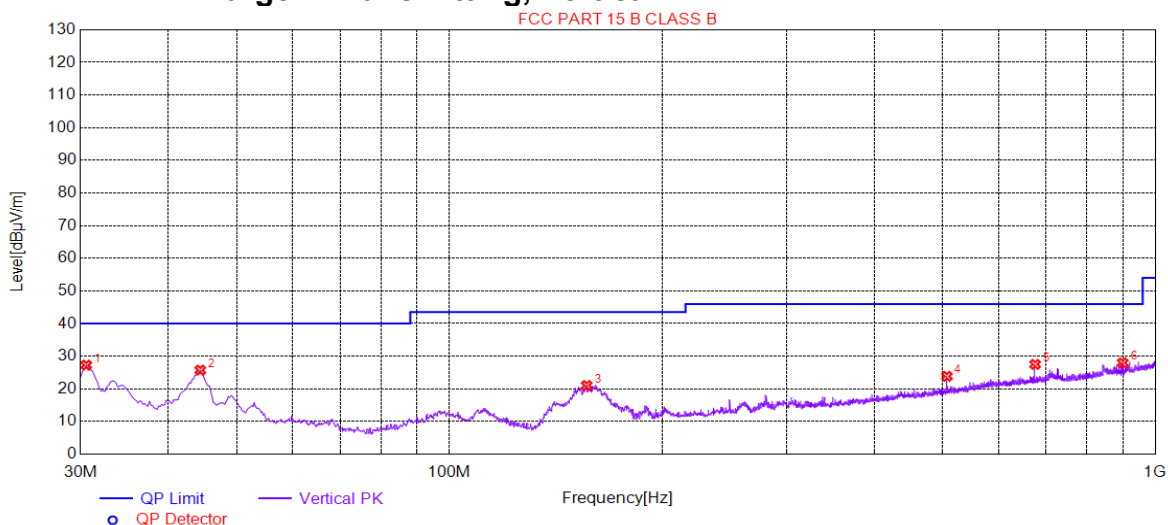
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4.9.1 Radiated emission below 1GHz

4.9.1.1 Charge + Transmitting, Vertical

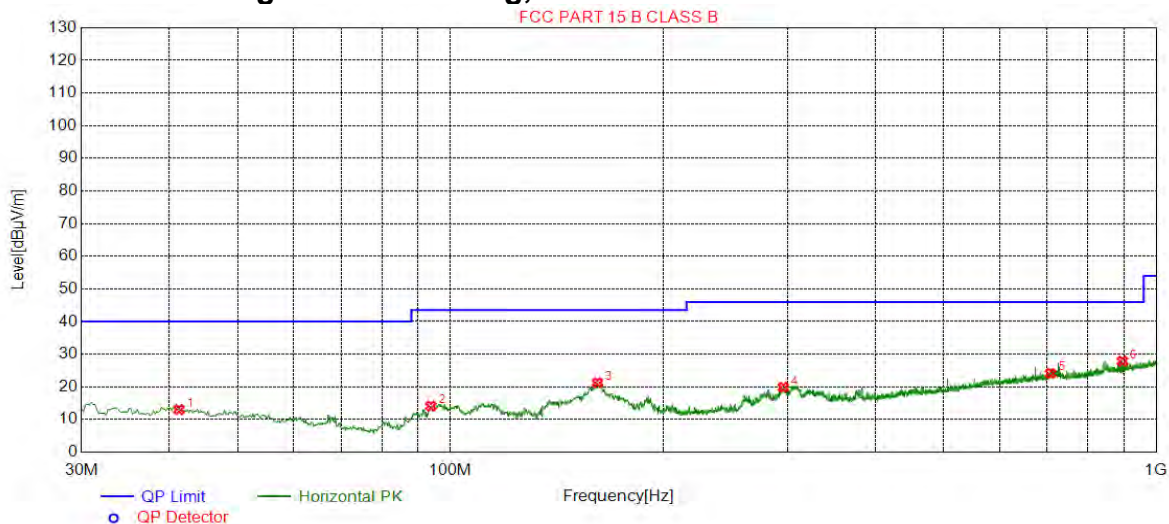


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	30.5821	27.30	-30.07	40.00	12.70	206	277	Vertical
2	44.3589	25.74	-30.16	40.00	14.26	226	248	Vertical
3	156.513	21.04	-34.79	43.50	22.46	181	14	Vertical
4	506.947	23.86	-23.14	46.00	22.14	267	298	Vertical
5	675.955	27.52	-19.76	46.00	18.48	166	280	Vertical
6	899.487	27.99	-16.04	46.00	18.01	253	60	Vertical



4.9.1.2 Charge + Transmitting, Horizontal



Suspected List

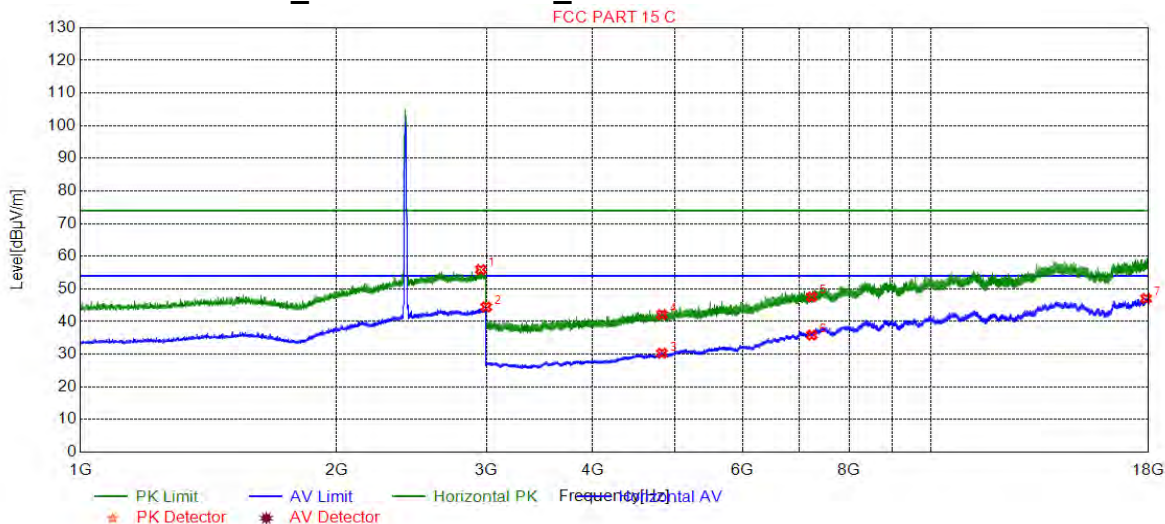
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	41.2543	13.06	-28.86	40.00	26.94	108	22	Horizontal
2	93.8388	14.14	-33.08	43.50	29.36	249	264	Horizontal
3	161.558	21.31	-34.54	43.50	22.19	164	101	Horizontal
4	296.221	19.86	-28.41	46.00	26.14	244	252	Horizontal
5	708.359	24.10	-19.31	46.00	21.90	236	10	Horizontal
6	895.801	27.89	-16.10	46.00	18.11	169	308	Horizontal



4.9.2 Transmitter emission above 1GHz

4.9.2.1 ANT1

4.9.2.1.1 802.11B_Lowest Channel_ Horizontal

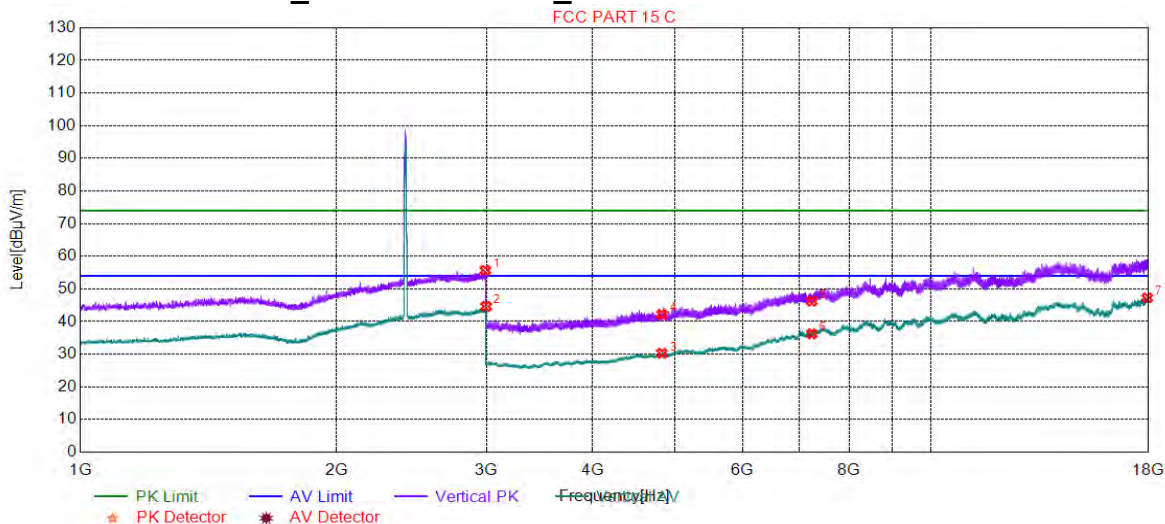


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2954.98	55.92	9.66	74.00	18.08	122	261	Horizontal
2	2998.49	44.48	9.46	54.00	9.52	213	39	Horizontal
3	4824.00	30.31	-18.21	54.00	23.69	245	342	Horizontal
4	4824.00	42.14	-18.21	74.00	31.86	173	233	Horizontal
5	7236.00	47.56	-9.99	74.00	26.44	149	218	Horizontal
6	7236.00	35.87	-9.99	54.00	18.13	113	18	Horizontal
7	17870.7	47.08	0.30	54.00	6.92	247	360	Horizontal



4.9.2.1.2 802.11B_Lowest Channel_ Vertical



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2991.49	55.74	9.49	74.00	18.26	208	358	Vertical
2	2997.99	44.66	9.46	54.00	9.34	173	18	Vertical
3	4824.00	30.30	-18.21	54.00	23.70	188	287	Vertical
4	4824.00	42.21	-18.21	74.00	31.79	170	260	Vertical
5	7236.00	46.26	-9.99	74.00	27.74	283	219	Vertical
6	7236.00	36.26	-9.99	54.00	17.74	204	360	Vertical
7	17933.9	47.28	0.70	54.00	6.72	180	169	Vertical



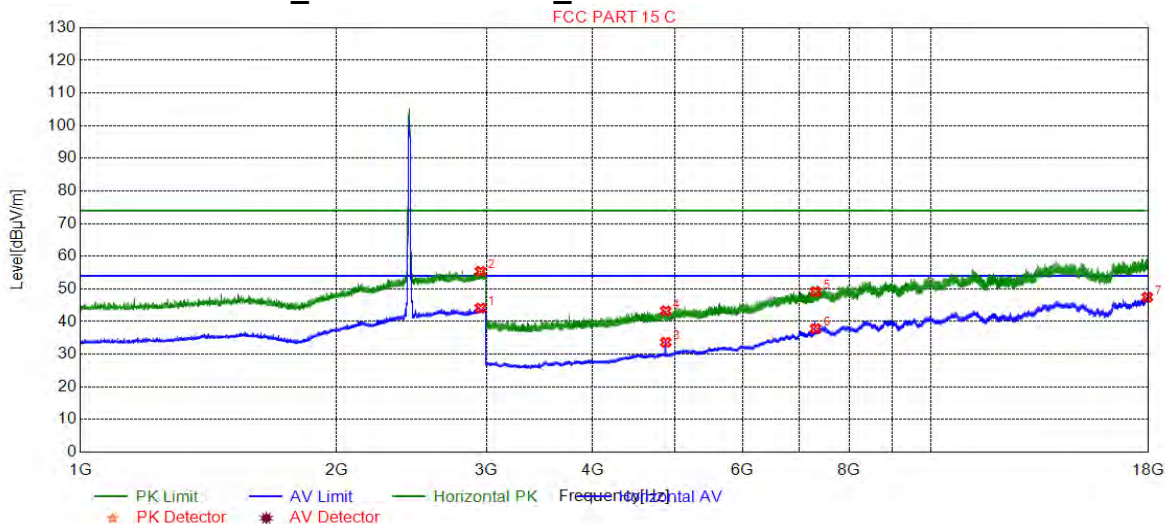
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4.9.2.1.3 802.11B_ Middle Channel_ Horizontal

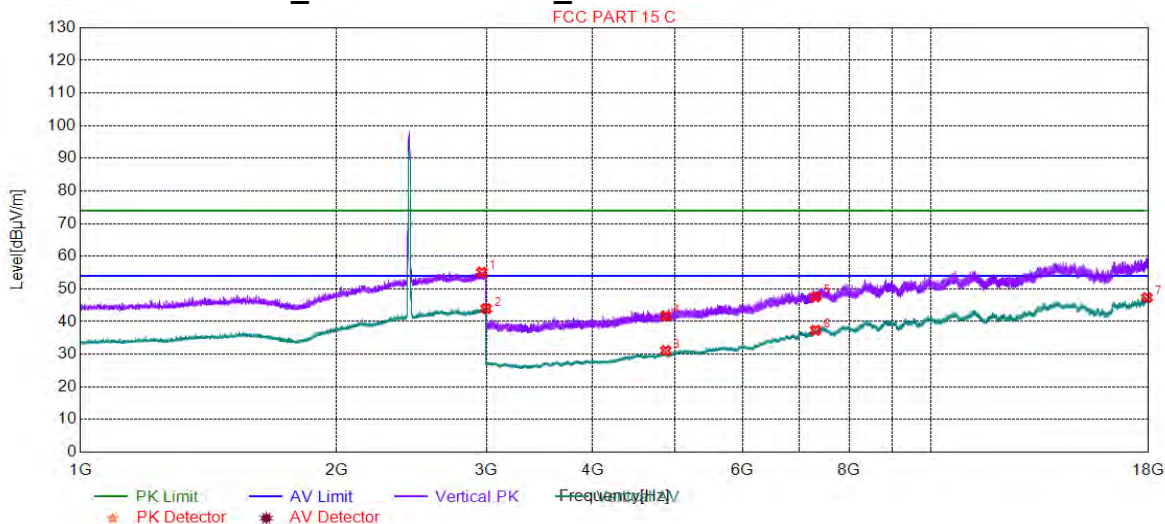


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2952.48	44.14	9.67	54.00	9.86	236	124	Horizontal
2	2952.98	55.41	9.67	74.00	18.59	241	83	Horizontal
3	4874.00	33.68	-17.99	54.00	20.32	148	41	Horizontal
4	4874.00	43.29	-17.99	74.00	30.71	141	96	Horizontal
5	7311.00	49.20	-9.74	74.00	24.80	235	229	Horizontal
6	7311.00	37.85	-9.74	54.00	16.15	231	178	Horizontal
7	17934.5	47.48	0.70	54.00	6.52	204	78	Horizontal



4.9.2.1.4 802.11B_ Middle Channel_ Vertical



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2963.49	55.15	9.62	74.00	18.85	214	18	Vertical
2	2998.49	43.99	9.46	54.00	10.01	170	332	Vertical
3	4874.00	31.12	-17.99	54.00	22.88	257	342	Vertical
4	4874.00	41.71	-17.99	74.00	32.29	238	315	Vertical
5	7311.00	47.58	-9.74	74.00	26.42	233	68	Vertical
6	7311.00	37.35	-9.74	54.00	16.65	205	270	Vertical
7	17923.5	47.37	0.70	54.00	6.63	153	360	Vertical



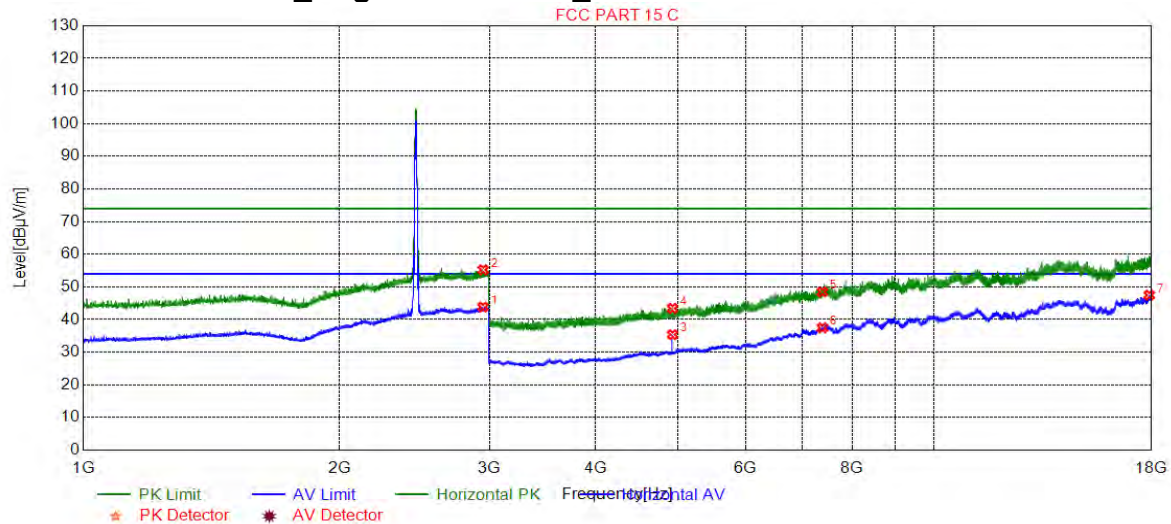
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4.9.2.1.5 802.11B_ Highest Channel_ Horizontal

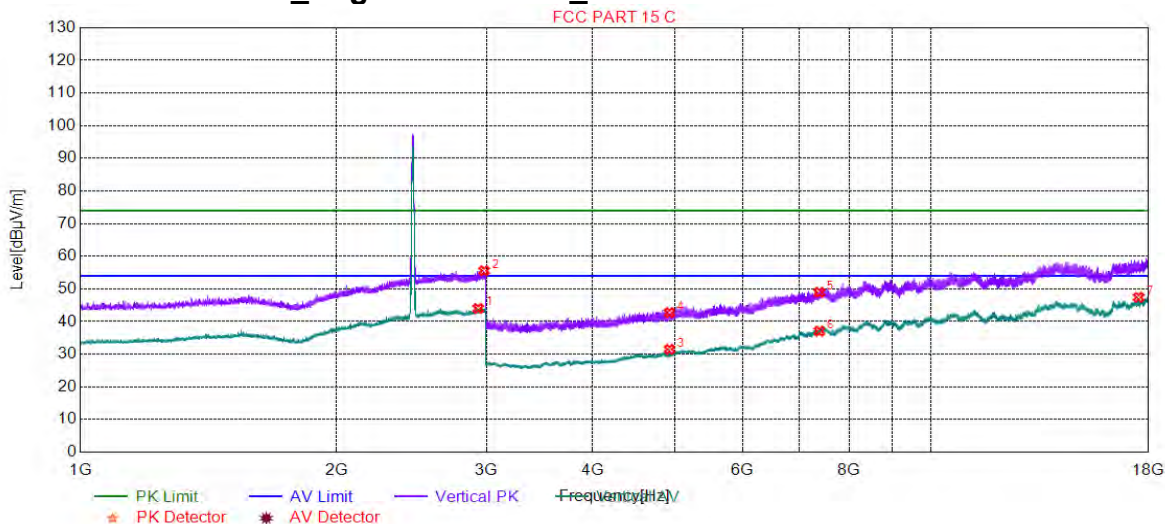


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2948.98	43.84	9.67	54.00	10.16	111	274	Horizontal
2	2950.48	55.24	9.68	74.00	18.76	210	68	Horizontal
3	4924.00	35.39	-17.72	54.00	18.61	192	94	Horizontal
4	4924.00	43.43	-17.72	74.00	30.57	247	67	Horizontal
5	7386.00	48.48	-9.55	74.00	25.52	117	68	Horizontal
6	7386.00	37.49	-9.55	54.00	16.51	163	169	Horizontal
7	17885.0	47.50	0.49	54.00	6.50	116	18	Horizontal



4.9.2.1.6 802.11B_ Highest Channel_ Vertical

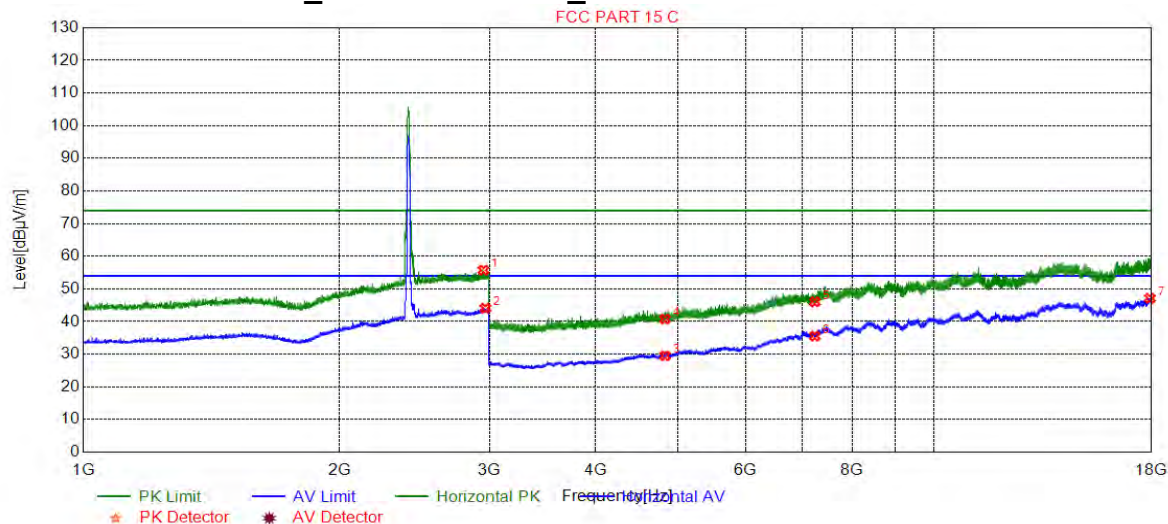


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2934.48	44.02	9.51	54.00	9.98	262	303	Vertical
2	2981.99	55.57	9.53	74.00	18.43	161	58	Vertical
3	4924.00	31.50	-17.72	54.00	22.50	160	259	Vertical
4	4924.00	42.75	-17.72	74.00	31.25	157	12	Vertical
5	7386.00	48.96	-9.55	74.00	25.04	279	18	Vertical
6	7386.00	37.07	-9.55	54.00	16.93	251	18	Vertical
7	17518.7	47.44	0.99	54.00	6.56	283	119	Vertical



4.9.2.1.7 802.11G_Lowest Channel_Horizontal

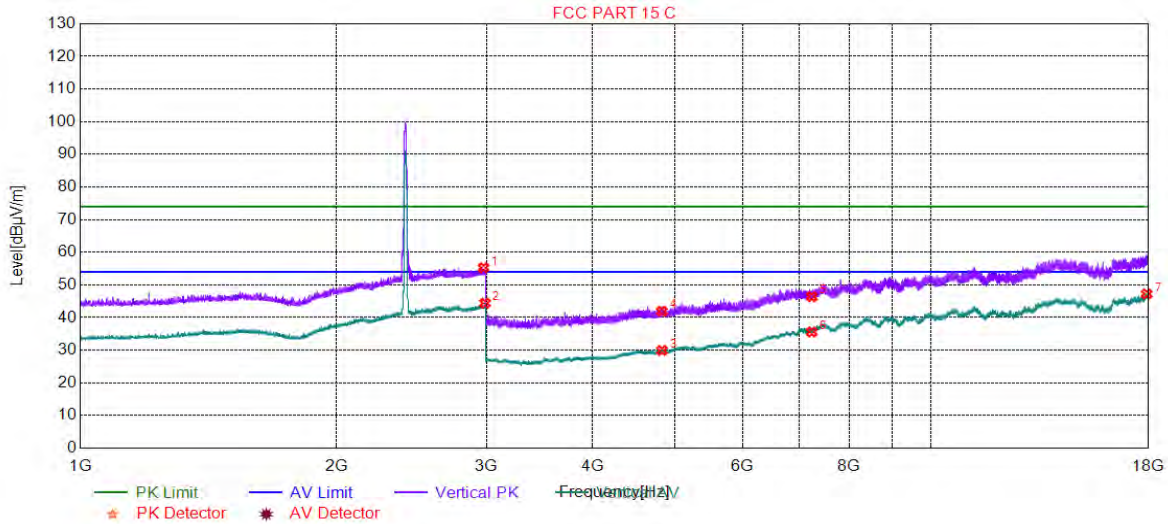


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2952.48	55.76	9.67	74.00	18.24	102	40	Horizontal
2	2967.49	44.08	9.60	54.00	9.92	139	342	Horizontal
3	4824.00	29.52	-18.21	54.00	24.48	163	205	Horizontal
4	4824.00	40.78	-18.21	74.00	33.22	202	151	Horizontal
5	7236.00	46.04	-9.99	74.00	27.96	170	319	Horizontal
6	7236.00	35.57	-9.99	54.00	18.43	249	319	Horizontal
7	17916.3	47.13	0.69	54.00	6.87	243	168	Horizontal



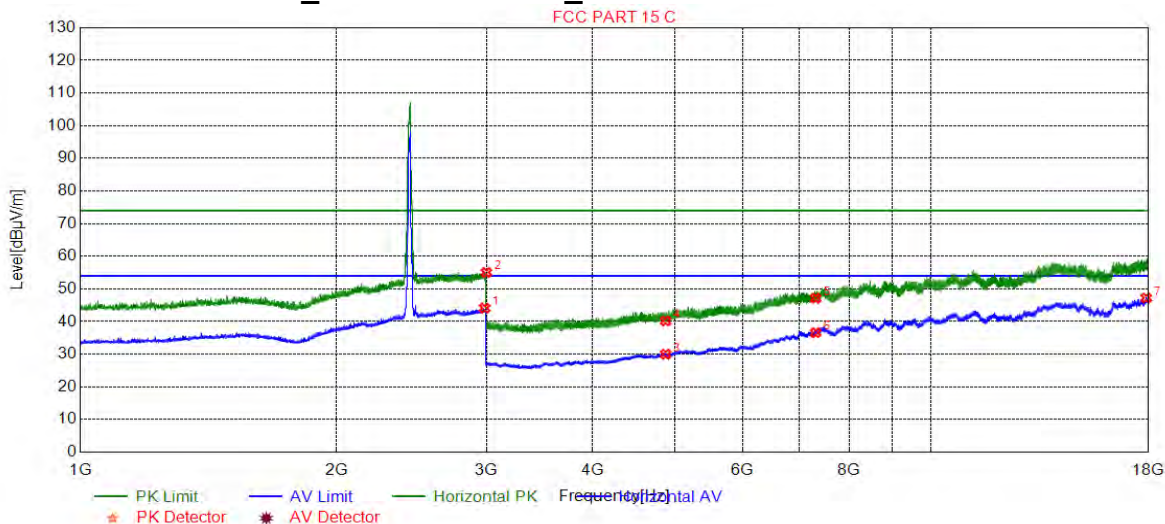
4.9.2.1.8 802.11G_Lowest Channel_Vertical



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2976.99	55.27	9.56	74.00	18.73	172	87	Vertical
2	2988.49	44.42	9.50	54.00	9.58	234	18	Vertical
3	4824.00	29.93	-18.21	54.00	24.07	283	151	Vertical
4	4824.00	41.97	-18.21	74.00	32.03	211	13	Vertical
5	7236.00	46.42	-9.99	74.00	27.58	243	319	Vertical
6	7236.00	35.61	-9.99	54.00	18.39	234	360	Vertical
7	17907.5	47.26	0.69	54.00	6.74	195	219	Vertical

4.9.2.1.9 802.11G_ Middle Channel_ Horizontal

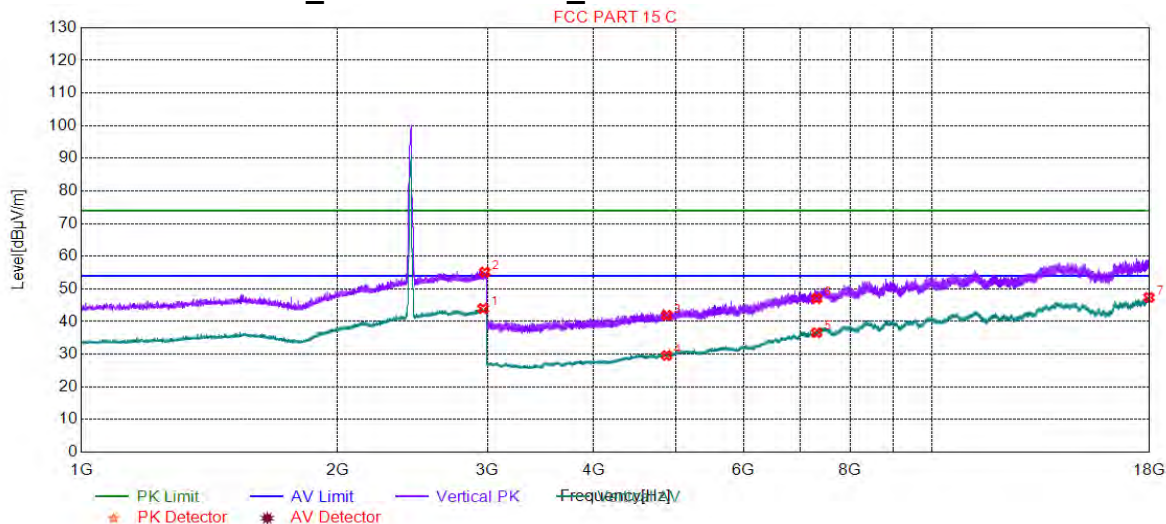


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2985.99	44.11	9.51	54.00	9.89	236	53	Horizontal
2	3000.00	55.04	9.45	74.00	18.96	238	25	Horizontal
3	4874.00	30.01	-17.99	54.00	23.99	220	12	Horizontal
4	4874.00	40.19	-17.99	74.00	33.81	218	204	Horizontal
5	7311.00	47.16	-9.74	74.00	26.84	224	360	Horizontal
6	7311.00	36.61	-9.74	54.00	17.39	197	269	Horizontal
7	17883.3	47.22	0.47	54.00	6.78	114	68	Horizontal



4.9.2.1.10 802.11G_Middle Channel_Vertical



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2965.49	44.00	9.61	54.00	10.00	211	84	Vertical
2	2979.49	55.15	9.54	74.00	18.85	190	249	Vertical
3	4874.00	41.90	-17.99	74.00	32.10	180	314	Vertical
4	4874.00	29.61	-17.99	54.00	24.39	194	94	Vertical
5	7311.00	36.59	-9.74	54.00	17.41	211	119	Vertical
6	7311.00	47.10	-9.74	74.00	26.90	193	219	Vertical
7	17968.6	47.42	0.71	54.00	6.58	255	219	Vertical



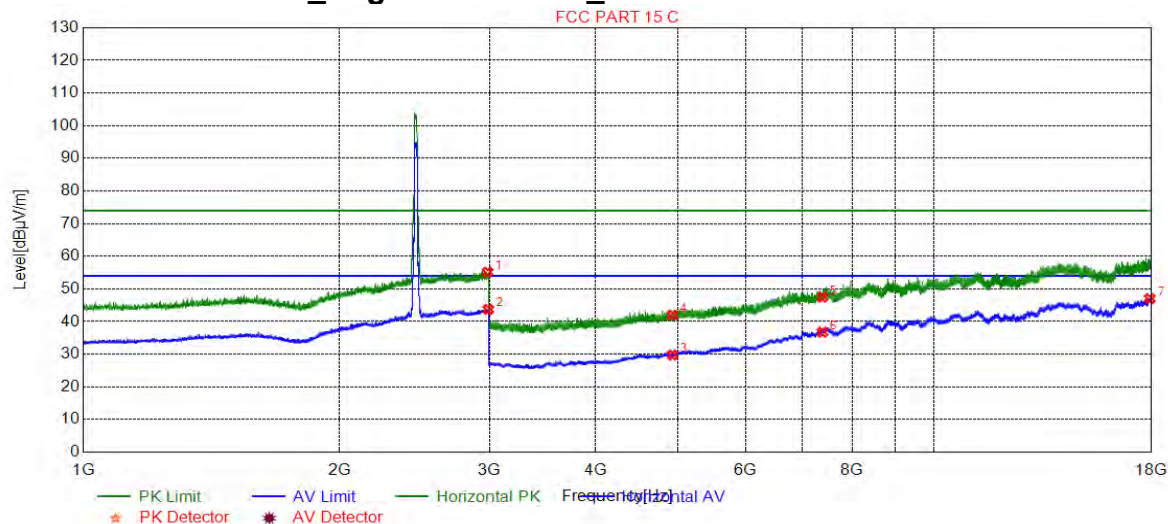
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4.9.2.1.11 802.11G_ Highest Channel_ Horizontal



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2985.49	55.16	9.52	74.00	18.84	172	232	Horizontal
2	2990.99	43.73	9.49	54.00	10.27	201	288	Horizontal
3	4924.00	29.77	-17.72	54.00	24.23	101	12	Horizontal
4	4924.00	42.00	-17.72	74.00	32.00	140	232	Horizontal
5	7386.00	47.50	-9.55	74.00	26.50	139	270	Horizontal
6	7386.00	36.76	-9.55	54.00	17.24	175	69	Horizontal
7	17915.2	47.03	0.69	54.00	6.97	109	270	Horizontal



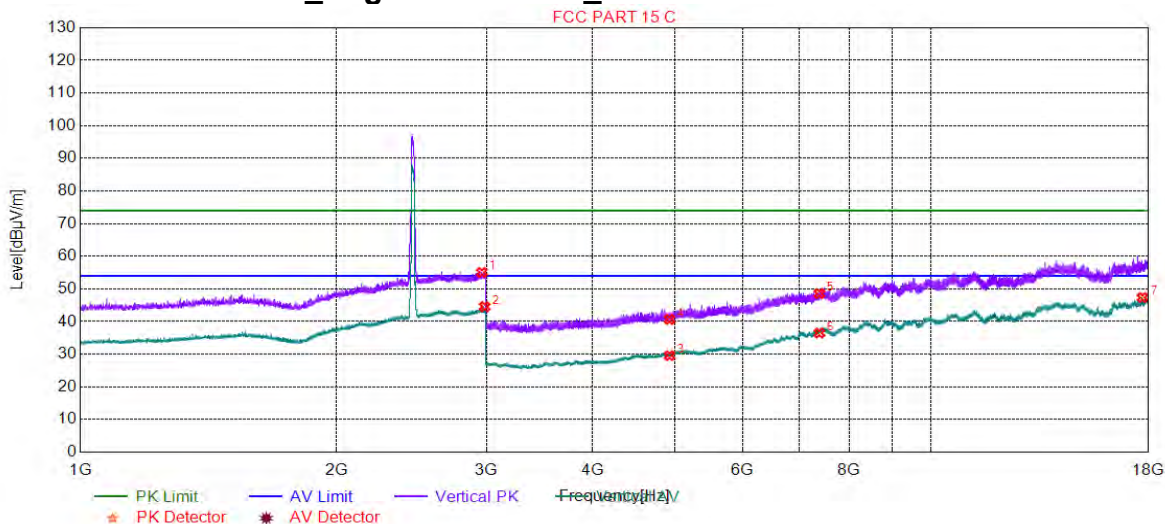
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4.9.2.1.12 802.11G_ Highest Channel_ Vertical

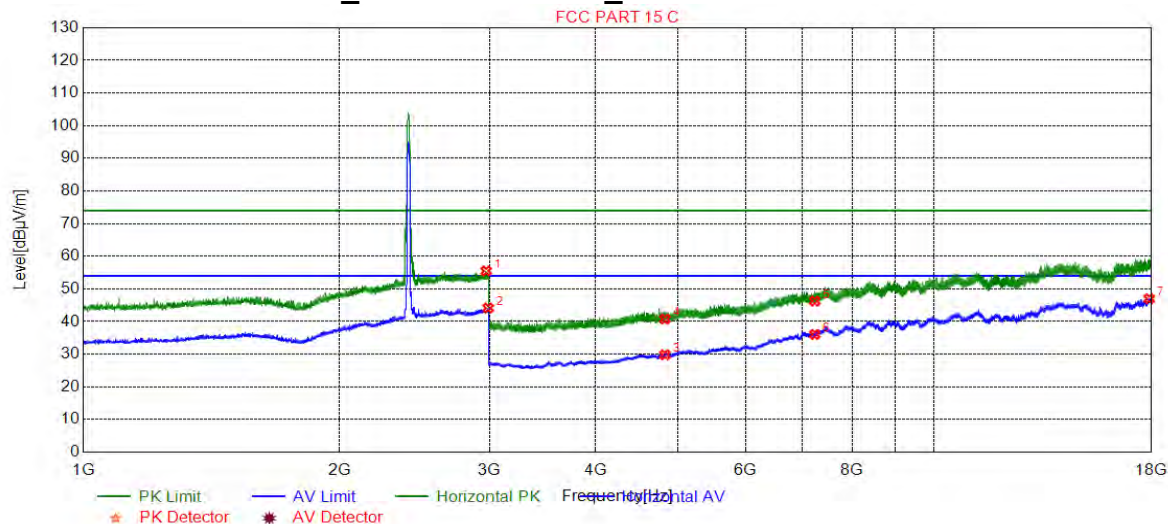


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2963.99	55.08	9.62	74.00	18.92	271	45	Vertical
2	2985.99	44.57	9.51	54.00	9.43	259	58	Vertical
3	4924.00	29.57	-17.72	54.00	24.43	204	287	Vertical
4	4924.00	40.66	-17.72	74.00	33.34	291	12	Vertical
5	7386.00	48.59	-9.55	74.00	25.41	257	220	Vertical
6	7386.00	36.48	-9.55	54.00	17.52	223	270	Vertical
7	17704.6	47.37	1.27	54.00	6.63	265	320	Vertical



4.9.2.1.13 802.11N20_Lowest Channel_Horizontal

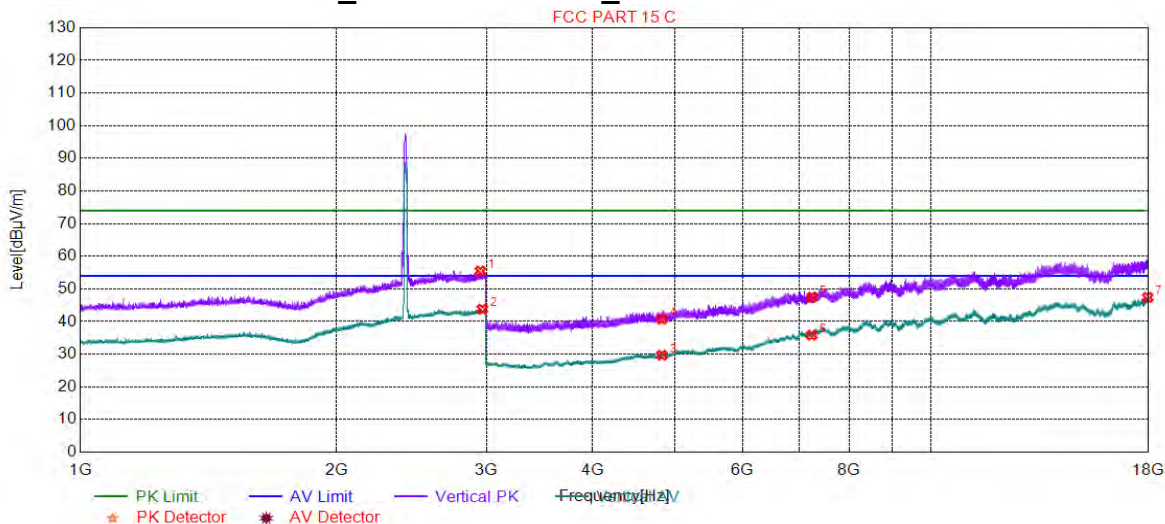


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2973.49	55.51	9.57	74.00	18.49	248	110	Horizontal
2	2989.99	44.16	9.50	54.00	9.84	212	219	Horizontal
3	4824.00	29.83	-18.21	54.00	24.17	112	96	Horizontal
4	4824.00	40.77	-18.21	74.00	33.23	184	260	Horizontal
5	7236.00	46.30	-9.99	74.00	27.70	191	220	Horizontal
6	7236.00	36.08	-9.99	54.00	17.92	169	220	Horizontal
7	17884.4	47.00	0.49	54.00	7.00	136	220	Horizontal



4.9.2.1.14 802.11N20_Lowest Channel_Vertical

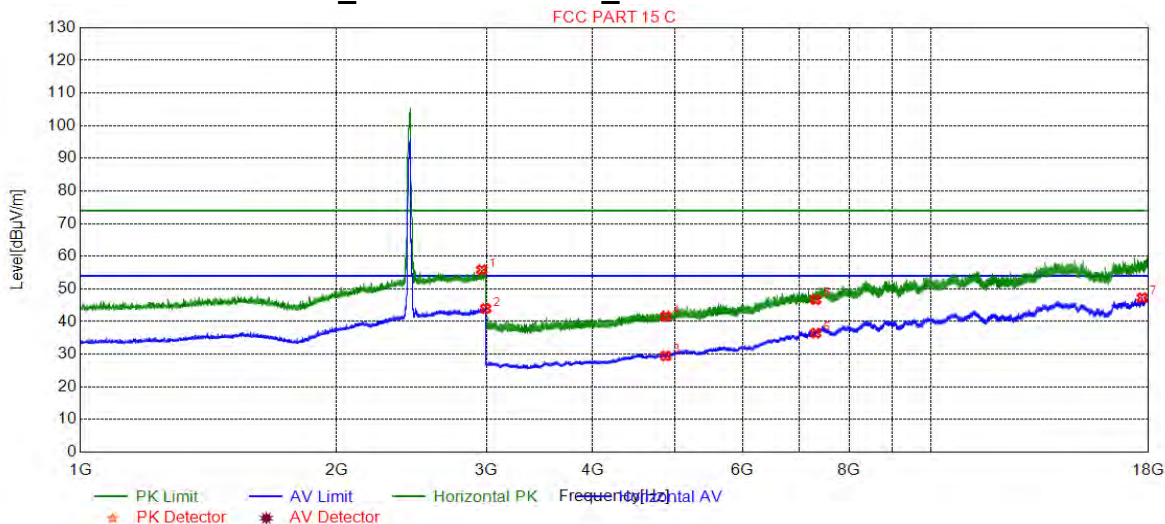


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2950.98	55.49	9.68	74.00	18.51	231	72	Vertical
2	2967.49	43.82	9.60	54.00	10.18	155	72	Vertical
3	4824.00	29.71	-18.21	54.00	24.29	293	151	Vertical
4	4824.00	40.72	-18.21	74.00	33.28	172	288	Vertical
5	7236.00	47.45	-9.99	74.00	26.55	298	360	Vertical
6	7236.00	35.85	-9.99	54.00	18.15	209	119	Vertical
7	17953.7	47.45	0.71	54.00	6.55	153	18	Vertical



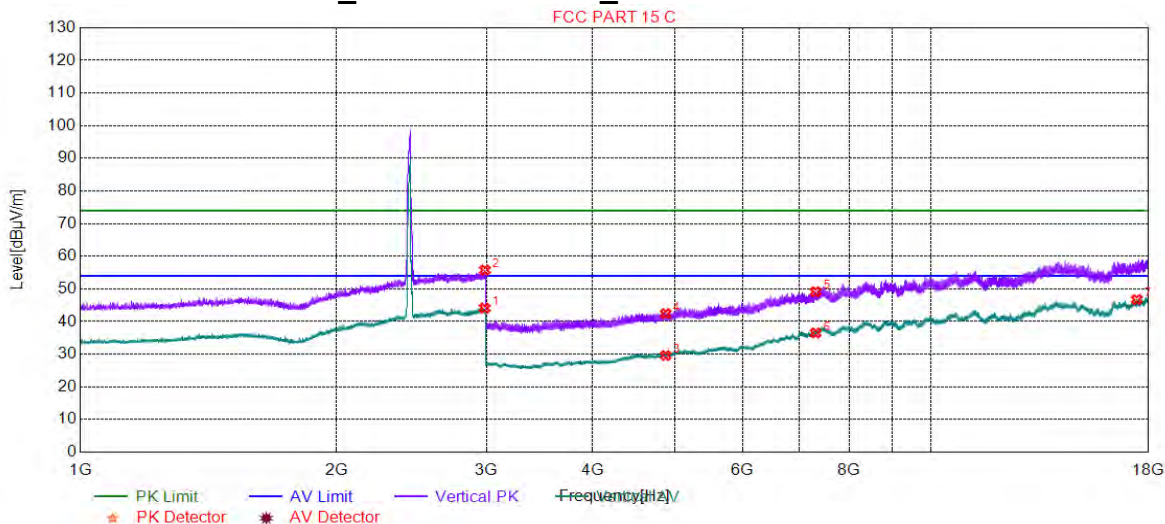
4.9.2.1.15 802.11N20_ Middle Channel_ Horizontal



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2962.99	55.85	9.62	74.00	18.15	154	110	Horizontal
2	2994.99	43.99	9.47	54.00	10.01	172	151	Horizontal
3	4874.00	29.48	-17.99	54.00	24.52	218	95	Horizontal
4	4874.00	41.61	-17.99	74.00	32.39	130	40	Horizontal
5	7311.00	46.70	-9.74	74.00	27.30	196	168	Horizontal
6	7311.00	36.46	-9.74	54.00	17.54	181	68	Horizontal
7	17689.7	47.31	1.35	54.00	6.69	108	18	Horizontal

4.9.2.1.16 802.11N20_Middle Channel_Vertical

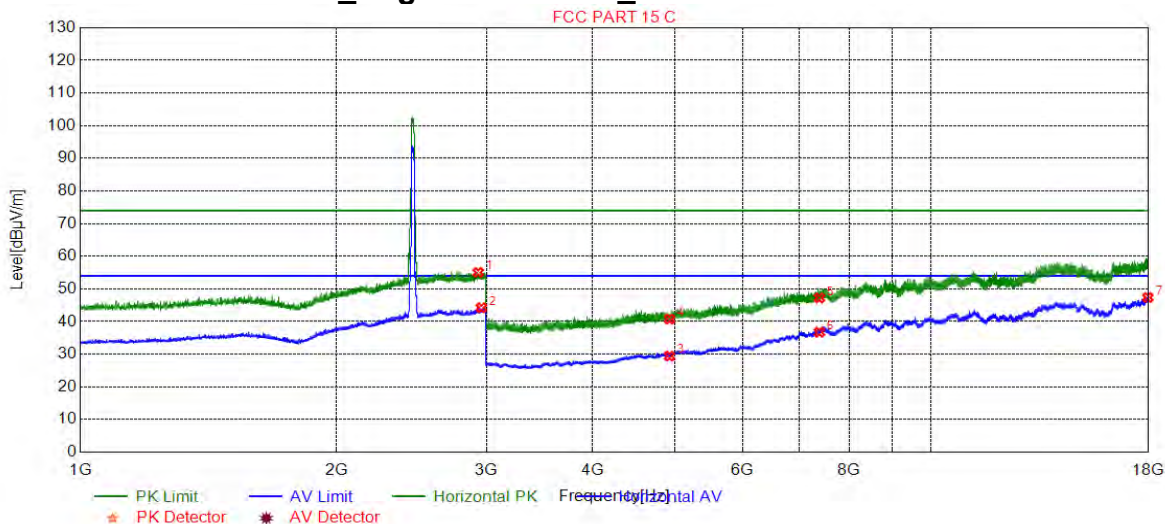


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2985.99	44.11	9.51	54.00	9.89	191	87	Vertical
2	2987.99	55.78	9.51	74.00	18.22	220	197	Vertical
3	4874.00	29.61	-17.99	54.00	24.39	283	14	Vertical
4	4874.00	42.45	-17.99	74.00	31.55	206	288	Vertical
5	7311.00	49.16	-9.74	74.00	24.84	270	319	Vertical
6	7311.00	36.51	-9.74	54.00	17.49	168	220	Vertical
7	17431.8	46.78	0.48	54.00	7.22	185	69	Vertical



4.9.2.1.17 802.11N20_ Highest Channel_ Horizontal

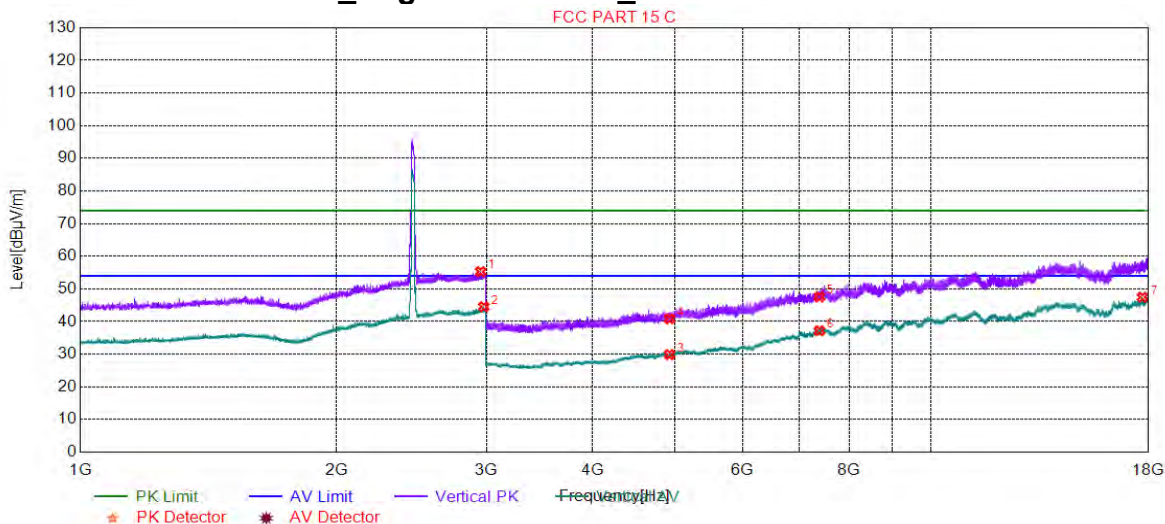


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2933.98	55.06	9.51	74.00	18.94	225	137	Horizontal
2	2959.48	44.23	9.64	54.00	9.77	178	137	Horizontal
3	4924.00	29.43	-17.72	54.00	24.57	208	205	Horizontal
4	4924.00	40.76	-17.72	74.00	33.24	169	260	Horizontal
5	7386.00	47.24	-9.55	74.00	26.76	140	69	Horizontal
6	7386.00	36.77	-9.55	54.00	17.23	195	69	Horizontal
7	17960.9	47.40	0.71	54.00	6.60	248	169	Horizontal



4.9.2.1.18 802.11N20_ Highest Channel_ Vertical



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2953.98	55.30	9.66	74.00	18.70	236	127	Vertical
2	2979.49	44.54	9.54	54.00	9.46	236	210	Vertical
3	4924.00	29.90	-17.72	54.00	24.10	245	122	Vertical
4	4924.00	40.87	-17.72	74.00	33.13	244	314	Vertical
5	7386.00	47.56	-9.55	74.00	26.44	291	320	Vertical
6	7386.00	37.19	-9.55	54.00	16.81	220	360	Vertical
7	17702.9	47.49	1.30	54.00	6.51	204	169	Vertical

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 have 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:			

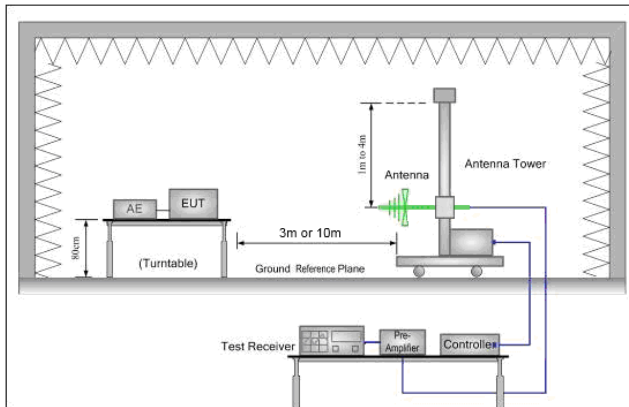


Figure 1. 30MHz to 1GHz

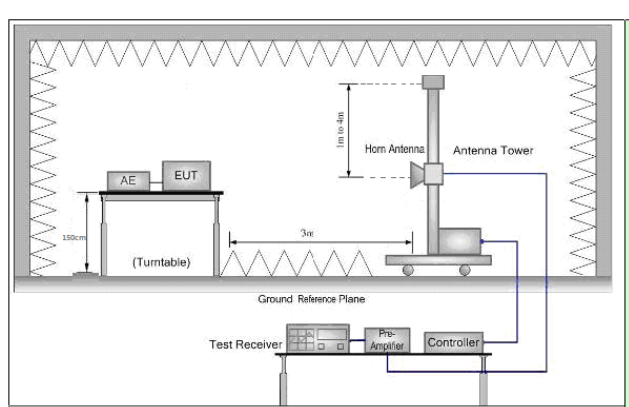


Figure 2. Above 1 GHz

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 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.
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); Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass



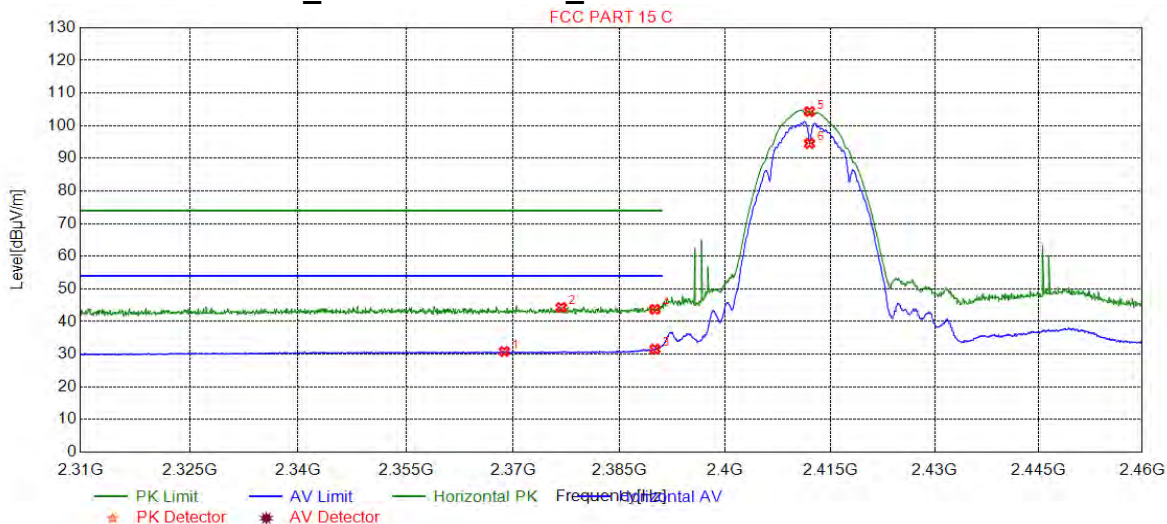
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Test plot as follows:

4.10.1 ANT1

4.10.1.1 802.11B_Lowest Channel_ Horizontal

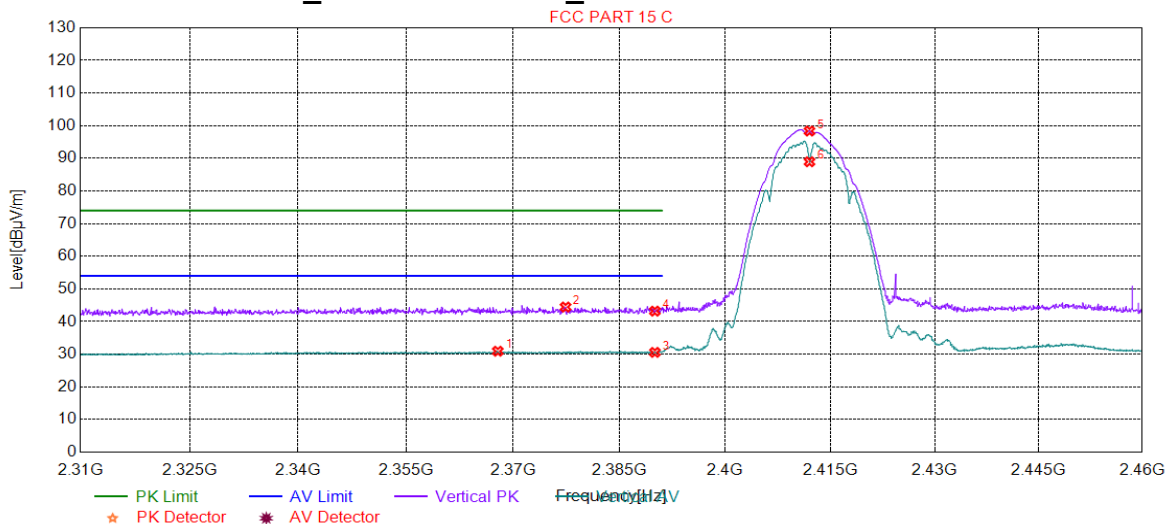


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2368.75	30.86	7.79	54.00	23.14	118	138	Horizontal
2	2376.78	44.31	7.78	74.00	29.69	141	188	Horizontal
3	2390.00	31.57	7.77	54.00	22.43	115	210	Horizontal
4	2390.00	43.75	7.77	74.00	30.25	225	2	Horizontal
5	2412.00	104.33	7.81	0.00	-104.33	188	248	Horizontal
6	2412.00	94.59	7.81	0.00	-94.59	219	205	Horizontal



4.10.1.2 802.11B_Lowest Channel_ Vertical



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2367.85	30.93	7.79	54.00	23.07	187	208	Vertical
2	2377.38	44.46	7.78	74.00	29.54	197	254	Vertical
3	2390.00	30.58	7.77	54.00	23.42	211	181	Vertical
4	2390.00	43.21	7.77	74.00	30.79	158	297	Vertical
5	2412.00	98.37	7.81	0.00	-98.37	207	220	Vertical
6	2412.00	88.96	7.81	0.00	-88.96	265	213	Vertical



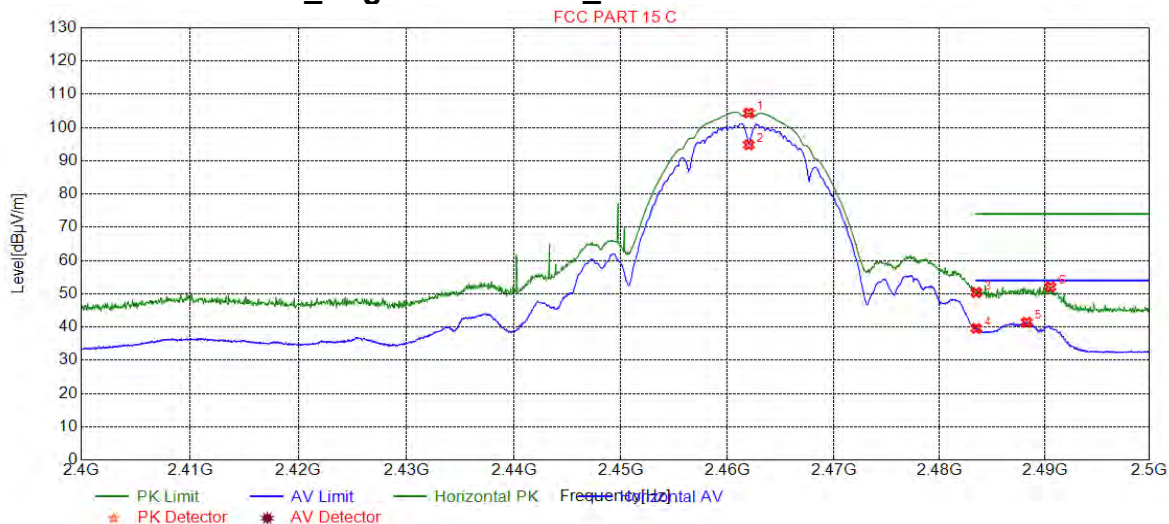
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4.10.1.3 802.11B_ Highest Channel_ Horizontal

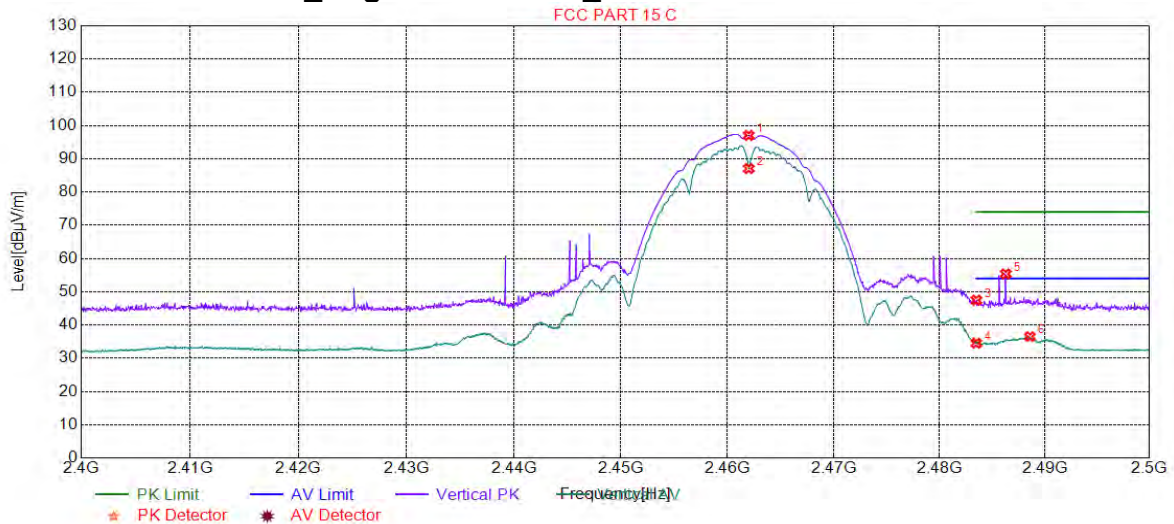


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	104.36	7.98	0.00	-104.36	173	204	Horizontal
2	2462.00	94.81	7.98	0.00	-94.81	143	204	Horizontal
3	2483.50	50.40	8.01	74.00	23.60	122	204	Horizontal
4	2483.50	39.59	8.01	54.00	14.41	108	204	Horizontal
5	2488.29	41.41	8.02	54.00	12.59	167	204	Horizontal
6	2490.54	52.09	8.02	74.00	21.91	158	209	Horizontal



4.10.1.4 802.11B_ Highest Channel_ Vertical

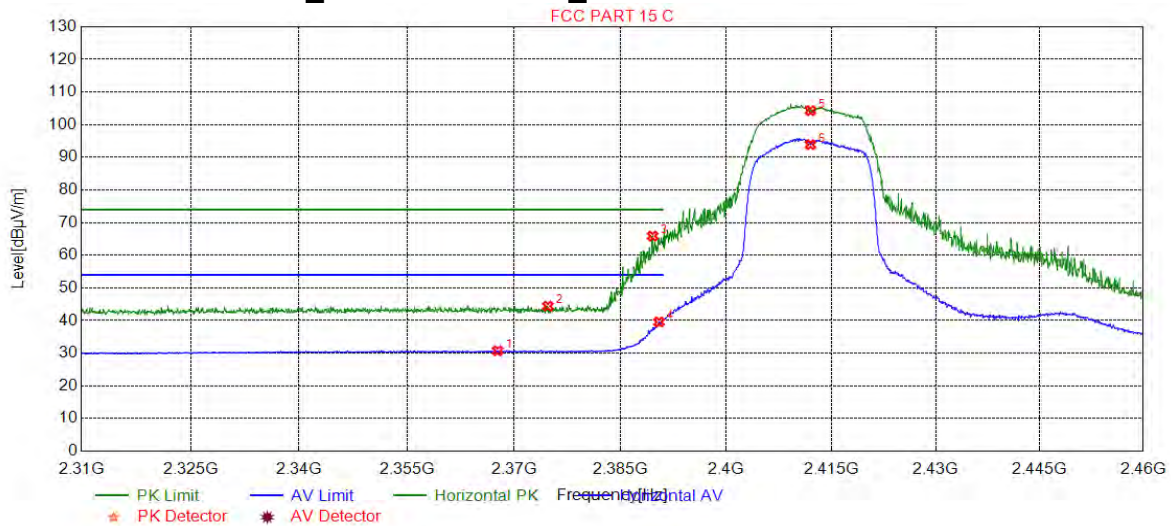


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	97.03	7.98	0.00	-97.03	193	220	Vertical
2	2462.00	87.06	7.98	0.00	-87.06	209	350	Vertical
3	2483.50	47.48	8.01	74.00	26.52	280	323	Vertical
4	2483.50	34.55	8.01	54.00	19.45	166	214	Vertical
5	2486.29	55.39	8.01	74.00	18.61	283	159	Vertical
6	2488.59	36.54	8.02	54.00	17.46	207	220	Vertical



4.10.1.5 802.11G_Lowest Channel_Horizontal



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2367.70	30.74	7.79	54.00	23.26	193	156	Horizontal
2	2374.75	44.44	7.79	74.00	29.56	131	117	Horizontal
3	2389.53	65.90	7.77	74.00	8.10	144	209	Horizontal
4	2390.44	39.57	7.77	54.00	14.43	119	215	Horizontal
5	2412.00	104.30	7.81	0.00	-104.30	221	209	Horizontal
6	2412.00	93.91	7.81	0.00	-93.91	225	215	Horizontal



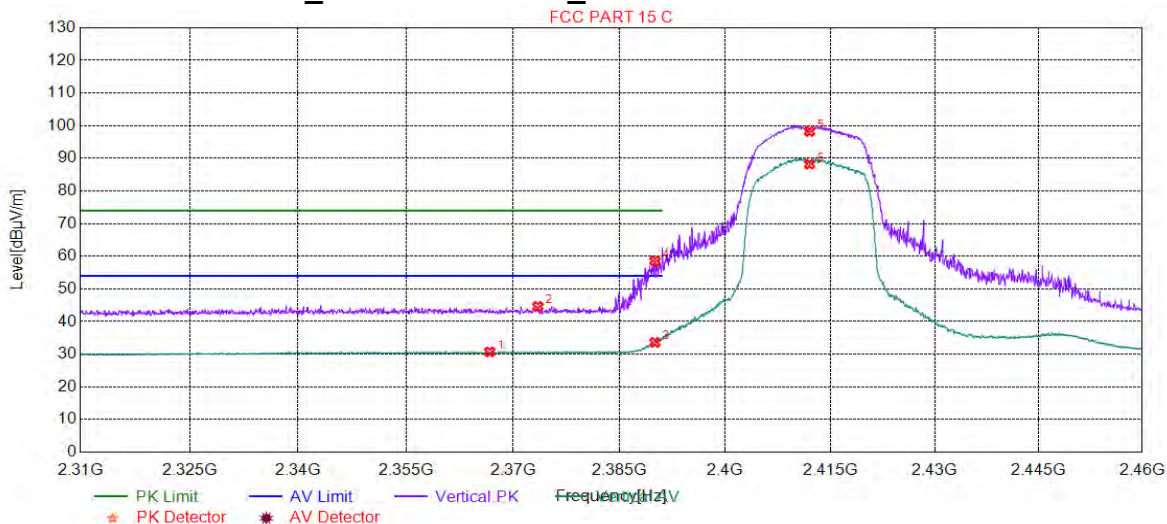
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4.10.1.6 802.11G_Lowest Channel_ Vertical

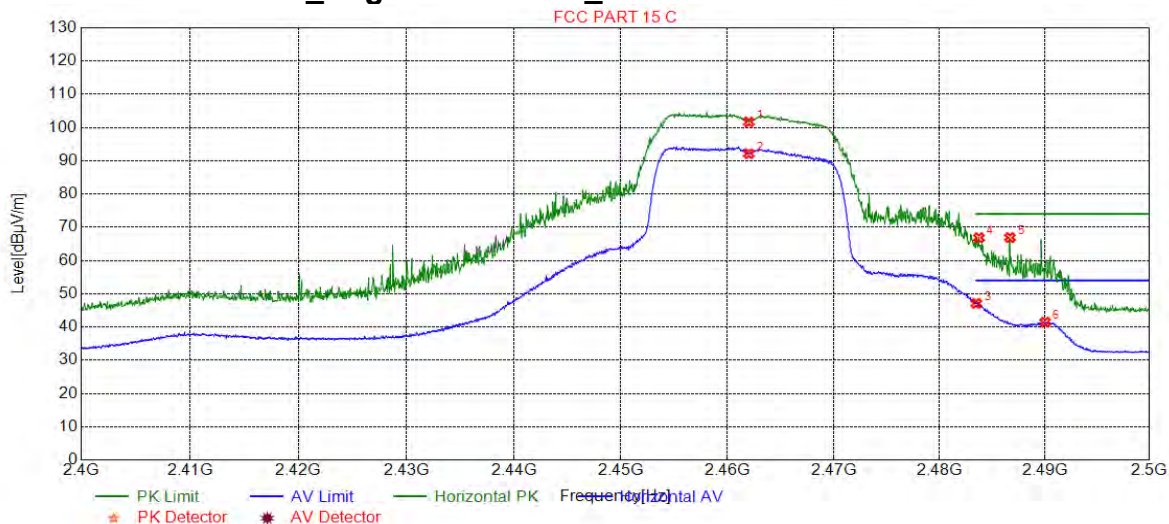


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2366.72	30.73	7.79	54.00	23.27	242	14	Vertical
2	2373.48	44.62	7.79	74.00	29.38	183	145	Vertical
3	2390.00	33.61	7.77	54.00	20.39	275	167	Vertical
4	2390.00	58.57	7.77	74.00	15.43	226	222	Vertical
5	2412.00	98.25	7.81	0.00	-98.25	199	329	Vertical
6	2412.00	88.24	7.81	0.00	-88.24	184	173	Vertical



4.10.1.7 802.11G_ Highest Channel_ Horizontal

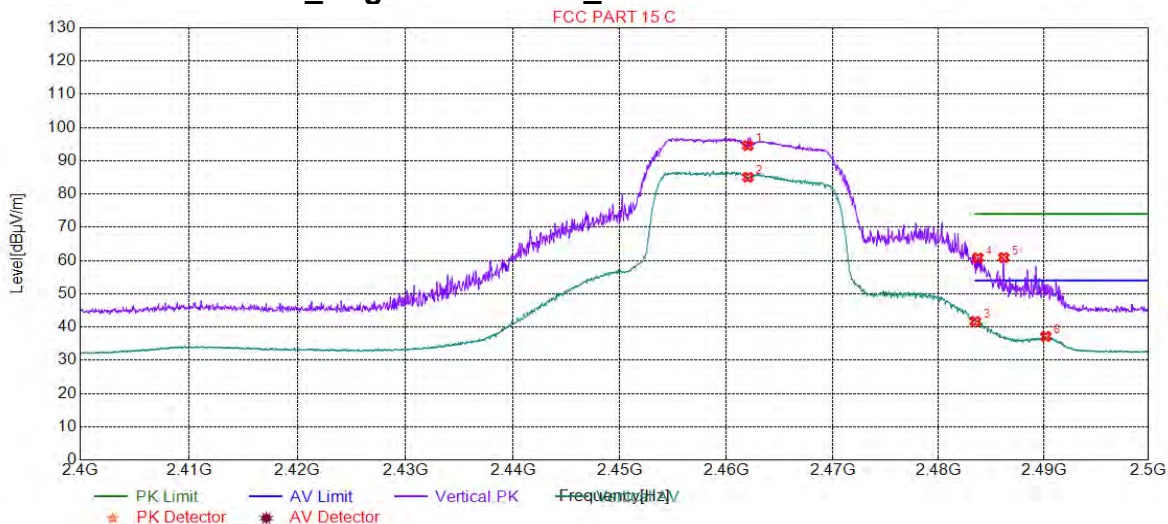


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	101.67	7.98	0.00	-101.67	206	205	Horizontal
2	2462.00	92.14	7.98	0.00	-92.14	175	210	Horizontal
3	2483.50	47.08	8.01	54.00	6.92	186	205	Horizontal
4	2483.74	66.86	8.01	74.00	7.14	111	205	Horizontal
5	2486.69	66.91	8.01	74.00	7.09	124	210	Horizontal
6	2490.04	41.46	8.02	54.00	12.54	194	210	Horizontal



4.10.1.8 802.11G_ Highest Channel_ Vertical

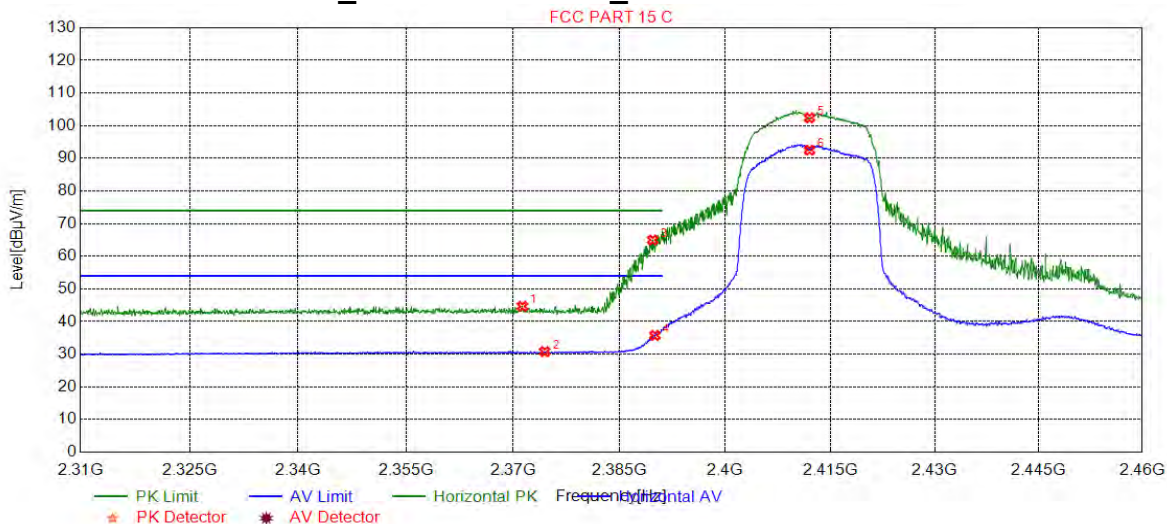


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	94.60	7.98	0.00	-94.60	299	226	Vertical
2	2462.00	85.05	7.98	0.00	-85.05	255	221	Vertical
3	2483.50	41.70	8.01	54.00	12.30	202	330	Vertical
4	2483.74	60.83	8.01	74.00	13.17	254	347	Vertical
5	2486.19	60.94	8.01	74.00	13.06	212	324	Vertical
6	2490.19	37.18	8.02	54.00	16.82	183	324	Vertical



4.10.1.9 802.11N20_ Lowest Channel_ Horizontal



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2371.30	44.68	7.79	74.00	29.32	174	266	Horizontal
2	2374.45	30.81	7.79	54.00	23.19	214	155	Horizontal
3	2389.68	64.99	7.77	74.00	9.01	104	211	Horizontal
4	2390.00	35.76	7.77	54.00	18.24	220	216	Horizontal
5	2412.00	102.42	7.81	0.00	-102.42	123	200	Horizontal
6	2412.00	92.51	7.81	0.00	-92.51	169	211	Horizontal



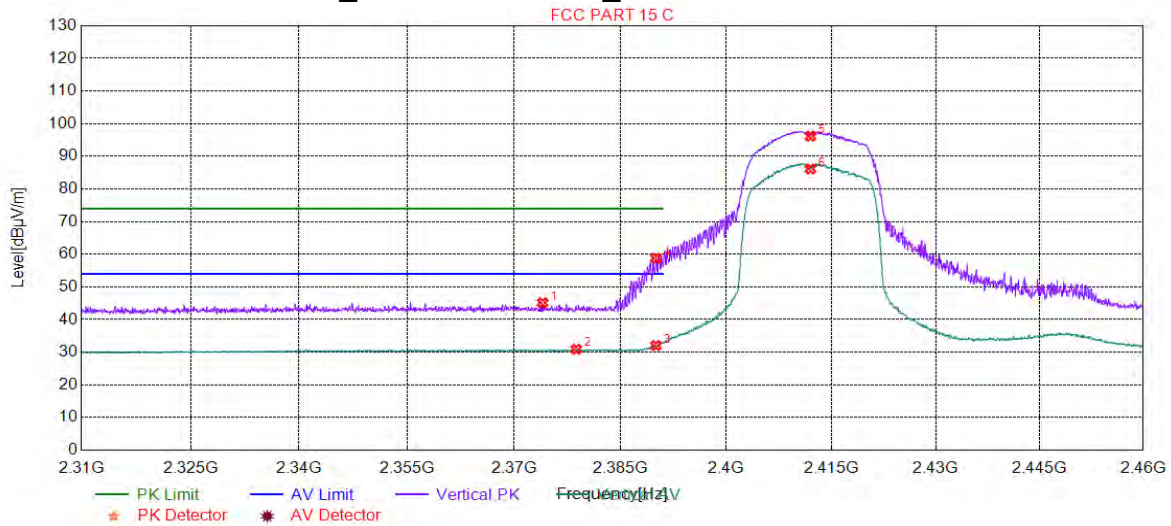
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4.10.1.10 802.11N20_Lowest Channel_Vertical

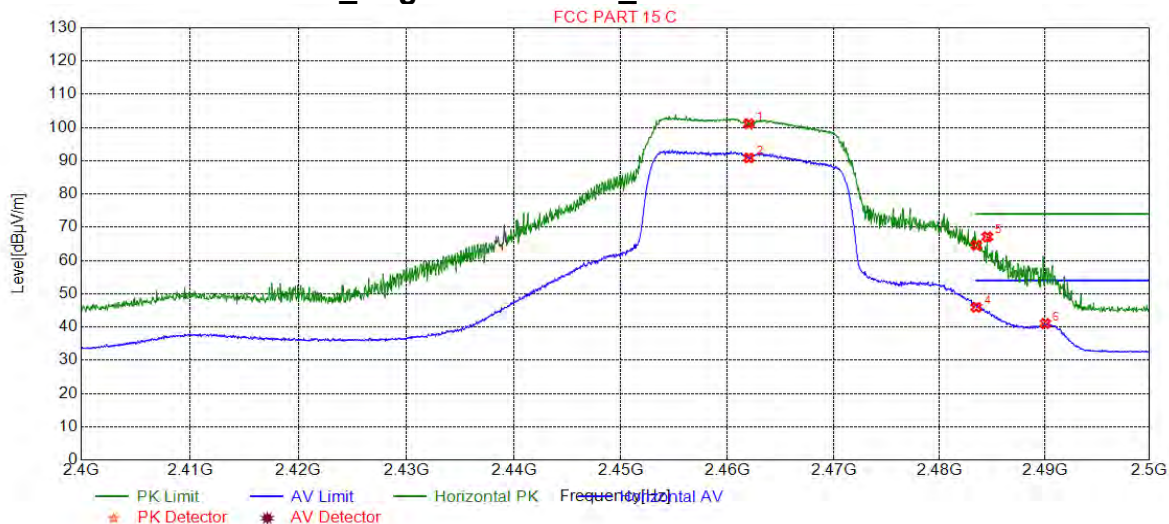


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2374.00	45.17	7.79	74.00	28.83	200	249	Vertical
2	2378.73	30.92	7.78	54.00	23.08	240	316	Vertical
3	2390.00	32.07	7.77	54.00	21.93	278	227	Vertical
4	2390.00	58.80	7.77	74.00	15.20	285	227	Vertical
5	2412.00	96.21	7.81	0.00	-96.21	220	353	Vertical
6	2412.00	86.14	7.81	0.00	-86.14	285	326	Vertical



4.10.1.11 802.11N20_ Highest Channel_ Horizontal

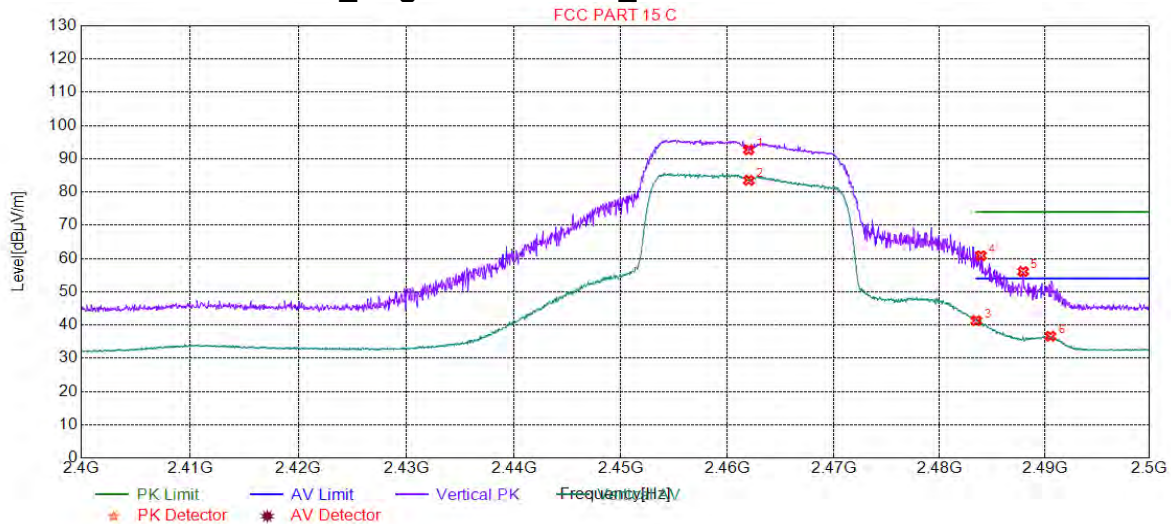


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	101.14	7.98	0.00	-101.14	204	204	Horizontal
2	2462.00	90.87	7.98	0.00	-90.87	212	209	Horizontal
3	2483.50	64.60	8.01	74.00	9.40	233	198	Horizontal
4	2483.50	45.95	8.01	54.00	8.05	233	209	Horizontal
5	2484.54	67.14	8.01	74.00	6.86	223	204	Horizontal
6	2490.04	41.06	8.02	54.00	12.94	226	209	Horizontal



4.10.1.12 802.11N20_ Highest Channel_ Vertical



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	92.66	7.98	0.00	-92.66	158	222	Vertical
2	2462.00	83.52	7.98	0.00	-83.52	162	222	Vertical
3	2483.50	41.32	8.01	54.00	12.68	181	325	Vertical
4	2483.94	60.90	8.01	74.00	13.10	279	330	Vertical
5	2487.94	56.11	8.02	74.00	17.89	296	347	Vertical
6	2490.54	36.65	8.02	54.00	17.35	248	325	Vertical

Remark:

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

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





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

Lab A:

No.	Item	Measurement Uncertainty
1	Total RF power, conducted	$\pm 0.75\text{dB}$
2	RF power density, conducted	$\pm 2.84\text{dB}$
3	Spurious emissions, conducted	$\pm 0.75\text{dB}$
4	Temperature test	$\pm 1^{\circ}\text{C}$
5	Humidity test	$\pm 3\%$
6	DC and low frequency voltages	$\pm 0.5\%$

Lab B:

No.	Item	Measurement Uncertainty
1	Conduction Emission	$\pm 3.0\text{dB}$ (150kHz to 30MHz)
2	Radiated Emission	$\pm 4.8\text{dB}$ (Below 1GHz)
		$\pm 4.8\text{dB}$ (1GHz to 6GHz)
		$\pm 4.5\text{dB}$ (6GHz to 18GHz)
		$\pm 5.02\text{dB}$ (Above 18GHz)





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	2021/7/14
				2019/7/16	2020/7/15
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	2020/7/15	2021/7/14
				2019/7/16	2020/7/15
Temperature Chamber	GIANT FORCE	ICT-150-40-CP-AR	W027-03	2019/10/27	2020/10/27
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2020/7/15	2021/7/14
				2019/7/16	2020/7/15

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/2020/70004.

The End



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