



FCC TEST REPORT

Application No: ZR/2020/90059
Applicant: Nauto
Address of Applicant: 220 Portage Avenue, Palo Alto, California 94306
Manufacturer: Nauto
Address of Manufacturer: 220 Portage Avenue, Palo Alto, California 94306
EUT Description: In-vehicle Camera
Model No.: Nauto 3-1
Trade Mark: Nauto
FCC ID: 2AKJ5-N31
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: 2020/10/27
Date of Test: 2020/10/27 to 2020/11/23
Date of Issue: 2021/5/13

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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Shenzhen Branch (SGS-CSTC Laboratory)

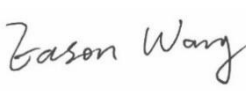
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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2020/11/23		Original
02		2021/5/13	Eason Wang	1. Add test site Information 2. Update equipment list

*This test report supersedes the original report (report No.: ZR/2020/9005902, issue date: 2020-11-23), original report shall be invalid.

Authorized for issue by:		
Prepared By		(Eason Wang) /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

Remark: 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:	Nauto
Address of Applicant:	220 Portage Avenue, Palo Alto, California 94306
Manufacturer:	Nauto
Address of Manufacturer:	220 Portage Avenue, Palo Alto, California 94306

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.

• FCC-Designation Number: CN1271



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3.4 General Description of EUT

EUT Description::	In-vehicle Camera
Model No.:	Nauto 3-1
Trade Mark:	Nauto
Hardware Version:	N3V8-NA
Software Version:	NautoN3_Shipping_U82_202010230751_SECURED
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 $f_c = 2407 \text{ MHz} + N * 5 \text{ MHz}$, where: - f_c = "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 IEEE for 802.11N(HT40) : 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:	-1.0dBi
Power Supply	☒ DC; ☐ 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		
Operation Frequency of each channel (802.11N HT40)							
Channel	Frequency	Channel	Frequency	Channel	Frequency		
3	2422MHz	6	2437MHz	9	2452MHz		
4	2427MHz	7	2442MHz				
5	2432MHz	8	2447MHz				



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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)	Frequency for 802.11N (HT40)
The Lowest channel	2412MHz	2422MHz
The Middle channel	2437MHz	2437MHz
The Highest channel	2462MHz	2452MHz

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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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 -1.0dBi.	



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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.		

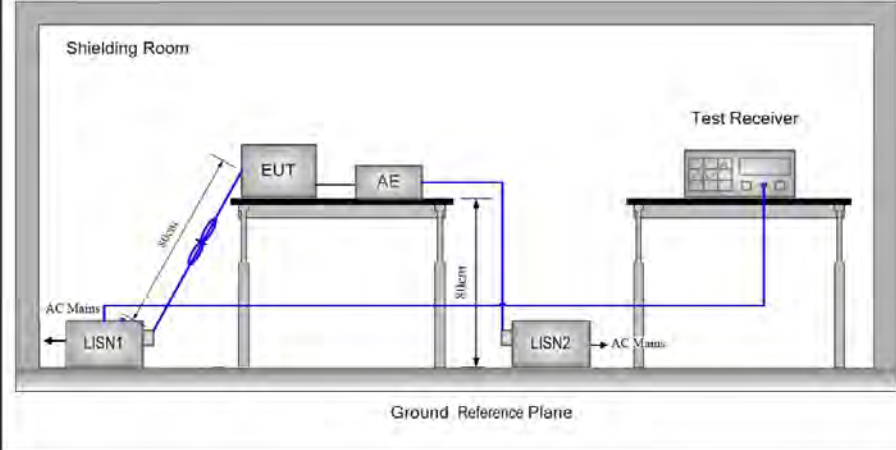


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Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates at lowest, middle and highest channel. Charge + Transmitting mode.
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate of 802.11B at lowest channel is the 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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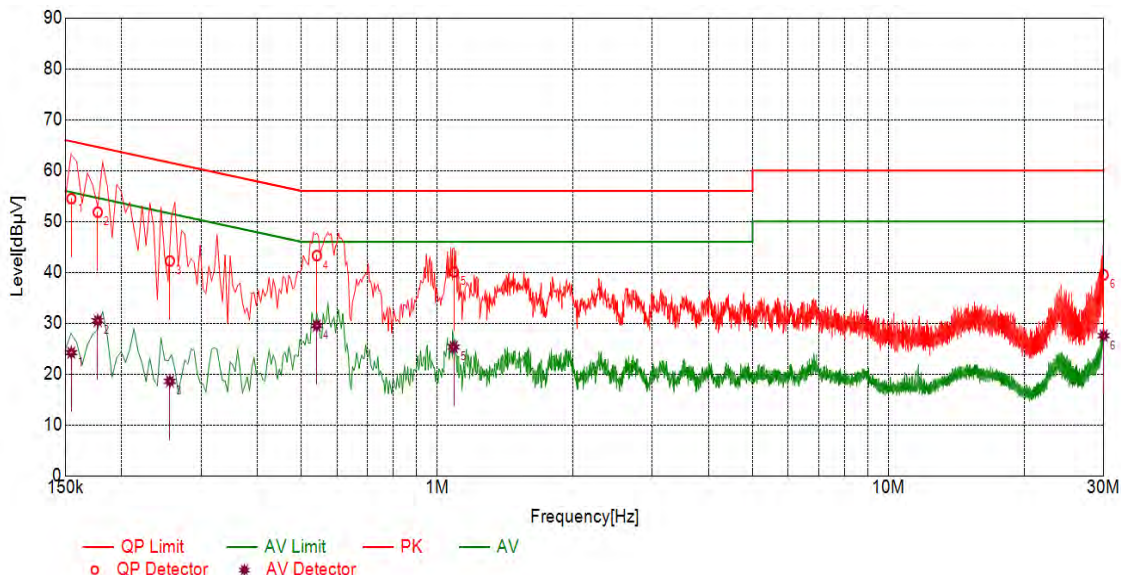


Measurement Data

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	0.1547	10.10	54.47	65.74	11.27	24.20	55.74	31.54	L
2	0.1770	10.10	51.81	64.63	12.82	30.49	54.63	24.14	L
3	0.2559	10.10	42.22	61.56	19.34	18.58	51.56	32.98	L
4	0.5414	10.10	43.29	56.00	12.71	29.52	46.00	16.48	L
5	1.0892	10.10	40.10	56.00	15.90	25.31	46.00	20.69	L
6	29.9989	10.11	39.50	60.00	20.50	27.56	50.00	22.44	L



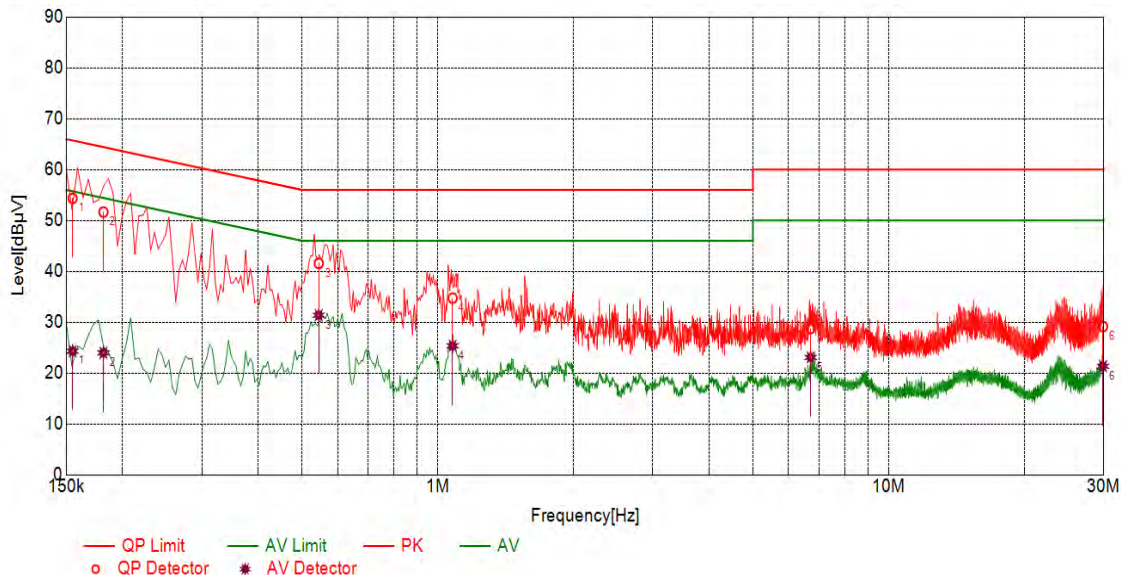
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Neutral Line:



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	0.1550	10.10	54.34	65.73	11.39	24.31	55.73	31.42	N
2	0.1814	10.10	51.64	64.42	12.78	23.97	54.42	30.45	N
3	0.5448	10.10	41.56	56.00	14.44	31.38	46.00	14.62	N
4	1.0792	10.10	34.74	56.00	21.26	25.36	46.00	20.64	N
5	6.7154	10.10	28.78	60.00	31.22	23.07	50.00	26.93	N
6	29.8904	10.11	29.15	60.00	30.85	21.34	50.00	28.66	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.



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4.3 Duty Cycle

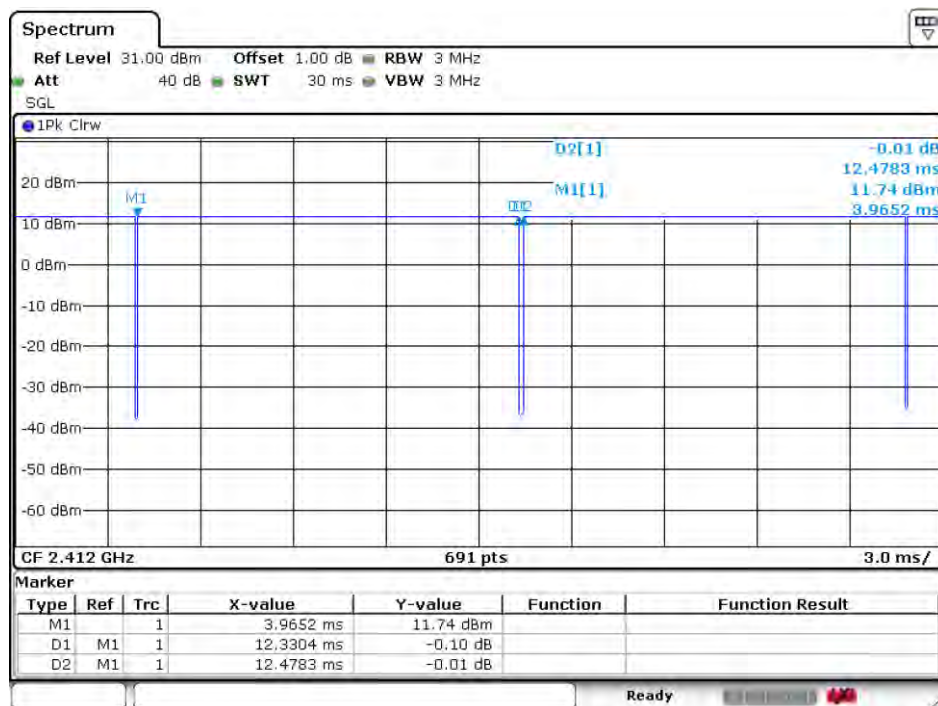
4.3.1 Test Results

Test Mode	TX Freq. [MHz]	Duty cycle [%]
11B	Ant 1: CH1,CH6,CH11	98.81
11G	Ant 1: CH1,CH6,CH11	98.33
11N20	Ant 1: CH1,CH6,CH11	96.89
11N40	Ant 1: CH3,CH6,CH9	94.74

4.3.1 Test Plots

4.3.1.1 ANT1

4.3.1.1.1 11B



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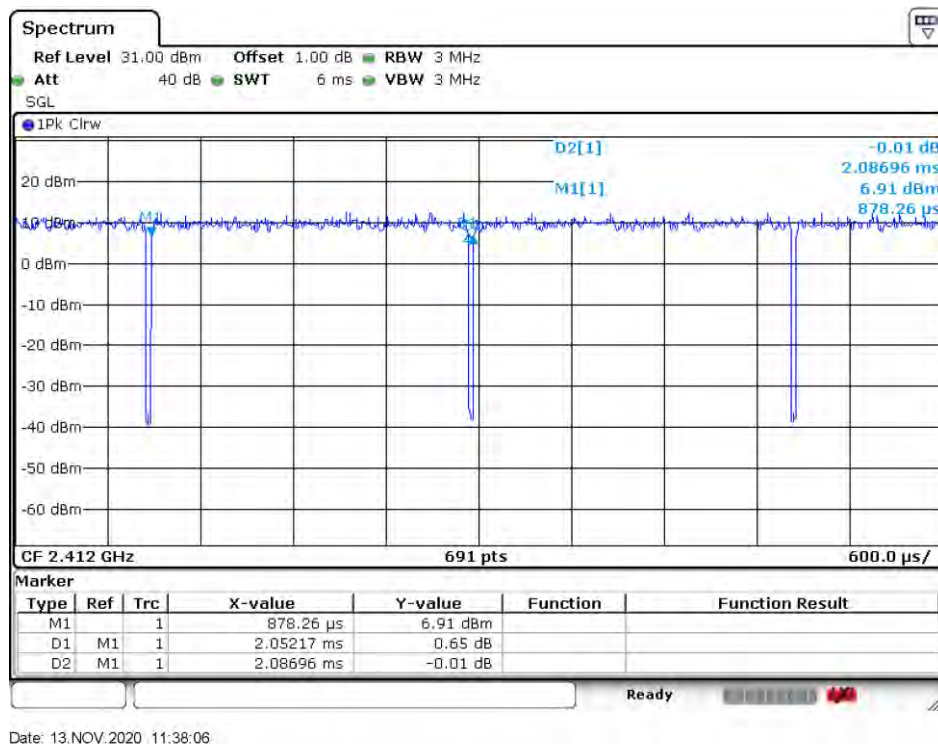


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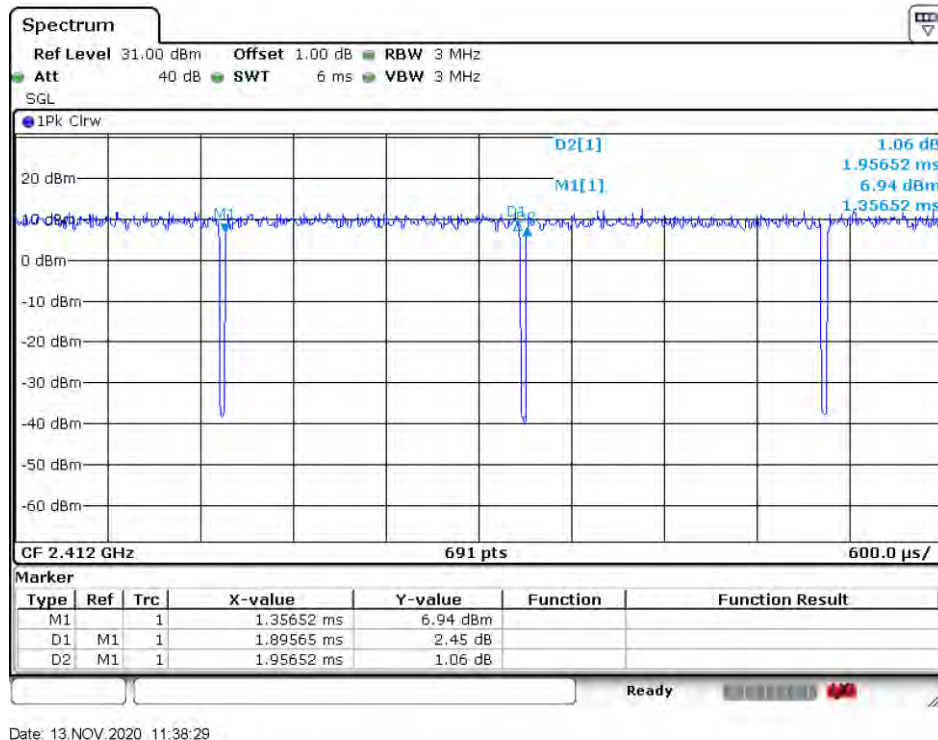
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4.3.1.1.2 11G



4.3.1.1.3 11N20



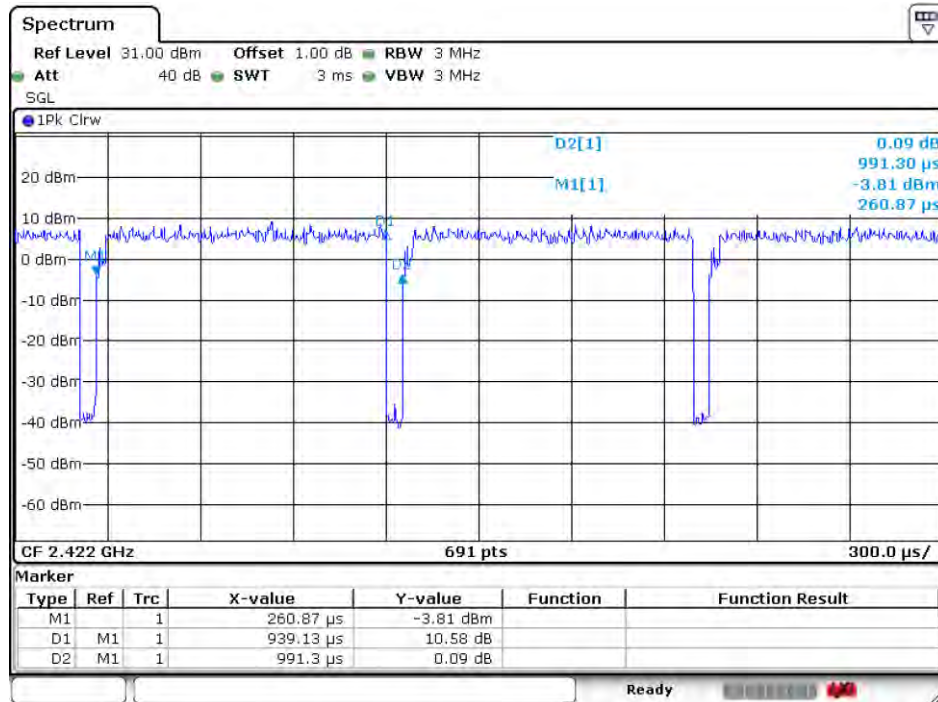
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4.3.1.1.4 11N40



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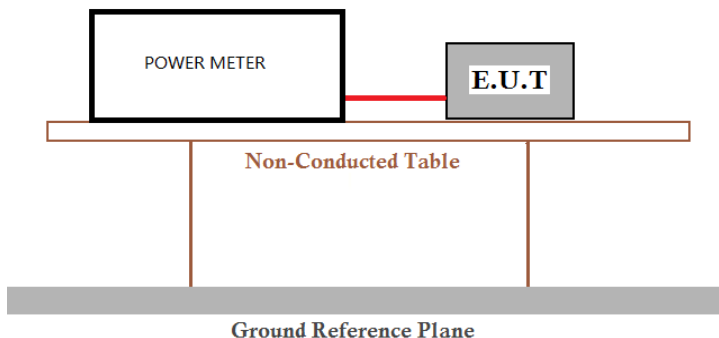
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4.4 Conducted Output Power

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); 13.5Mbps of rate is the worst case of 802.11N(HT40).
Limit:	30dBm
Test Results:	Pass



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4.4.1 Test Results

Mode	Test Channel	Peak Output Power (dBm)	Limit (dBm)	Result
802.11B	Lowest	15.62	30.00	Pass
	Middle	15.77	30.00	Pass
	Highest	16.05	30.00	Pass
802.11G	Lowest	12.98	30.00	Pass
	Middle	12.91	30.00	Pass
	Highest	13.20	30.00	Pass
802.11N20	Lowest	11.55	30.00	Pass
	Middle	11.89	30.00	Pass
	Highest	12.06	30.00	Pass
802.11N40	Lowest	11.63	30.00	Pass
	Middle	11.79	30.00	Pass
	Highest	11.95	30.00	Pass



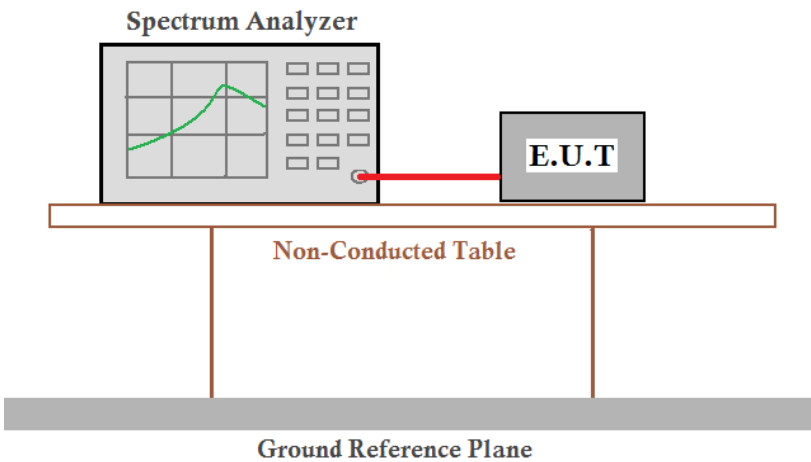
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4.5 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth

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:	
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); 13.5Mbps of rate is the worst case of 802.11N(HT40).
Limit:	≥ 500 kHz
Test Results:	Pass

4.5.1 Test Results

Mode	Test Channel	Occupied Bandwidth (MHz)	6dB Emission Bandwidth (MHz)	Limit (kHz)	Result
802.11B	Lowest	13.81	9.03	≥500	Pass
	Middle	13.76	9.03	≥500	Pass
	Highest	13.76	8.51	≥500	Pass
802.11G	Lowest	16.71	15.93	≥500	Pass
	Middle	16.76	15.89	≥500	Pass
	Highest	16.71	15.89	≥500	Pass
802.11N20	Lowest	17.89	16.28	≥500	Pass
	Middle	17.89	16.89	≥500	Pass
	Highest	17.89	16.32	≥500	Pass
802.11N40	Lowest	36.30	36.30	≥500	Pass
	Middle	36.30	35.97	≥500	Pass
	Highest	36.21	35.64	≥500	Pass



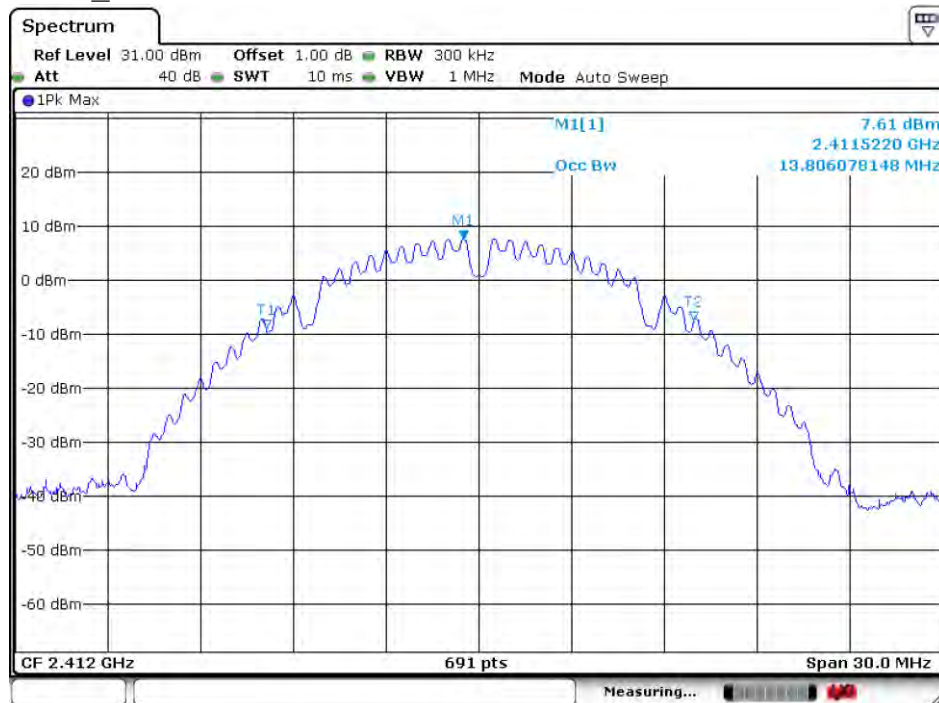
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4.5.2 Test plots

4.5.2.1 ANT1

4.5.2.1.1 802.11B_Lowest Channel



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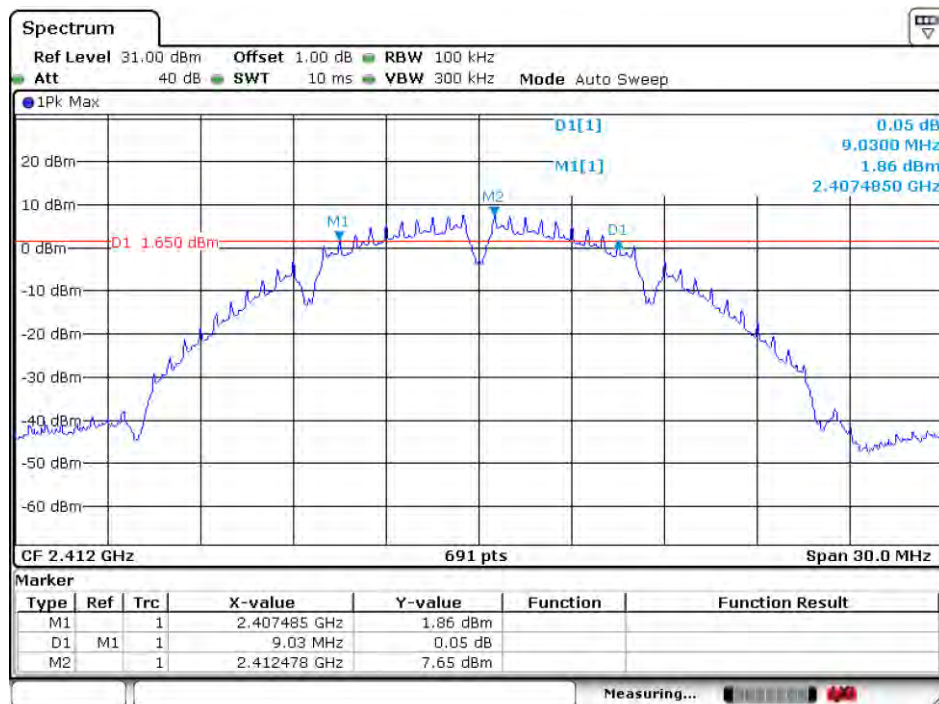


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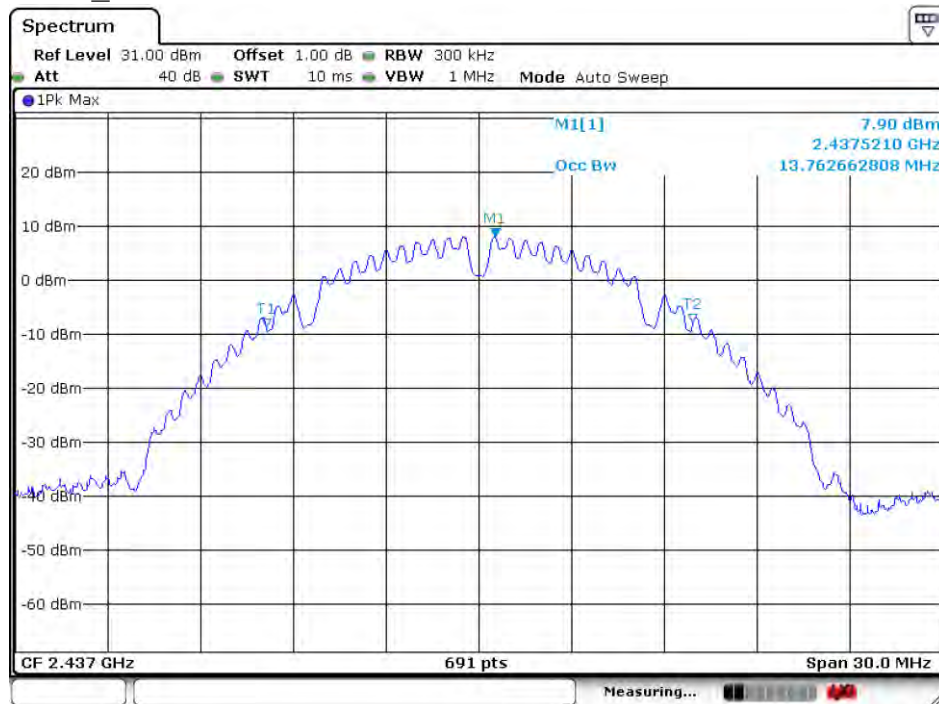
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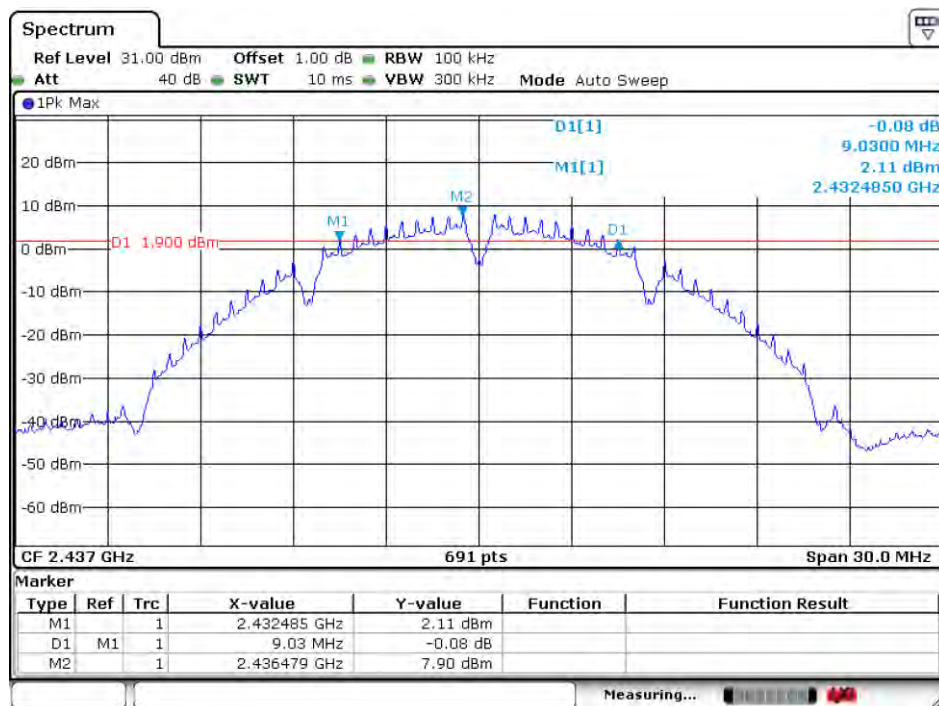
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4.5.2.1.2 802.11B_ Middle Channel



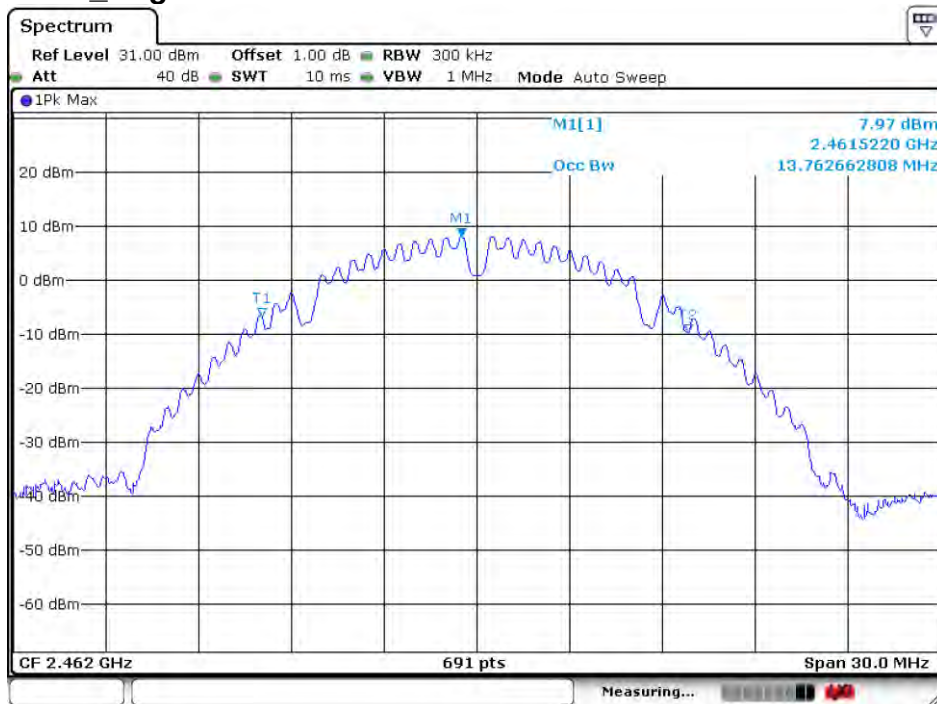
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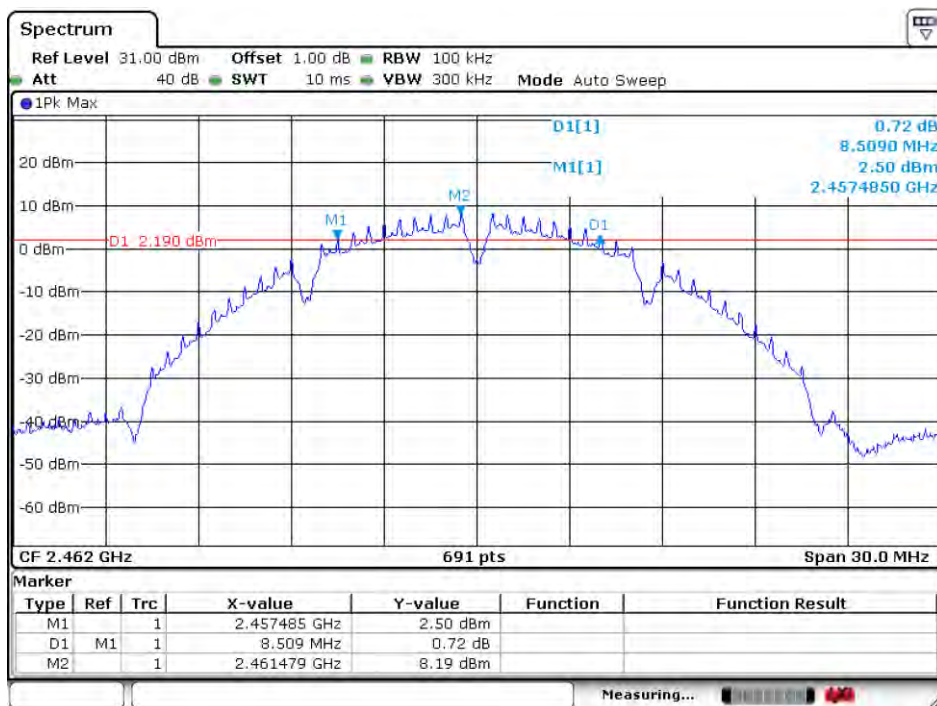
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4.5.2.1.3 802.11B_Highest Channel



Date: 13 NOV 2020 10:45:18



Date: 13.NOV.2020 10:15:07



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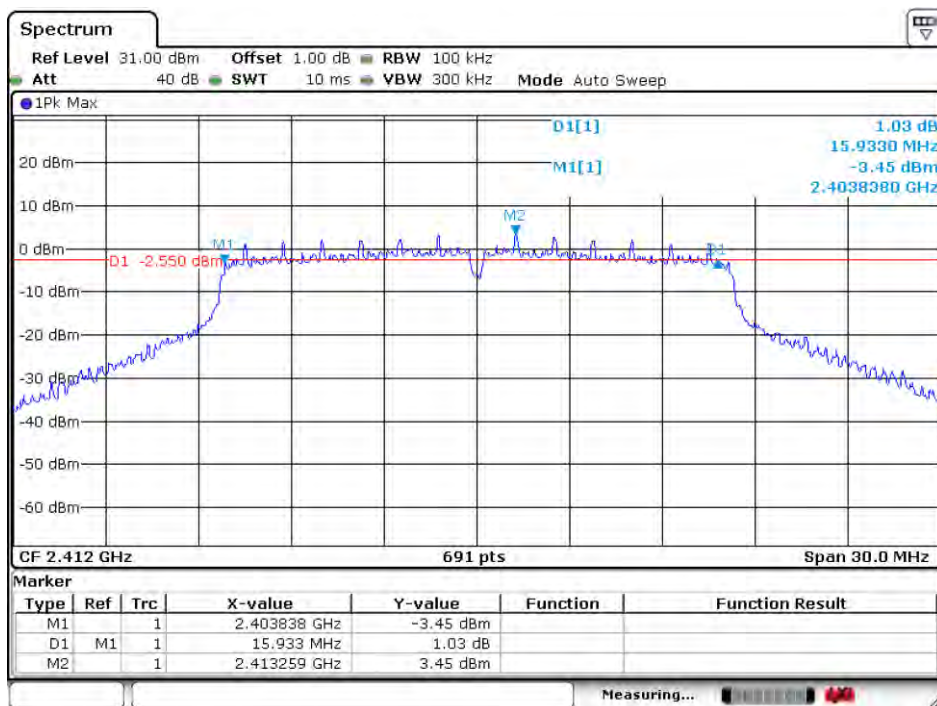
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4.5.2.1.4 802.11G Lowest Channel



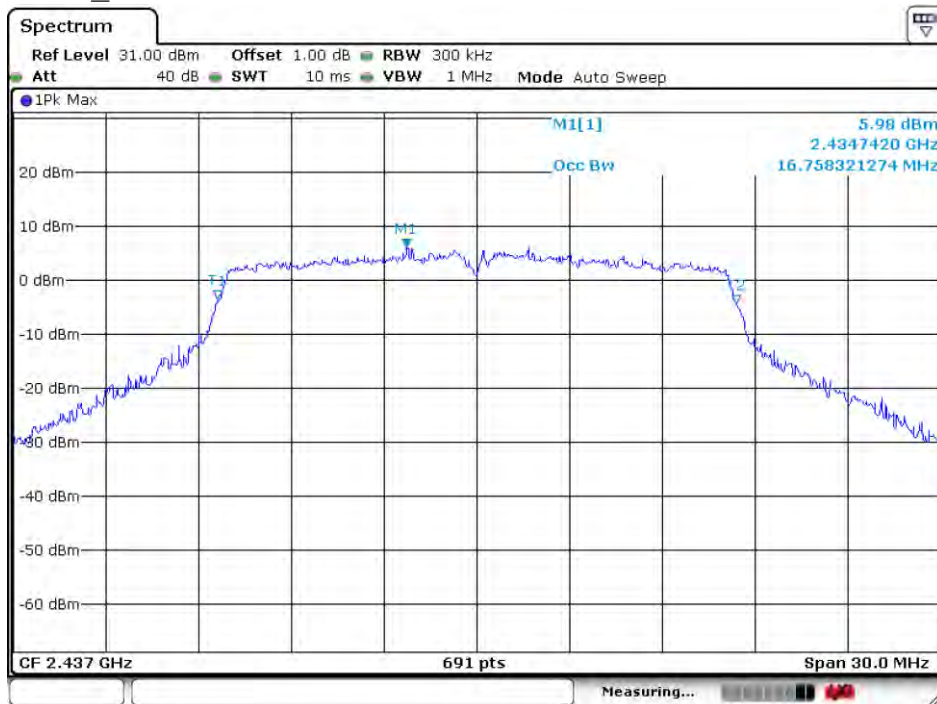
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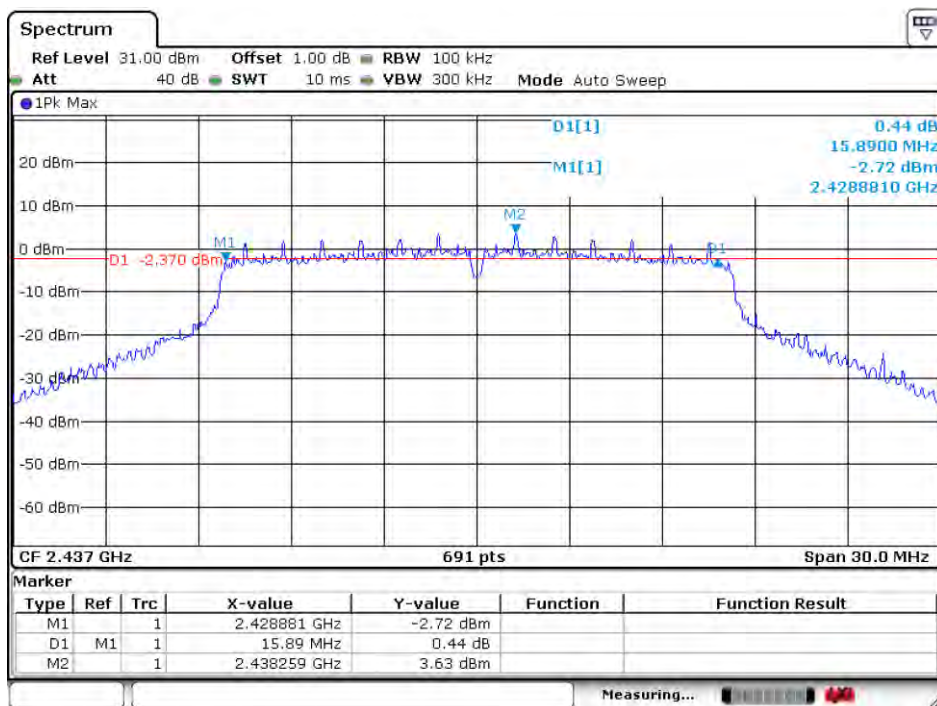
Date: 13.NOV.2020 10:23:24



4.5.2.1.5 802.11G_Middle Channel



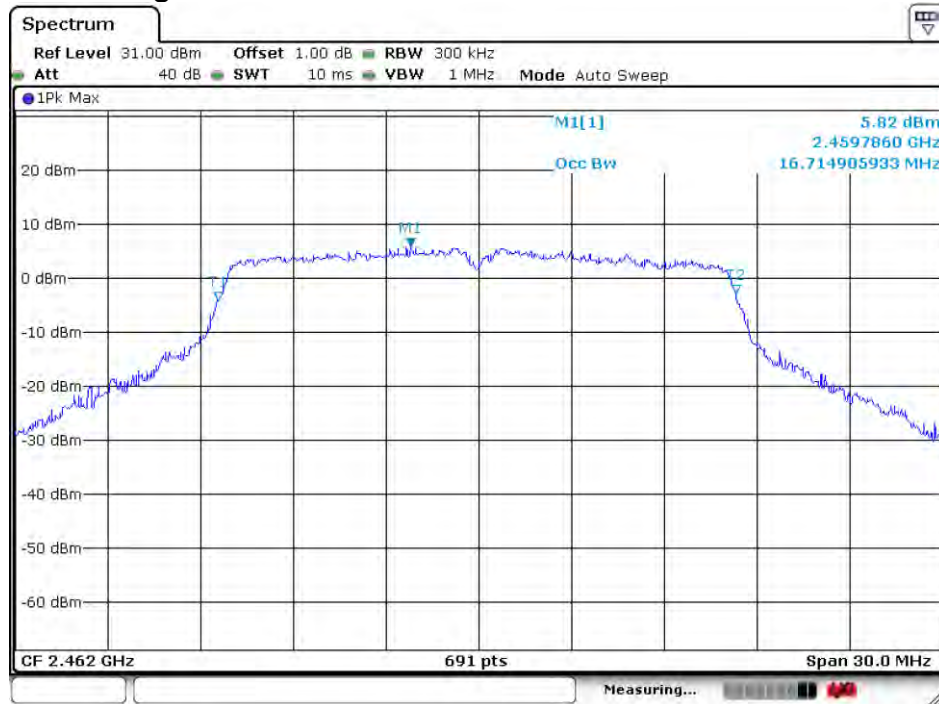
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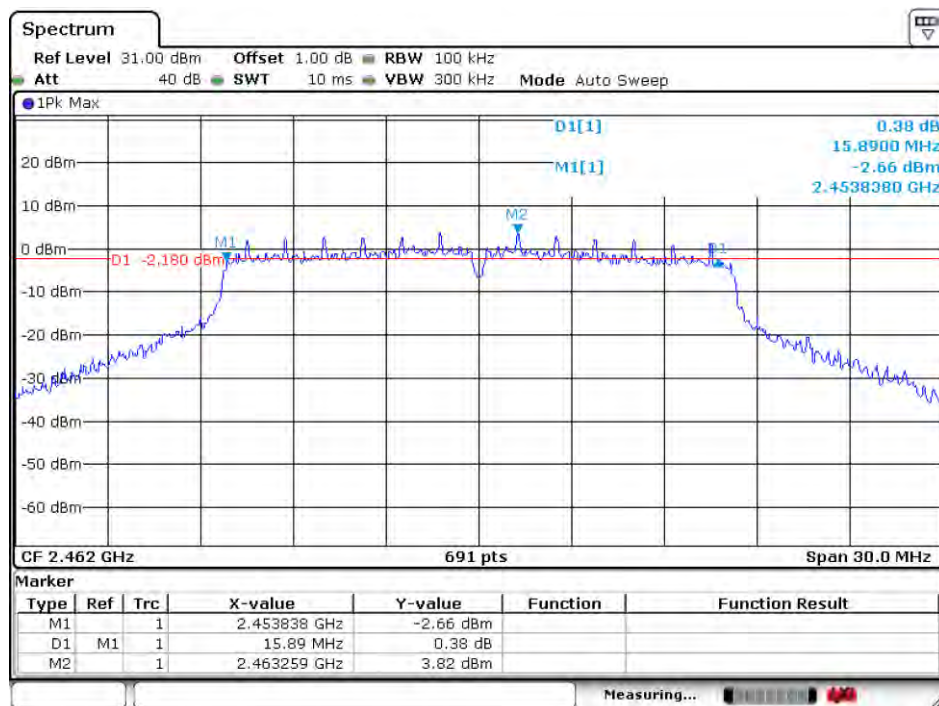
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4.5.2.1.6 802.11G_Highest Channel



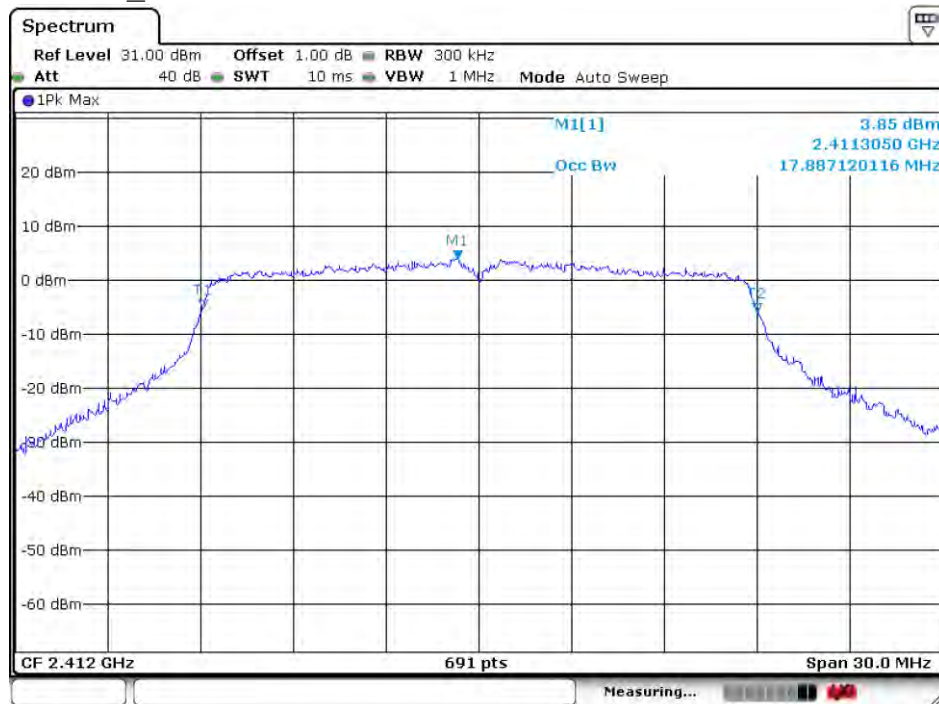
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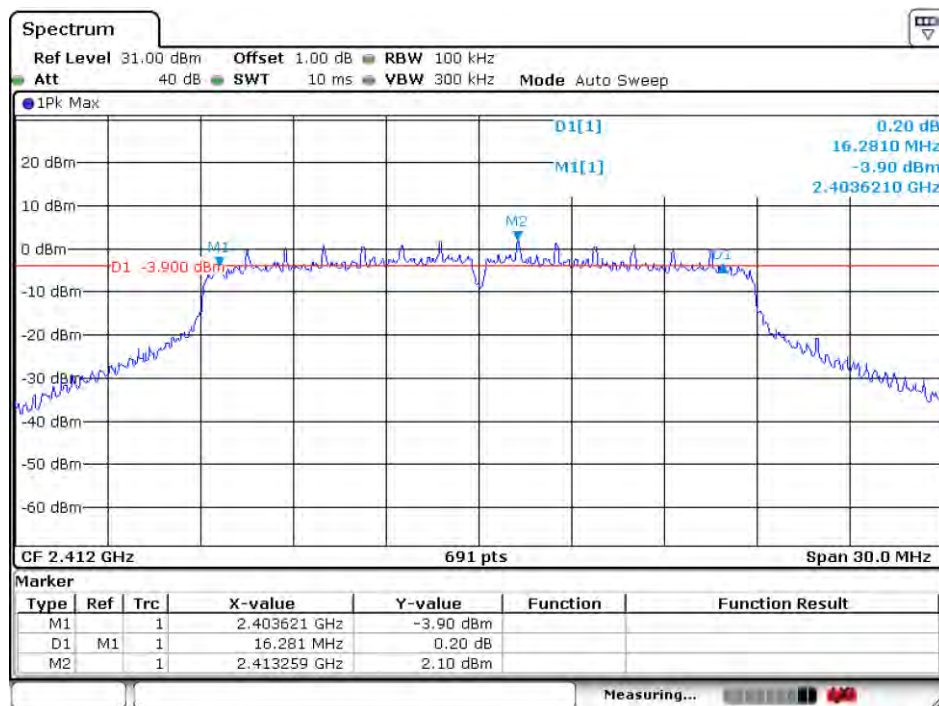
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4.5.2.1.7 802.11N20 Lowest Channel



Date: 13.NOV.2020 10:59:33



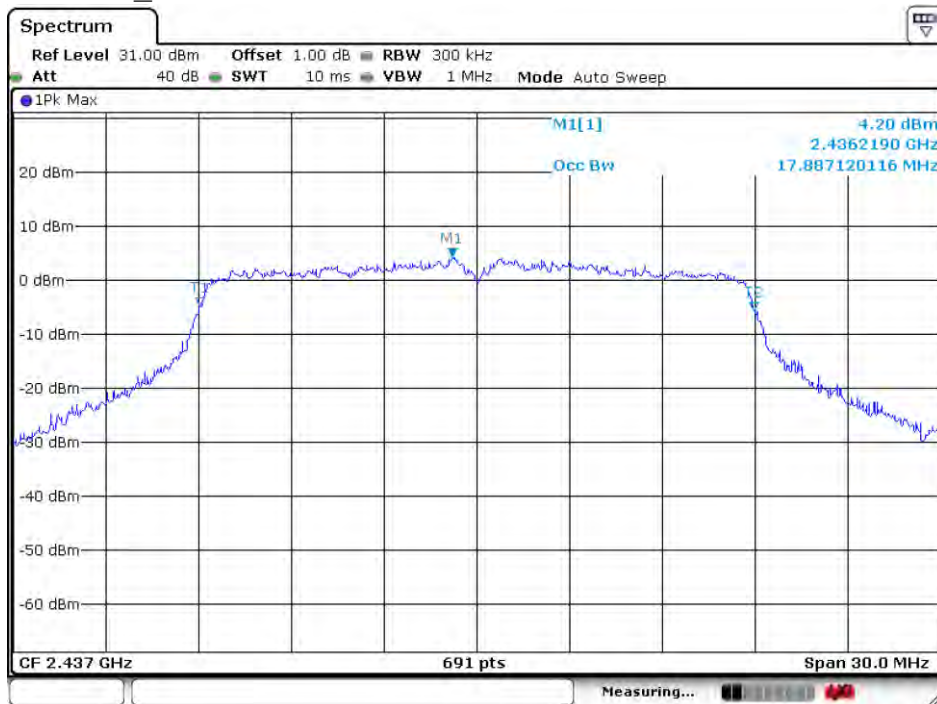
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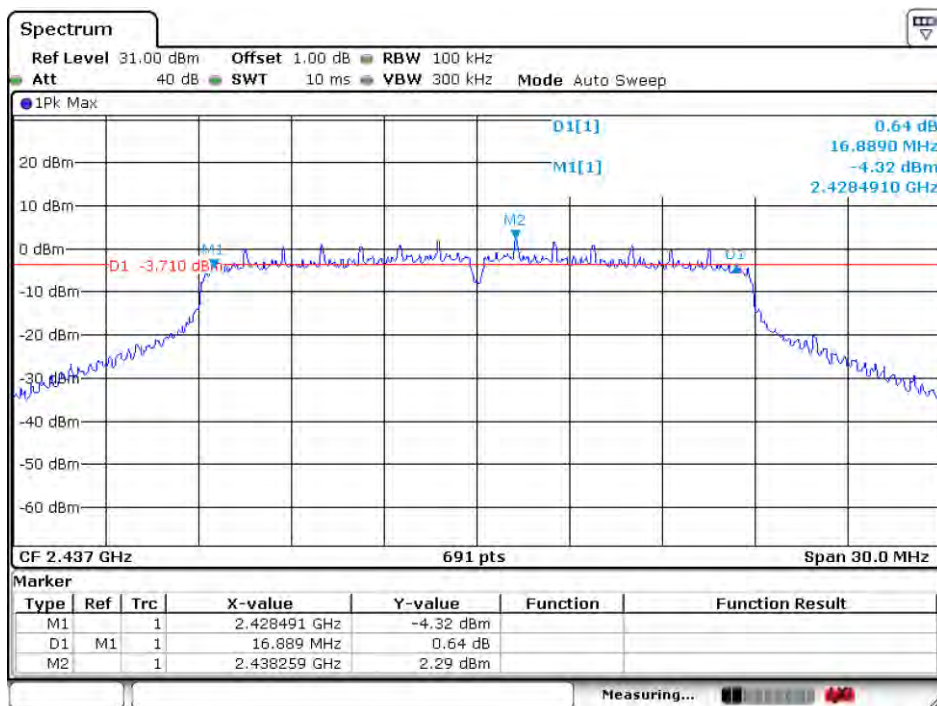
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4.5.2.1.8 802.11 N20_ Middle Channel



Date: 13.NOV.2020 10:59:55



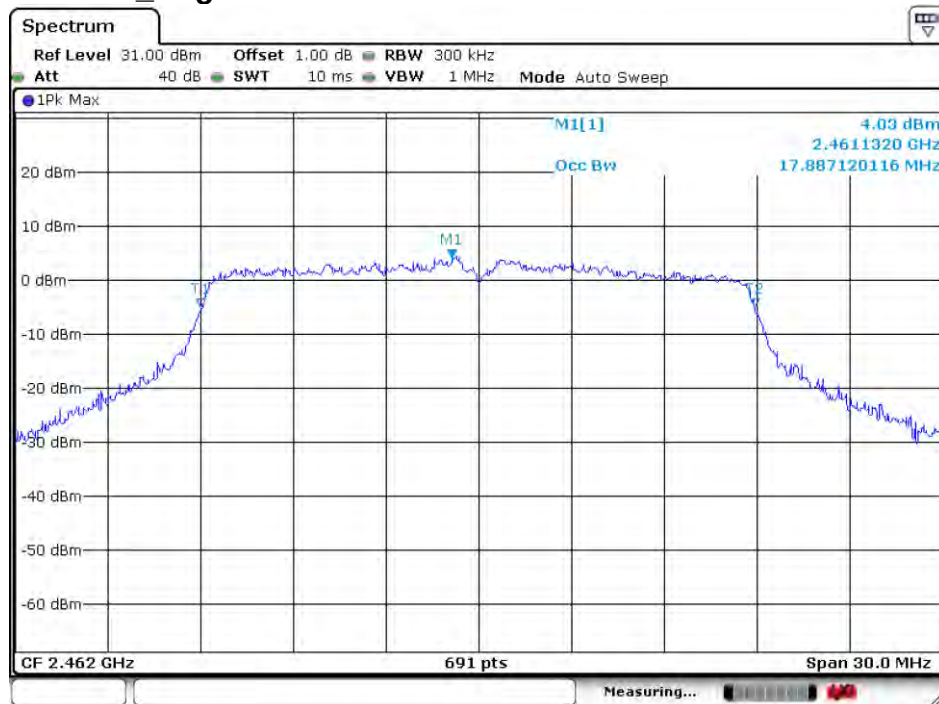
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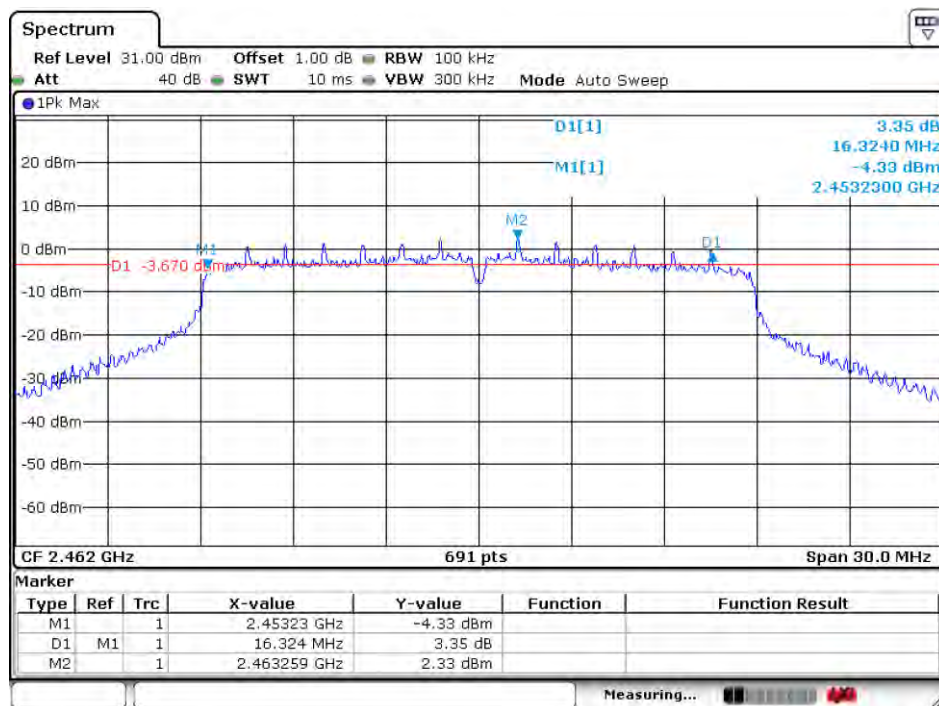
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4.5.2.1.9 802.11 N20_ Highest Channel



Date: 13.NOV.2020 11:00:07



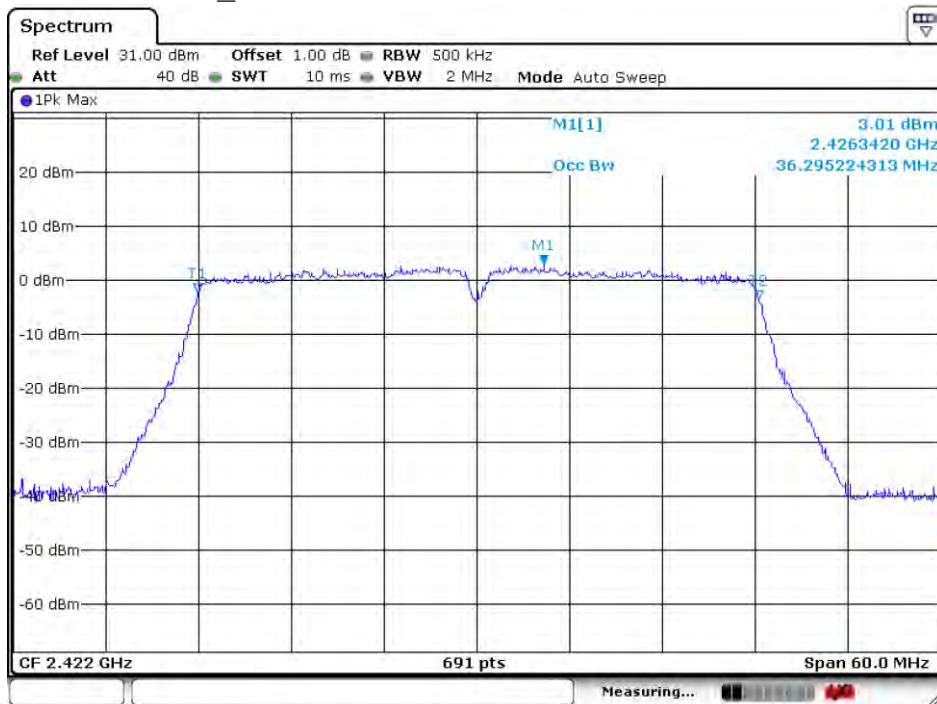
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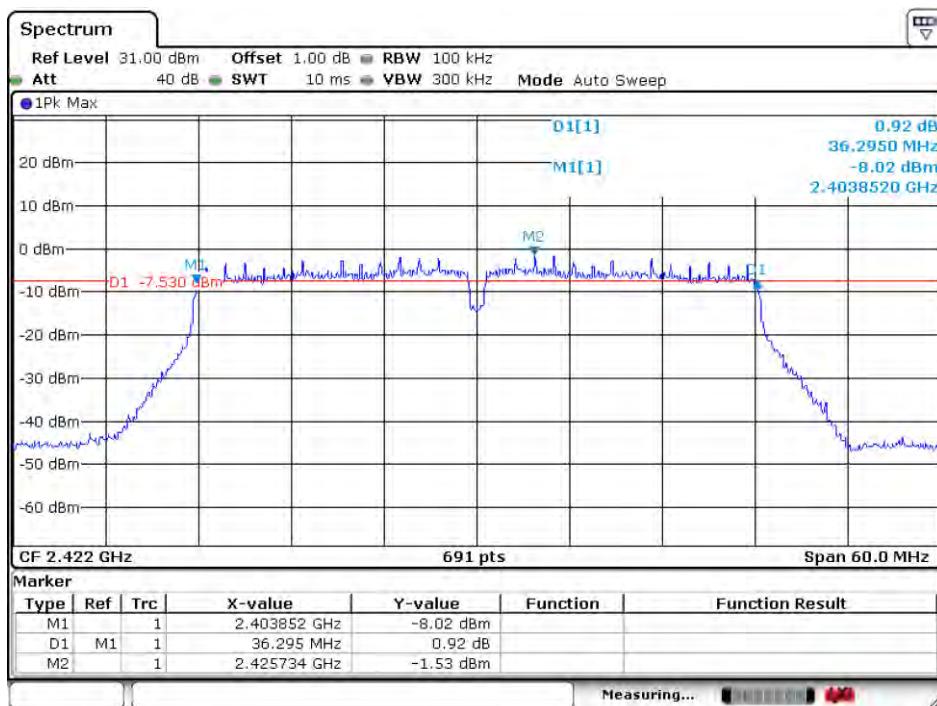
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4.5.2.1.10 802.11N40_Lowest Channel



Date: 13.NOV.2020 11:00:48



Date: 13.NOV.2020 10:38:25

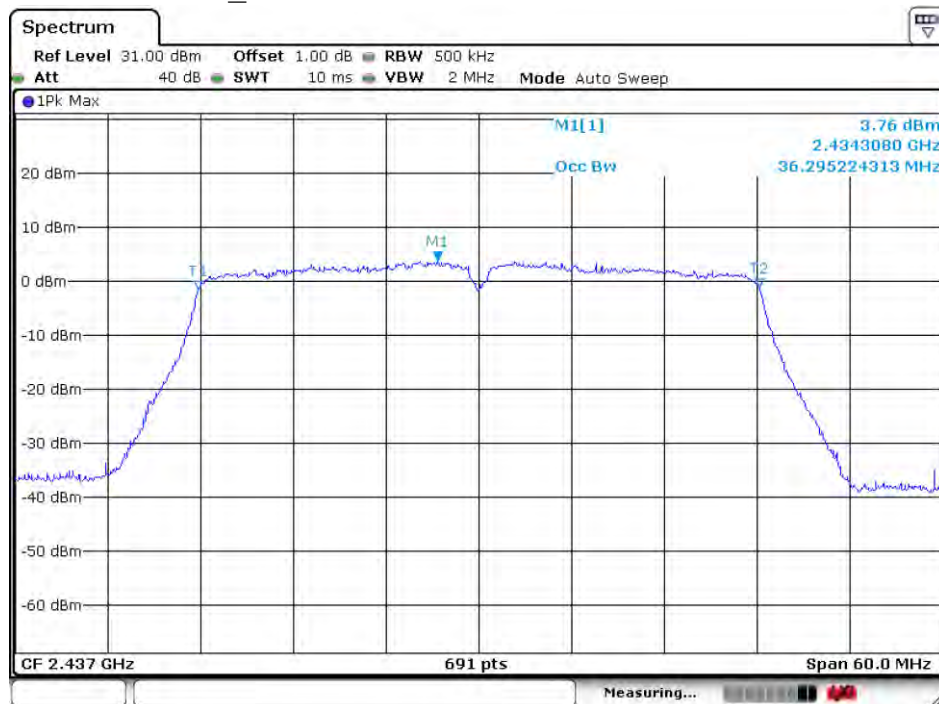


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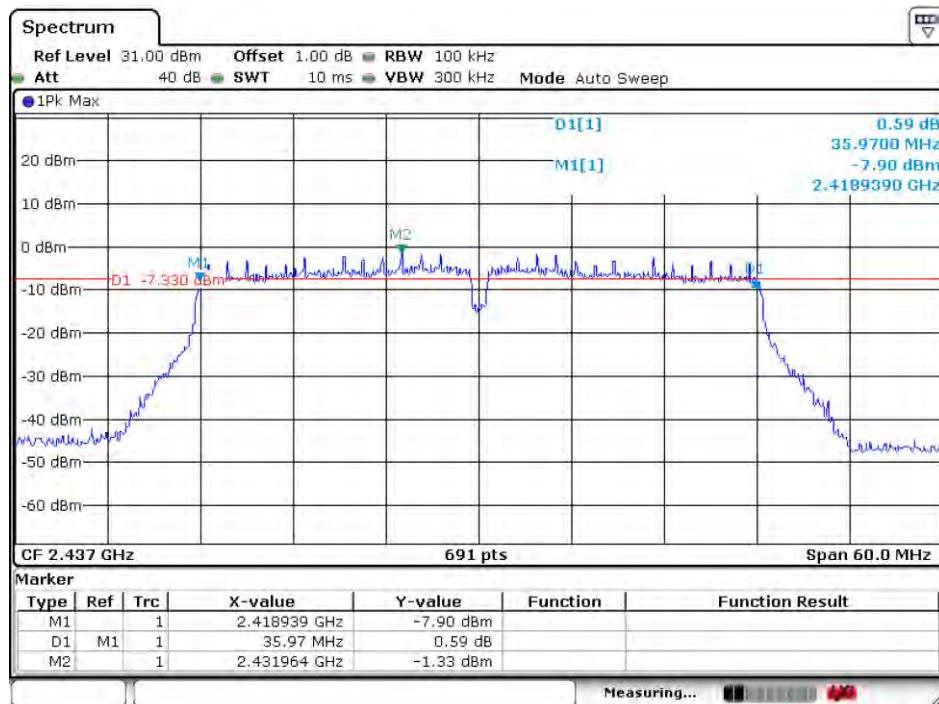
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4.5.2.1.11 802.11 N40_ Middle Channel



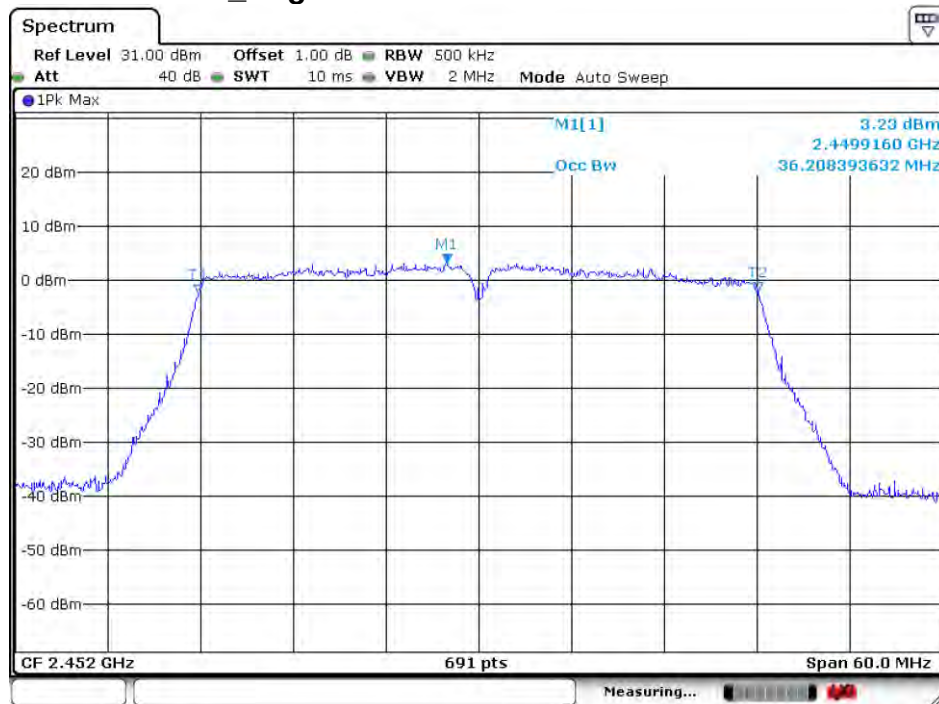
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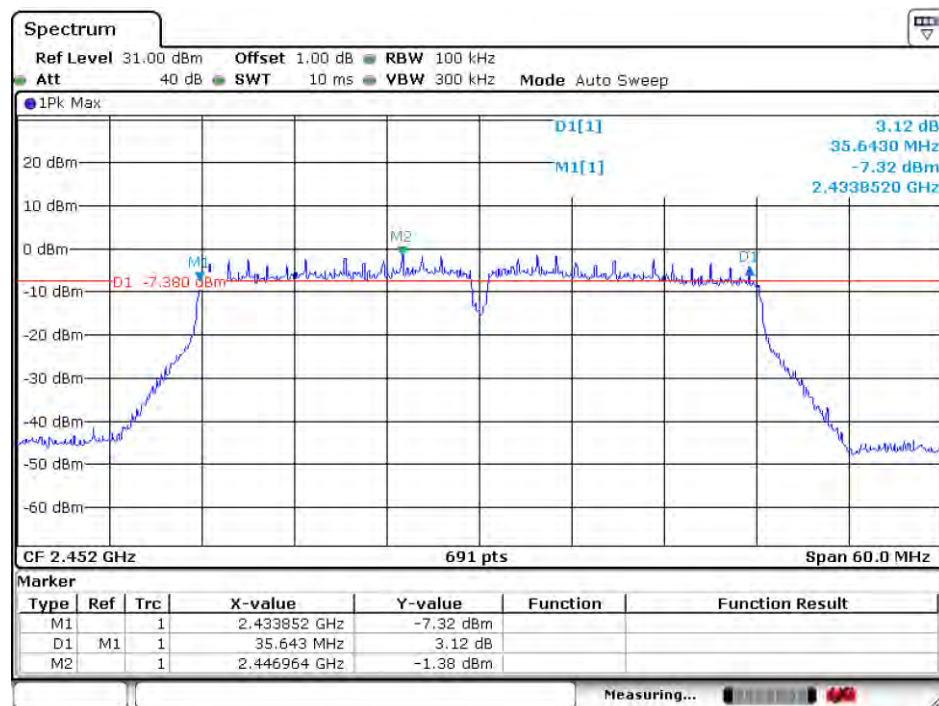
Date: 13.NOV.2020 10:38:58



4.5.2.1.12 802.11 N40_ Highest Channel



Date: 13.NOV.2020 11:02:42



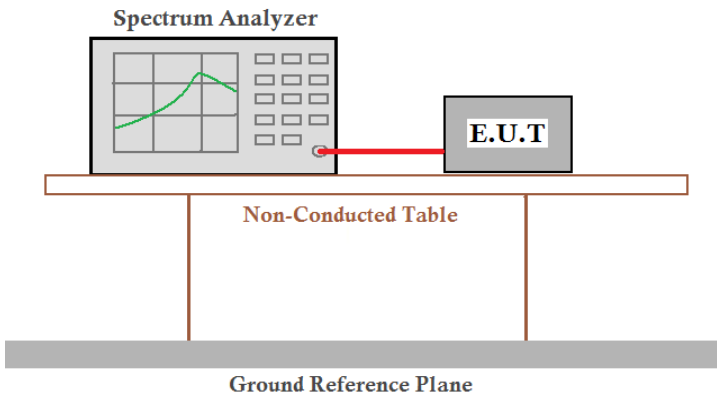
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4.6 Power Spectral Density

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); 13.5Mbps of rate is the worst case of 802.11N(HT40).
Limit:	≤8.00dBm/3kHz
Test Results:	Pass

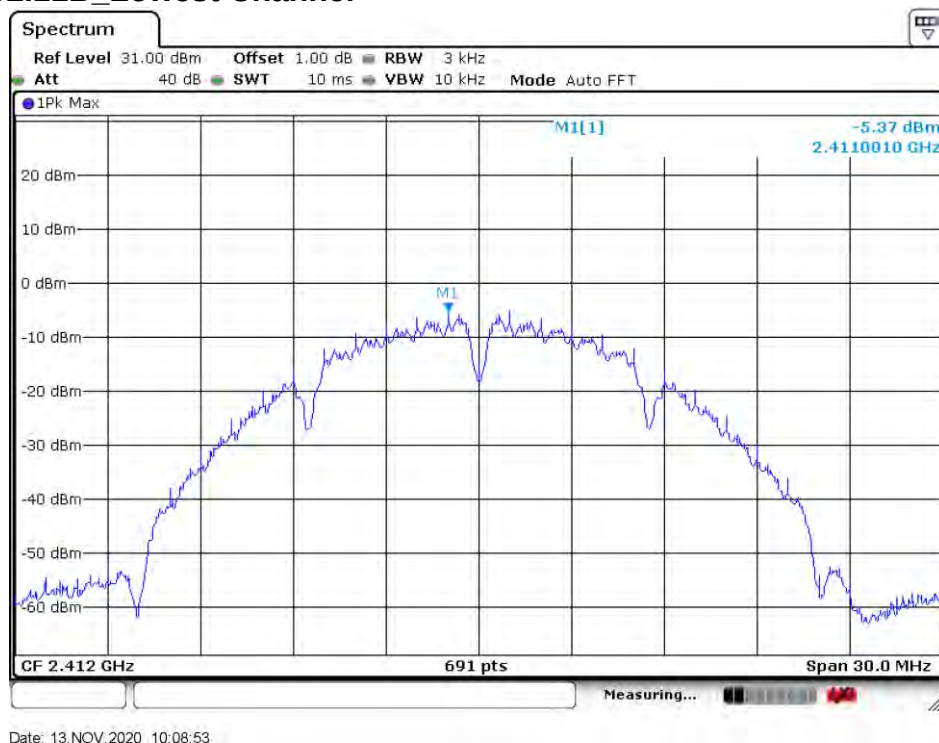
4.6.1 Test Results

Mode	Test Channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
802.11B	Lowest	-5.37	≤8.00	Pass
	Middle	-5.01	≤8.00	Pass
	Highest	-4.77	≤8.00	Pass
802.11G	Lowest	-11.30	≤8.00	Pass
	Middle	-11.68	≤8.00	Pass
	Highest	-11.44	≤8.00	Pass
802.11N20	Lowest	-12.09	≤8.00	Pass
	Middle	-11.80	≤8.00	Pass
	Highest	-12.17	≤8.00	Pass
802.11N40	Lowest	-16.46	≤8.00	Pass
	Middle	-14.81	≤8.00	Pass
	Highest	-16.04	≤8.00	Pass

4.6.2 Test plots

4.6.2.1 ANT1

4.6.2.1.1 802.11B_Lowest Channel



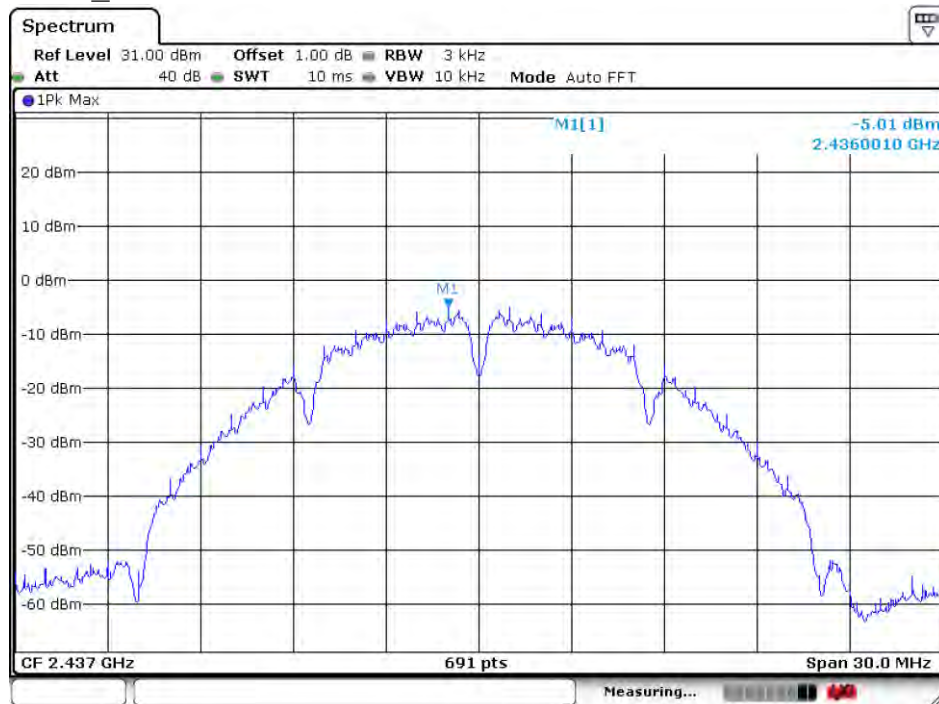
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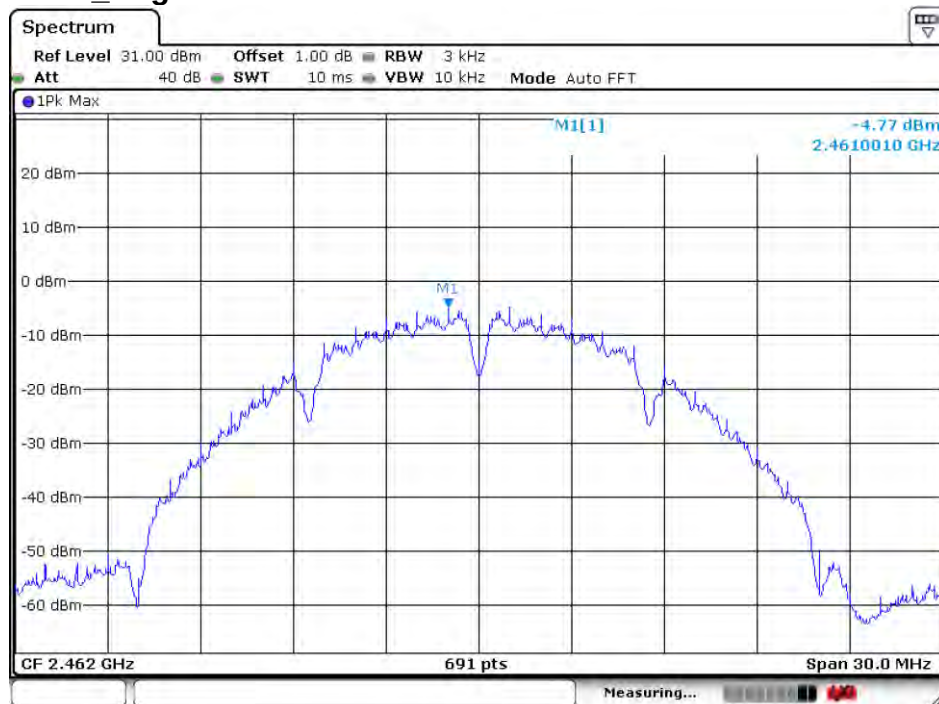
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4.6.2.1.2 802.11B_ Middle Channel



Date: 13.NOV.2020 10:10:38

4.6.2.1.3 802.11B_ Highest Channel



Date: 13.NOV.2020 10:10:52

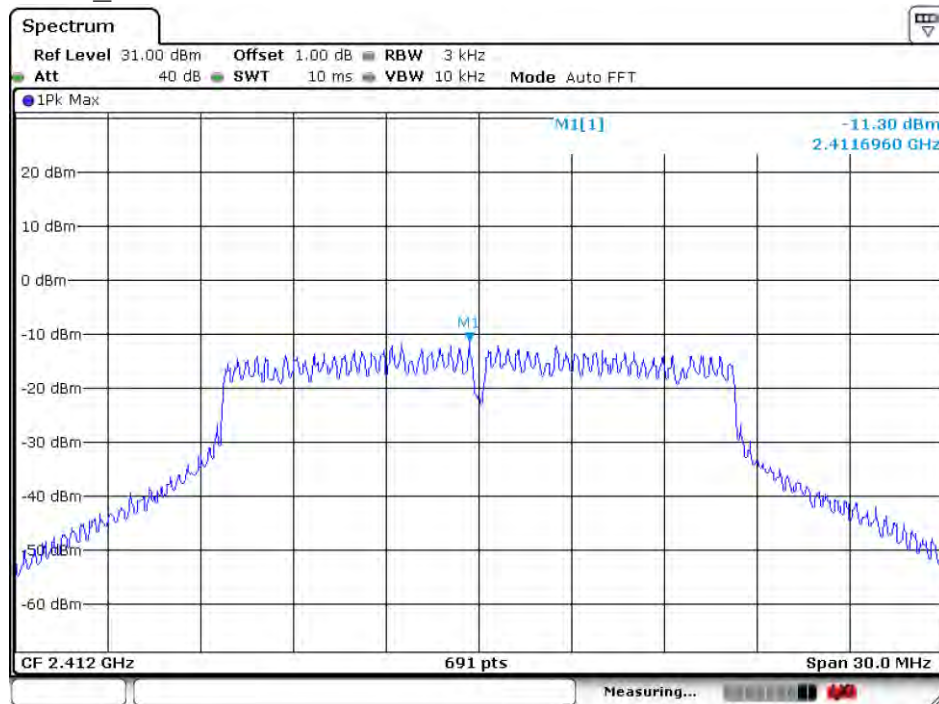


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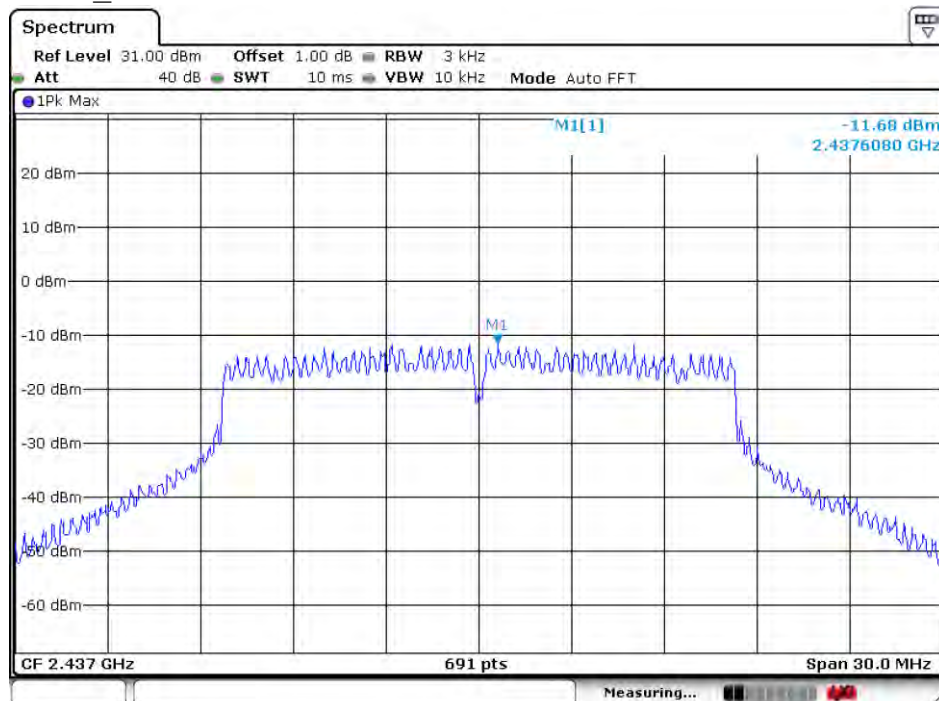
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4.6.2.1.4 802.11G_Lowest Channel



Date: 13.NOV.2020 10:07:58

4.6.2.1.5 802.11G_Middle Channel



Date: 13.NOV.2020 10:08:19

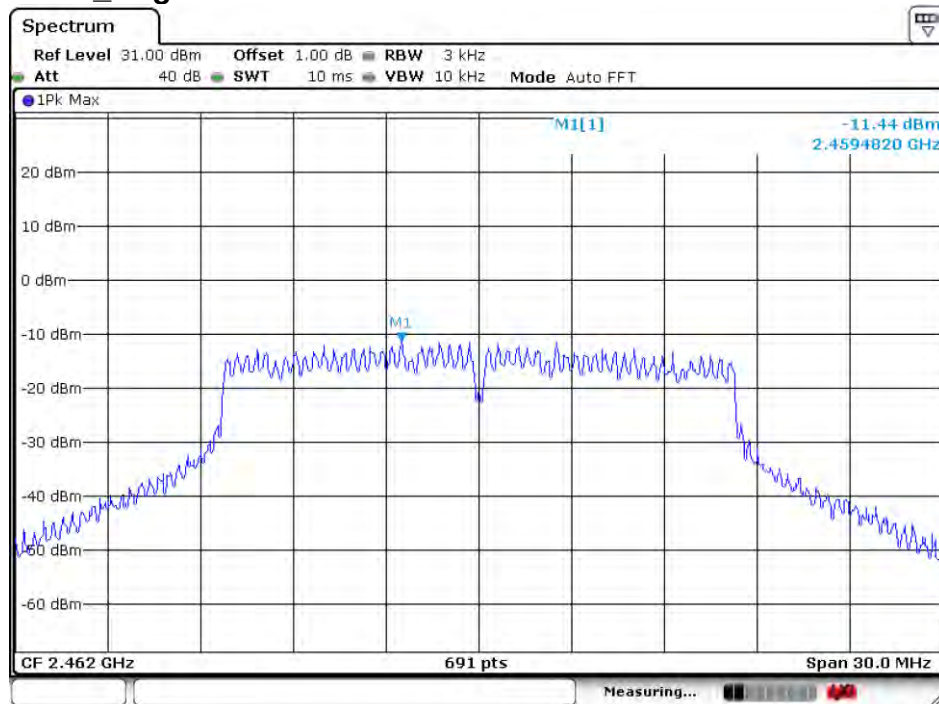


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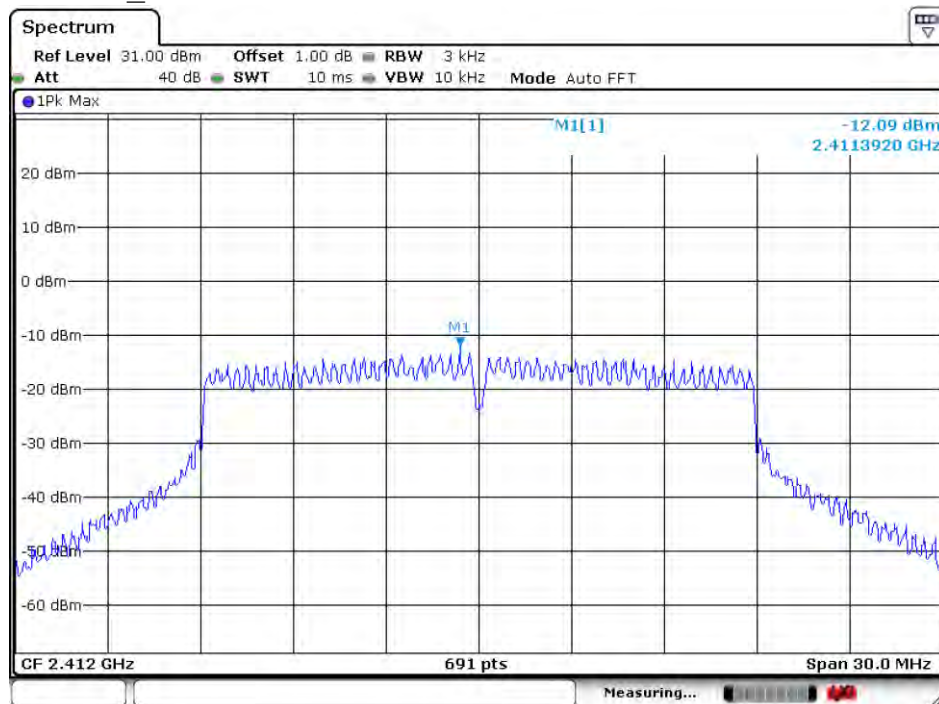
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4.6.2.1.6 802.11G_Highest Channel



Date: 13.NOV.2020 10:08:33

4.6.2.1.7 802.11N20_Lowest Channel



Date: 13.NOV.2020 10:06:37

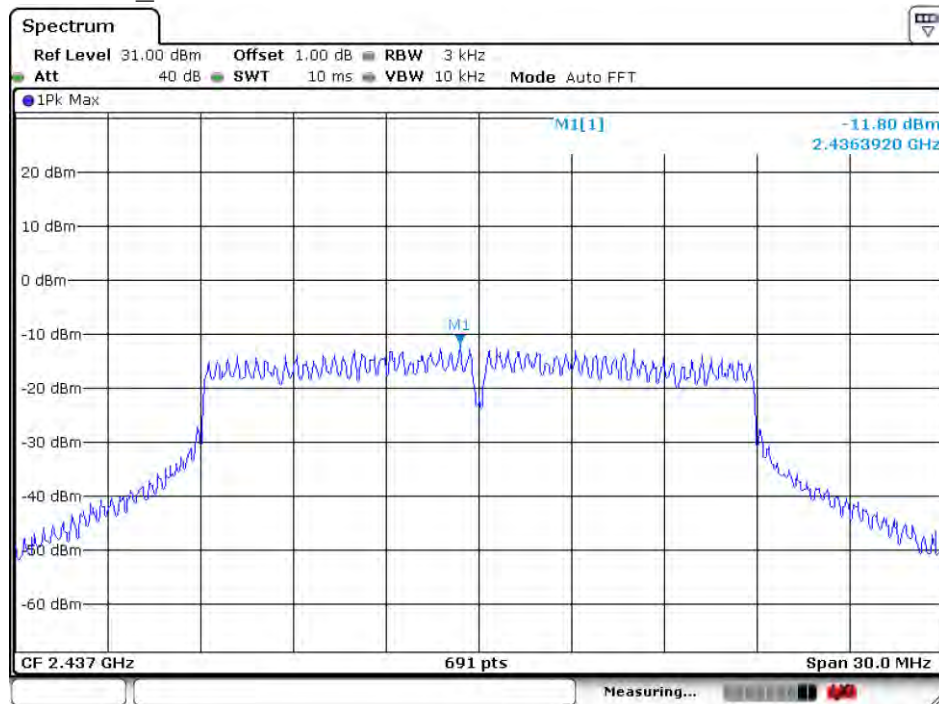


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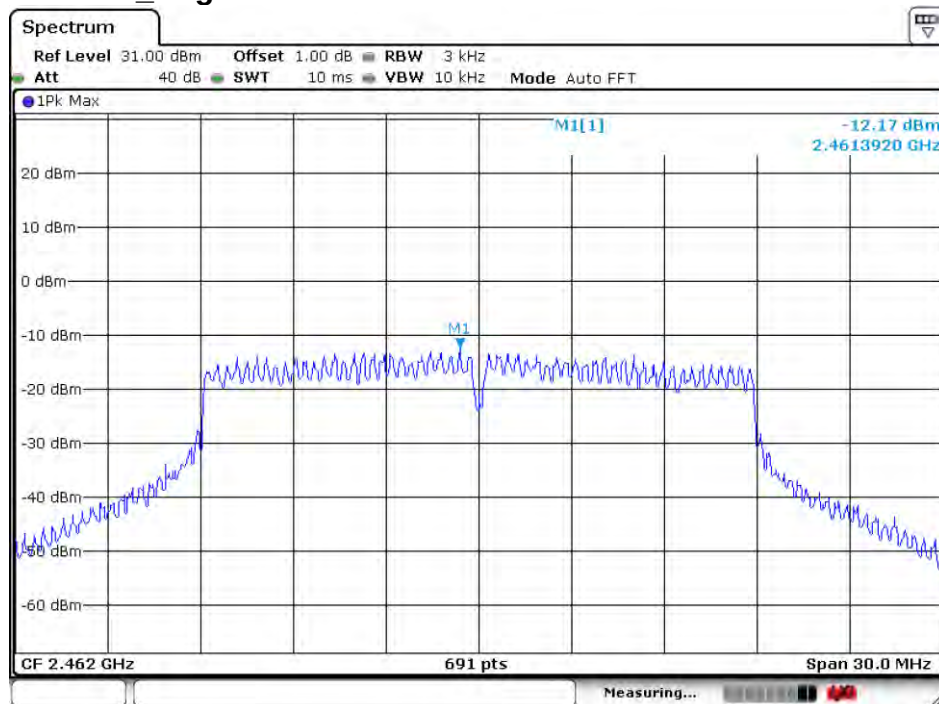
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4.6.2.1.8 802.11 N20_ Middle Channel



Date: 13.NOV.2020 10:07:13

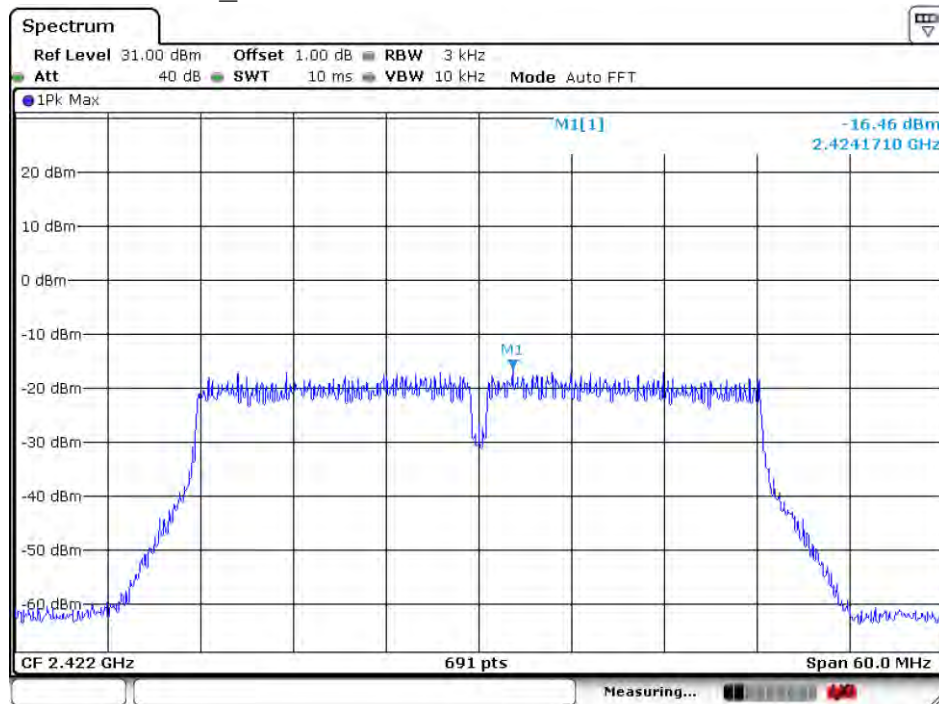
4.6.2.1.9 802.11 N20_ Highest Channel



Date: 13.NOV.2020 10:07:30

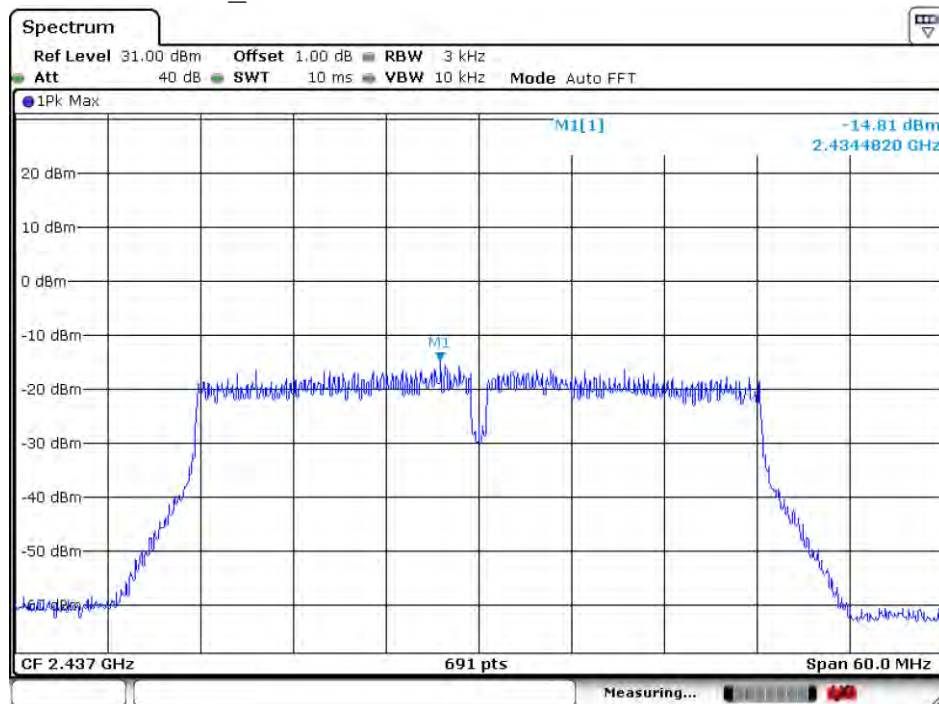


4.6.2.1.10 802.11N40_Lowest Channel



Date: 13.NOV.2020 10:06:02

4.6.2.1.11 802.11 N40_Middle Channel



Date: 13.NOV.2020 10:05:26

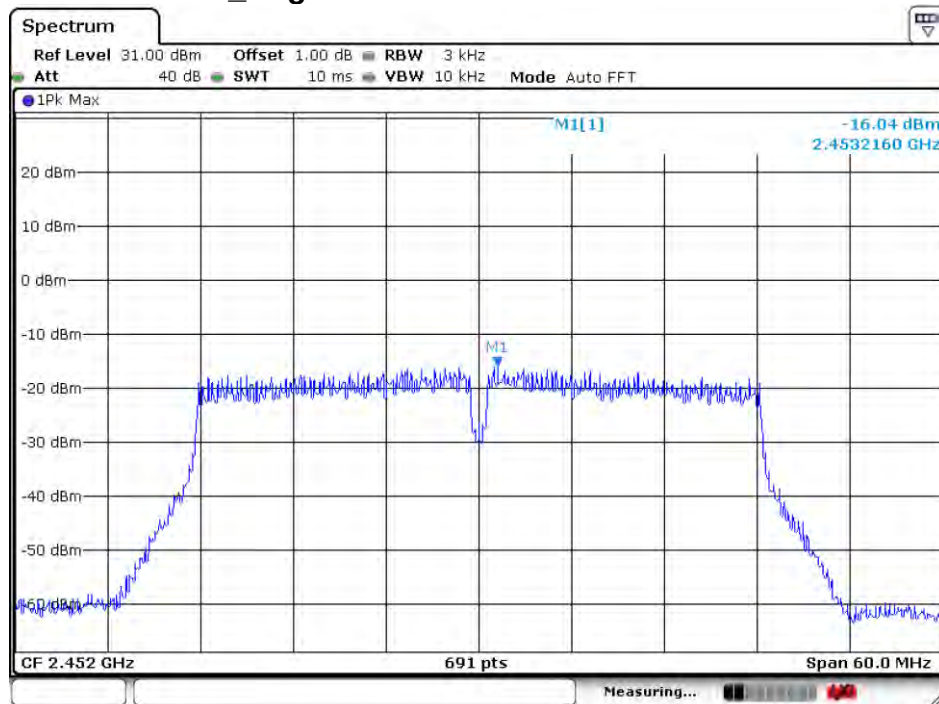


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4.6.2.1.12 802.11 N40_ Highest Channel



Date: 13.NOV.2020 10:05:45



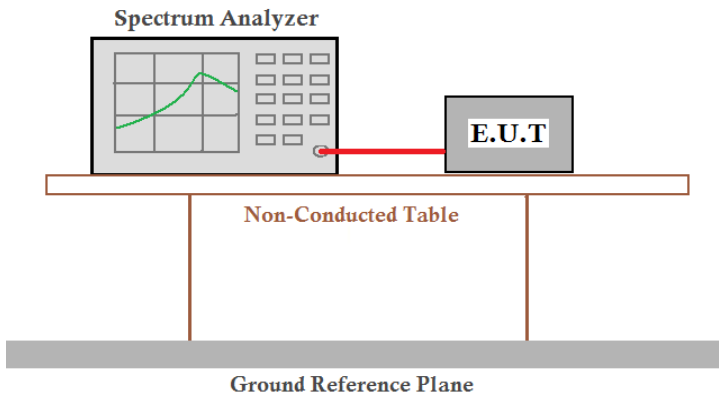
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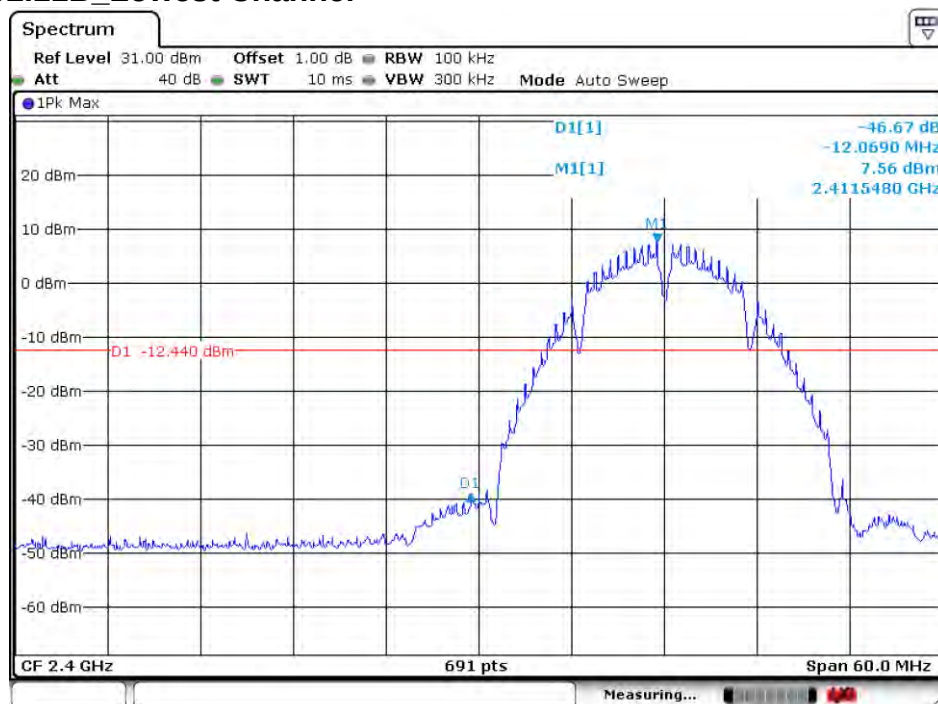
4.7 Band-edge for RF Conducted Emissions

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) ; 13.5Mbps of rate is the worst case of 802.11N(HT40).
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 ANT1

4.7.1.1.1 802.11B_Lowest Channel



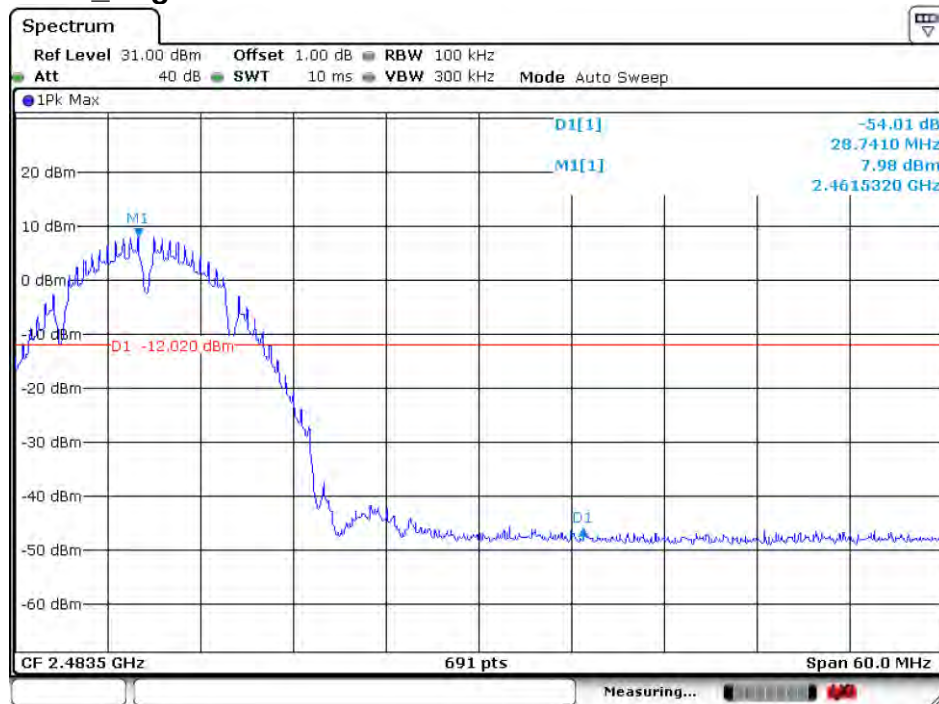
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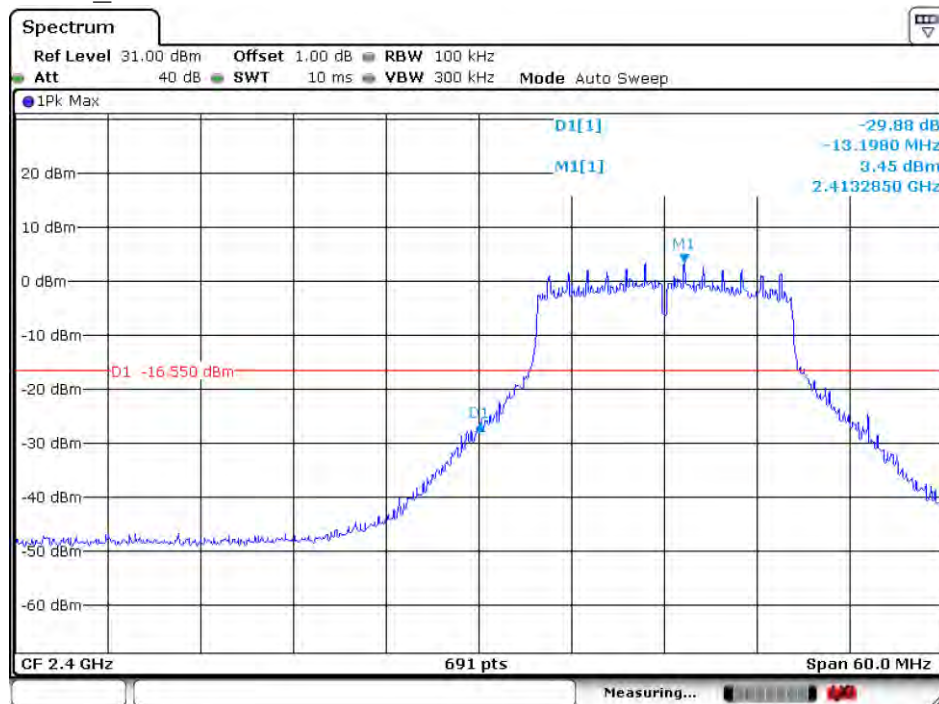
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4.7.1.1.2 802.11B_Highest Channel



Date: 13.NOV.2020 11:21:54

4.7.1.1.3 802.11G_Lowest Channel



Date: 13.NOV.2020 11:16:42

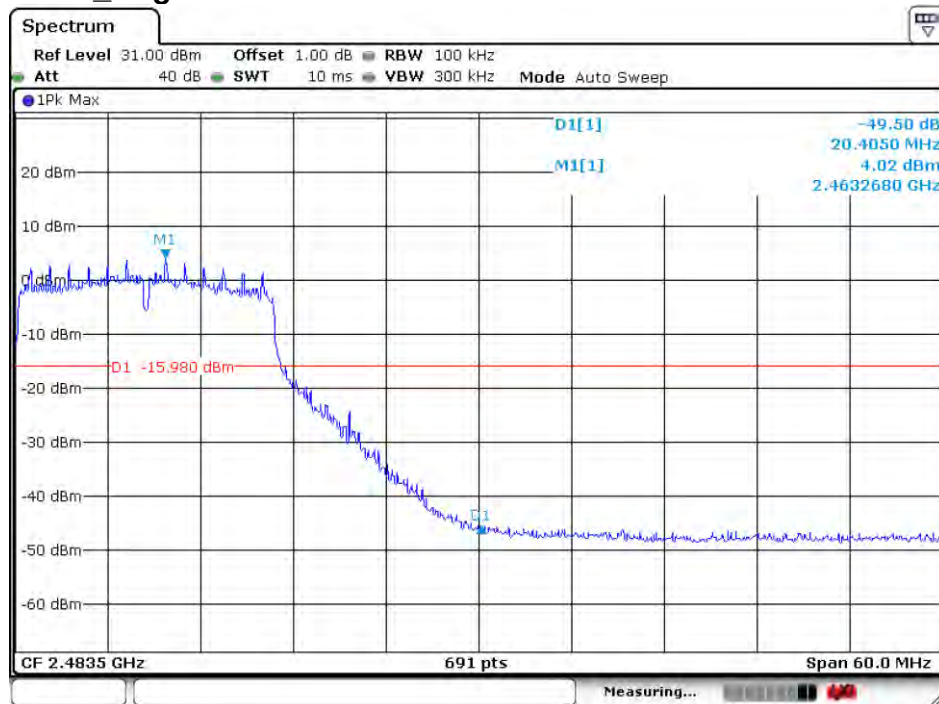


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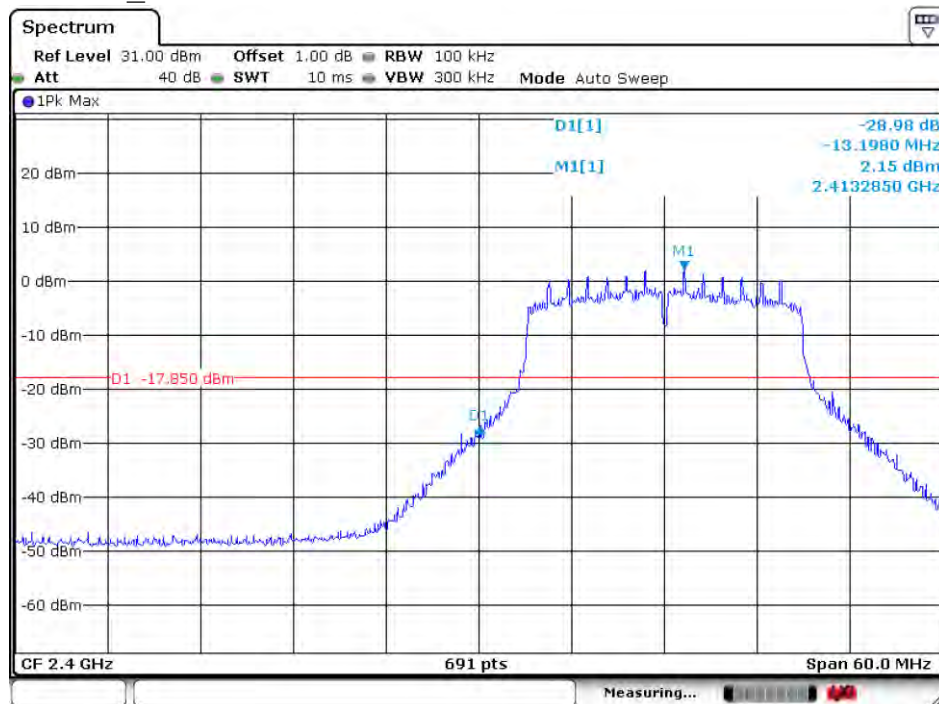
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4.7.1.1.4 802.11G_Highest Channel



Date: 13.NOV.2020 11:19:06

4.7.1.1.5 802.11N20_Lowest Channel



Date: 13.NOV.2020 11:12:57

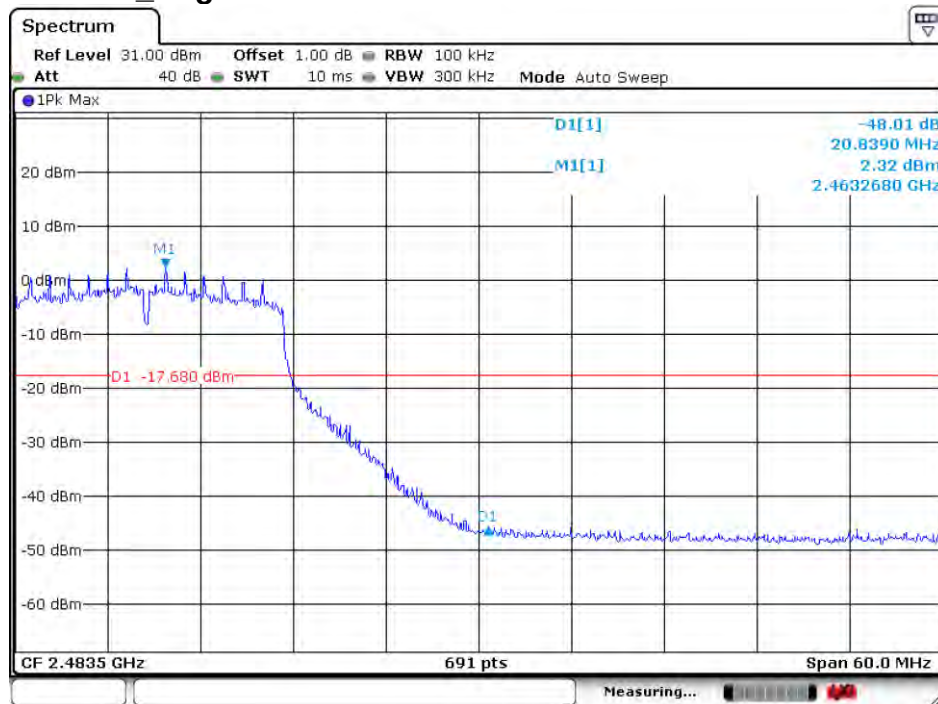


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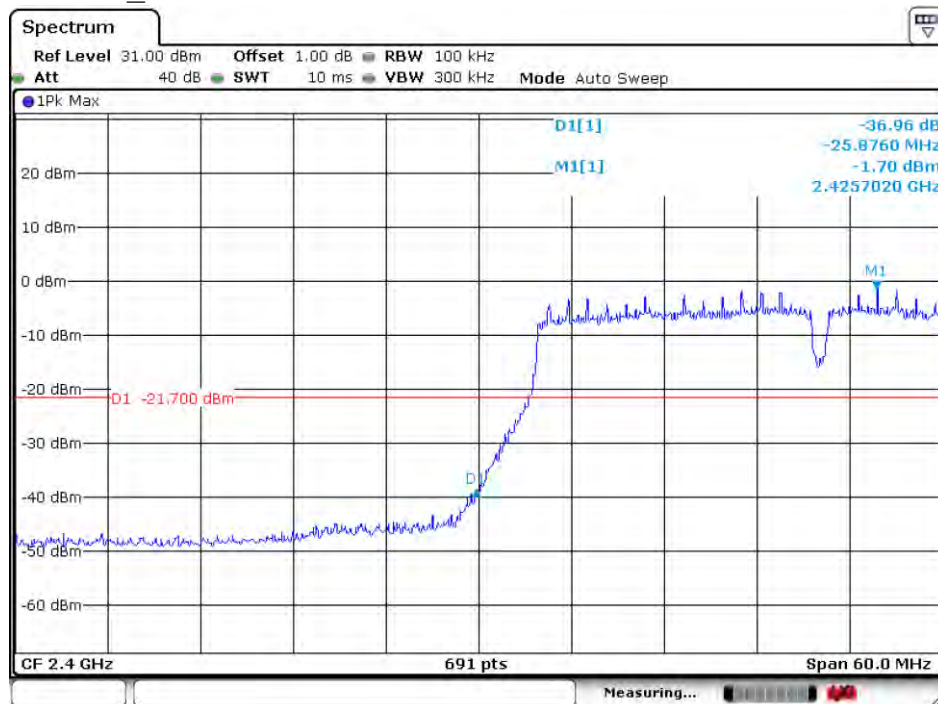
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4.7.1.1.6 802.11 N20_ Highest Channel



Date: 13.NOV.2020 11:14:54

4.7.1.1.7 802.11N40_ Lowest Channel



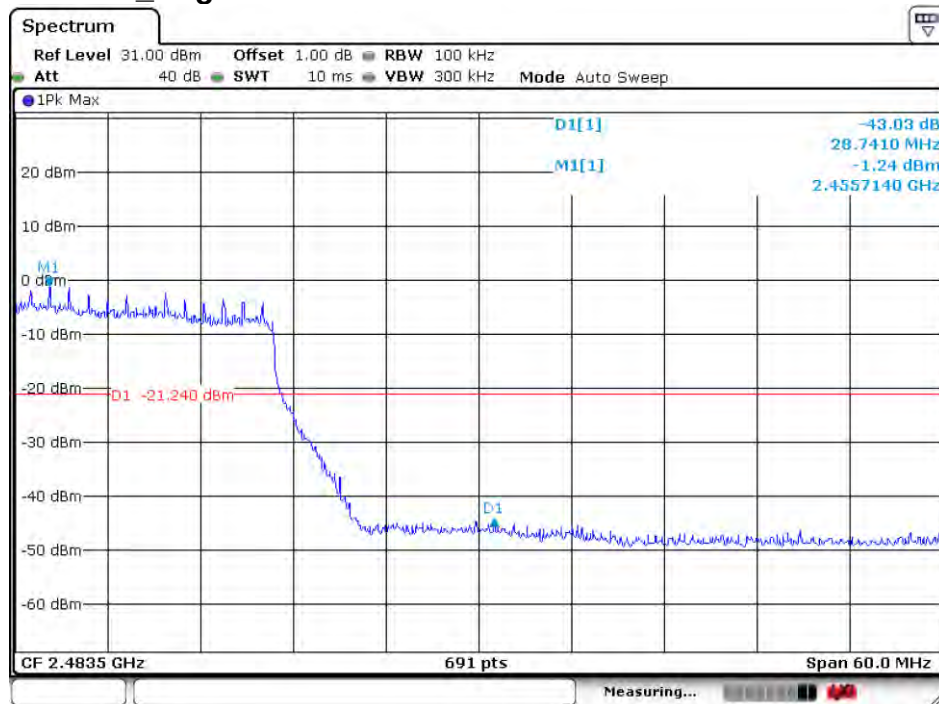
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4.7.1.1.8 802.11 N40_ Highest Channel



Date: 13.NOV.2020 11:09:59



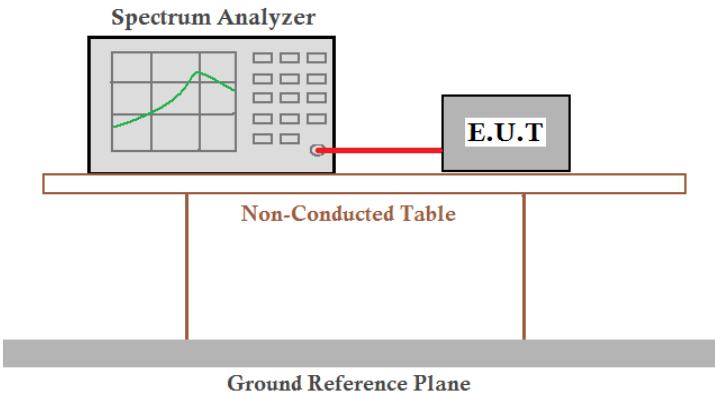
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4.8 RF Conducted Spurious Emissions

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); 13.5Mbps of rate is the worst case of 802.11N(HT40).
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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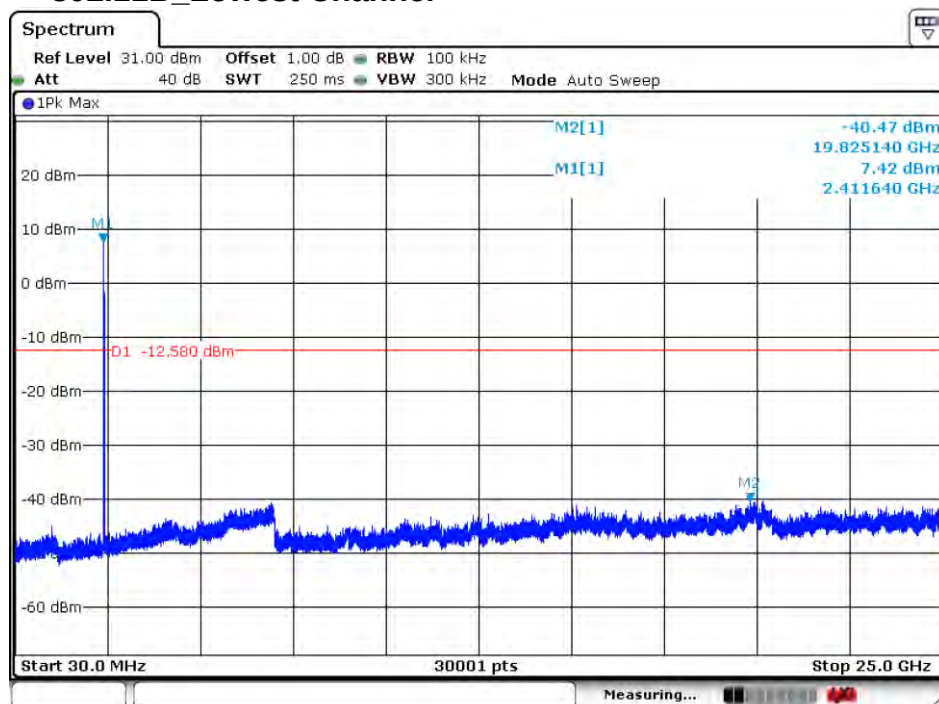
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4.8.1 Test plots

4.8.1.1 ANT1

4.8.1.1.1 802.11B_Lowest Channel



Date: 13.NOV.2020 11:25:58



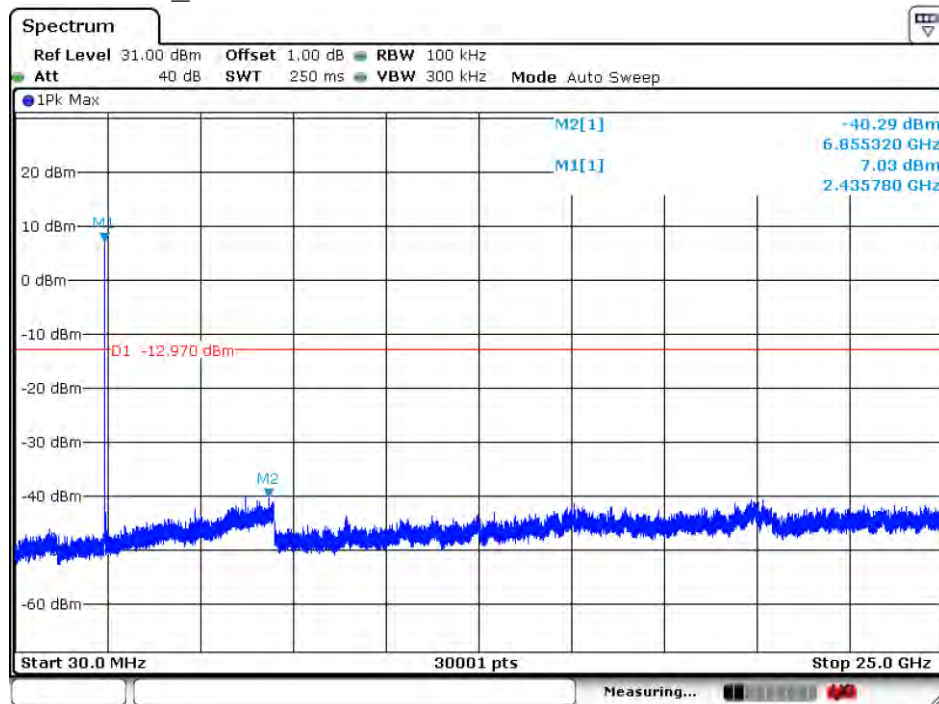
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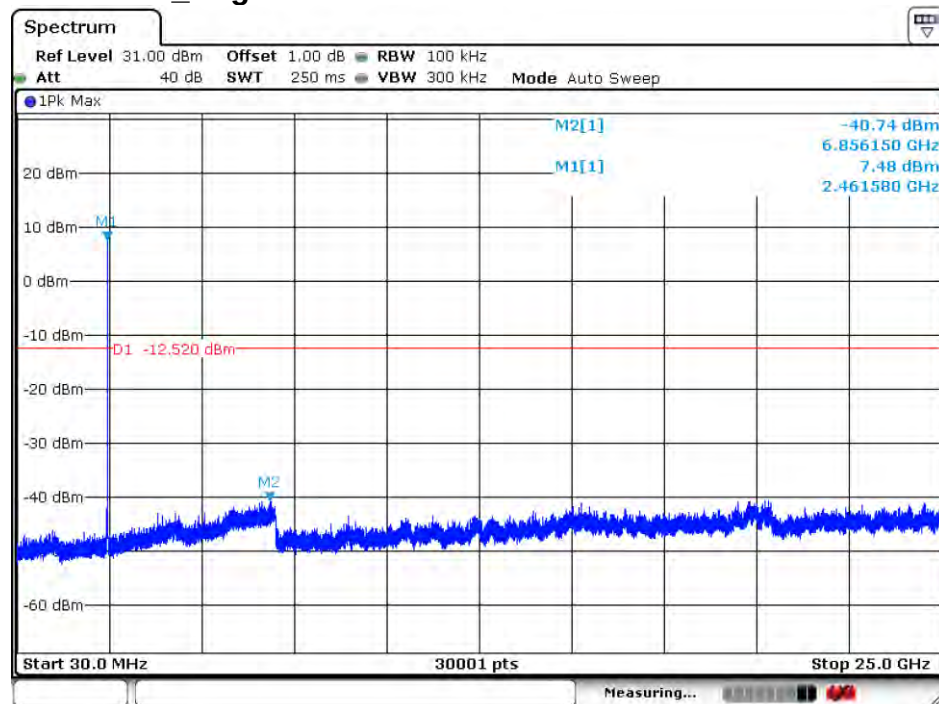
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4.8.1.1.2 802.11B_Middle Channel



Date: 13.NOV.2020 11:24:26

4.8.1.1.3 802.11B_Highest Channel



Date: 13.NOV.2020 11:23:21

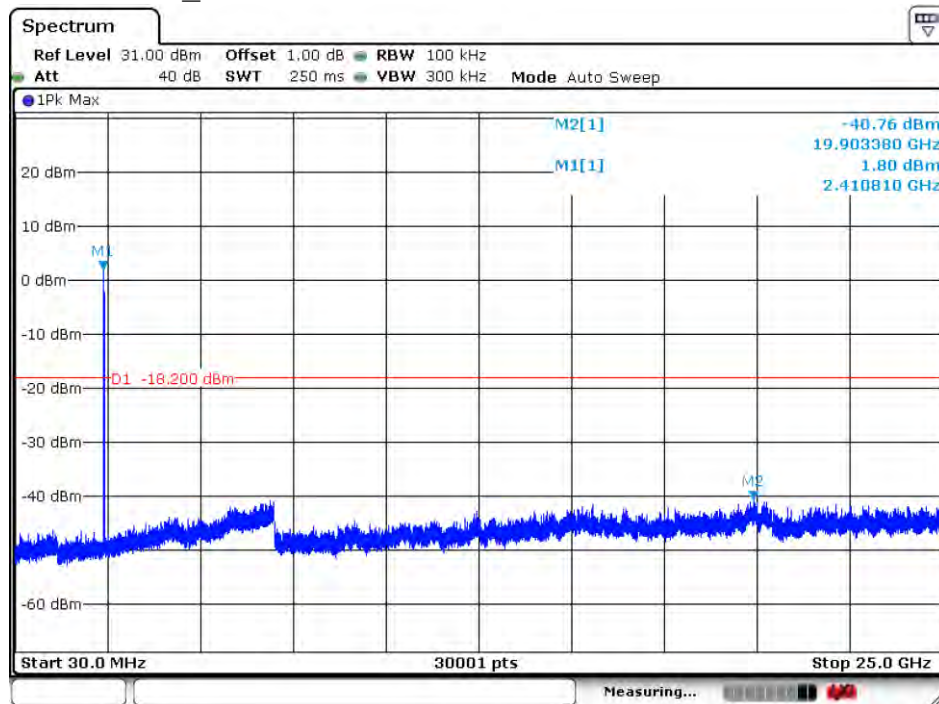


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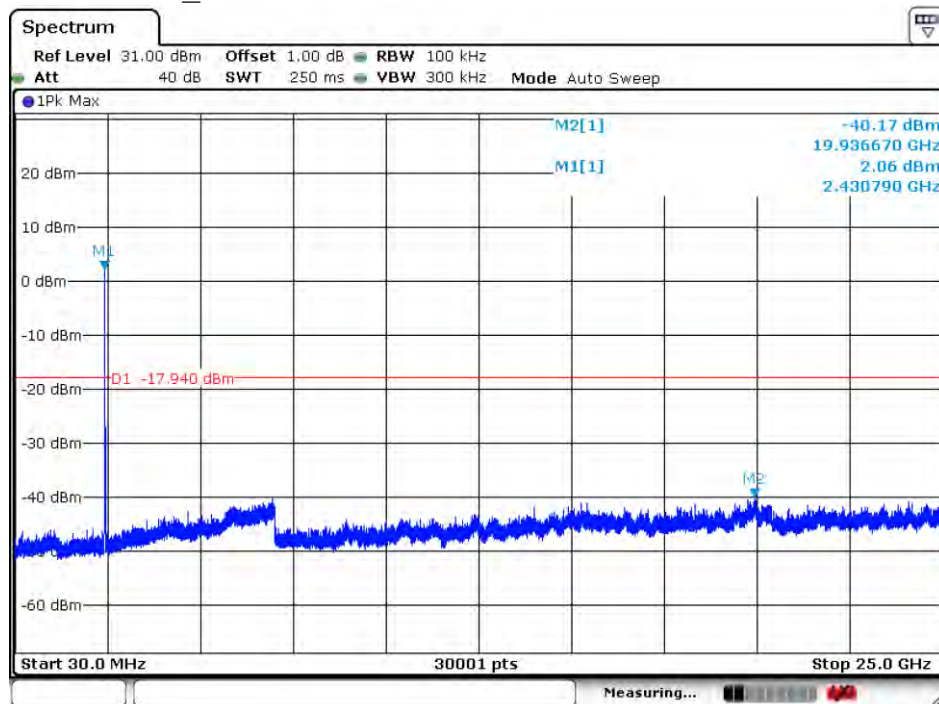
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4.8.1.1.4 802.11G _Lowest Channel



Date: 13.NOV.2020 11:27:23

4.8.1.1.5 802.11G _Middle Channel



Date: 13.NOV.2020 11:29:25

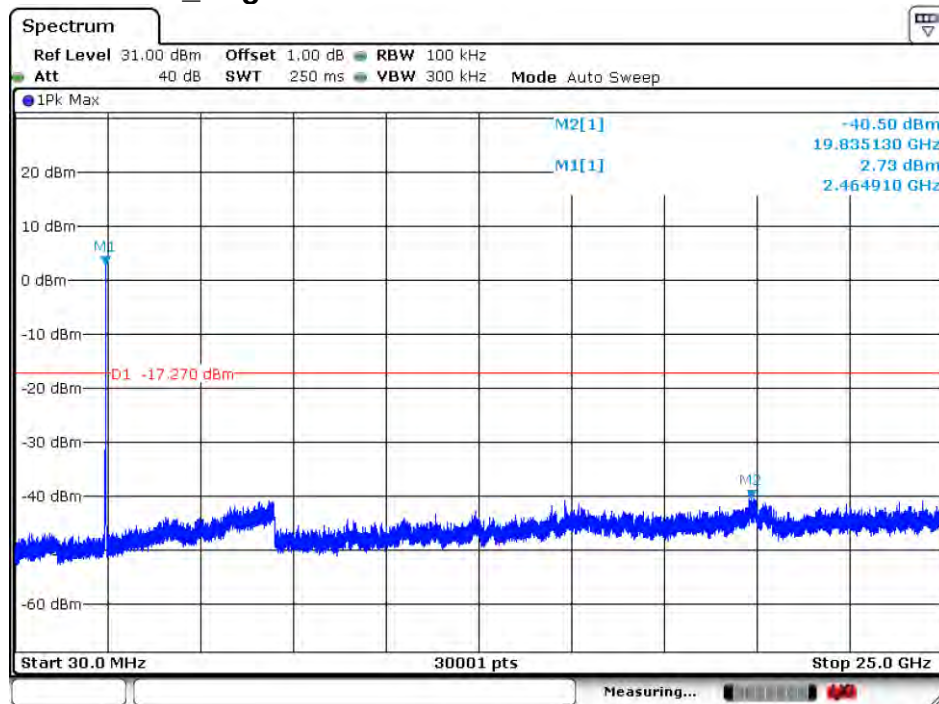


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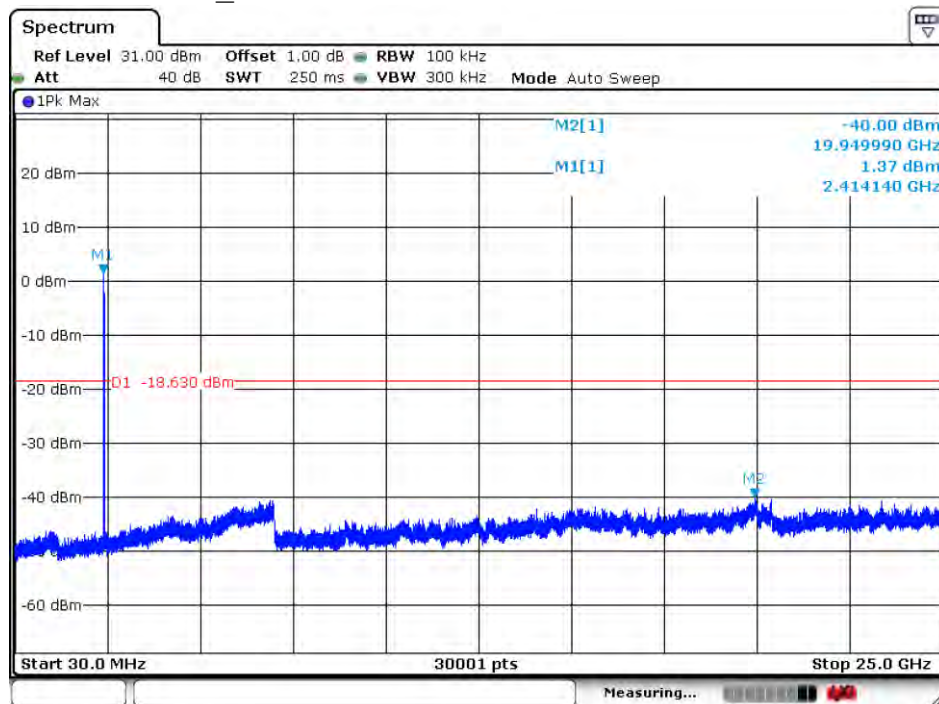
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4.8.1.1.6 802.11G_Highest Channel



Date: 13.NOV.2020 11:30:19

4.8.1.1.7 802.11N20_Lowest Channel



Date: 13.NOV.2020 11:32:14

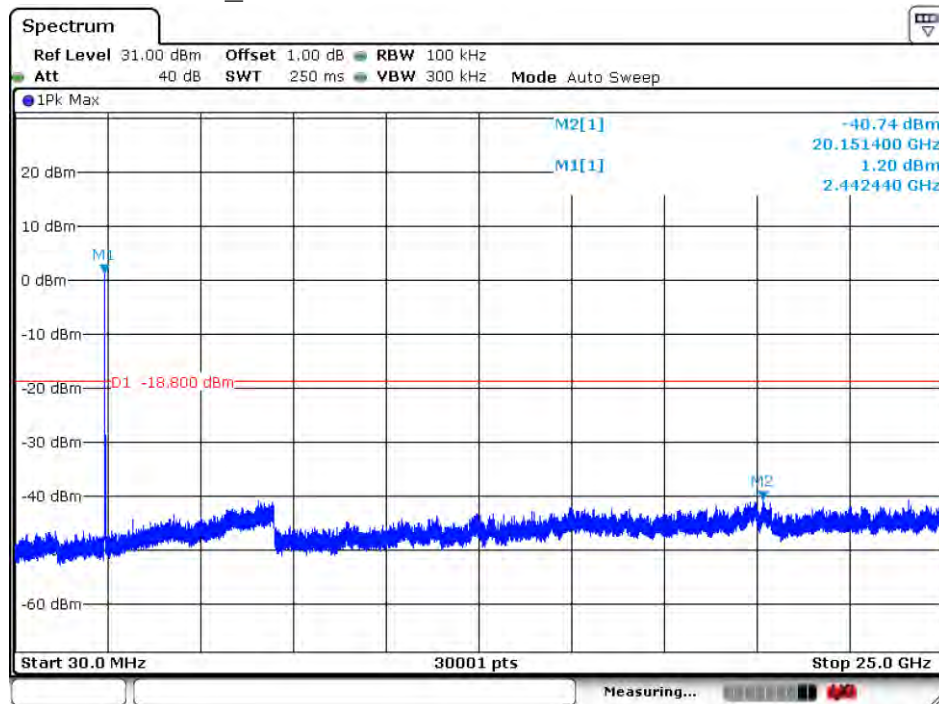


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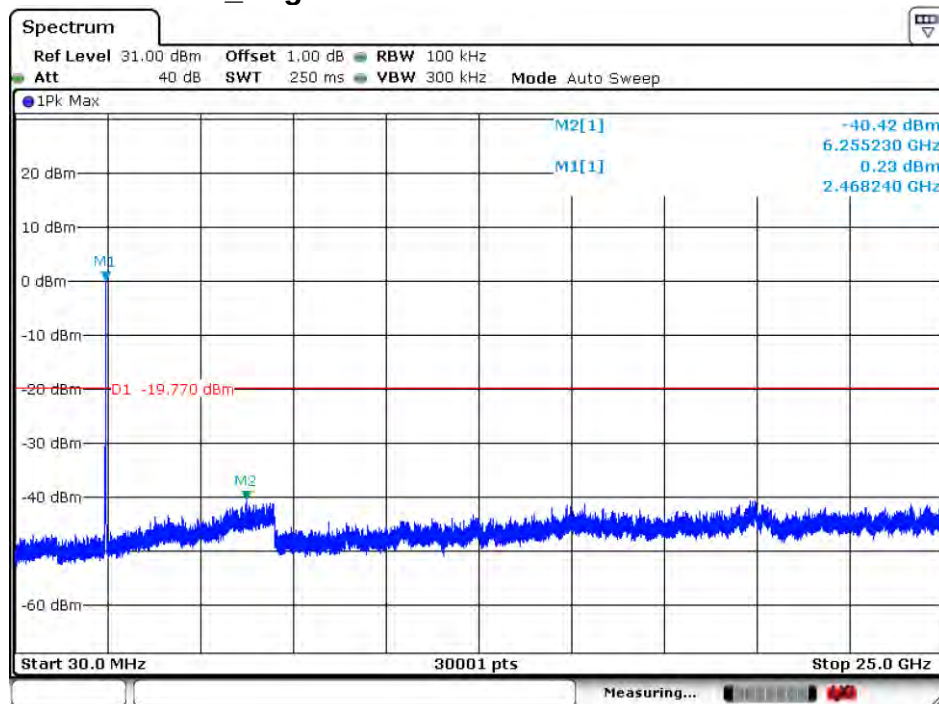
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4.8.1.1.8 802.11 N20_ Middle Channel



Date: 13.NOV.2020 11:33:17

4.8.1.1.9 802.11 N20_ Highest Channel



Date: 13.NOV.2020 11:34:15

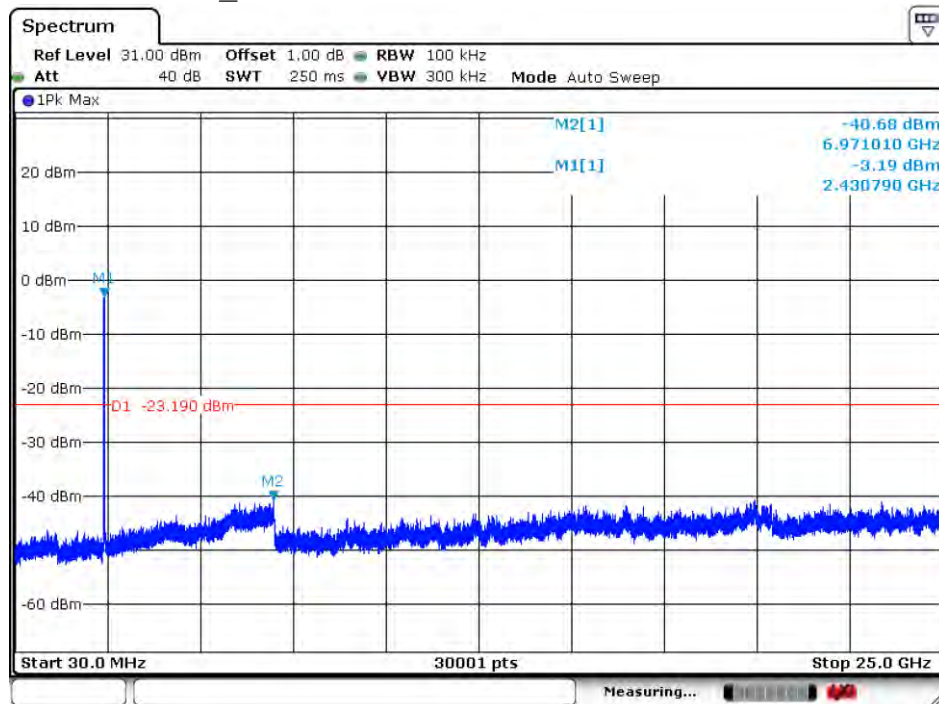


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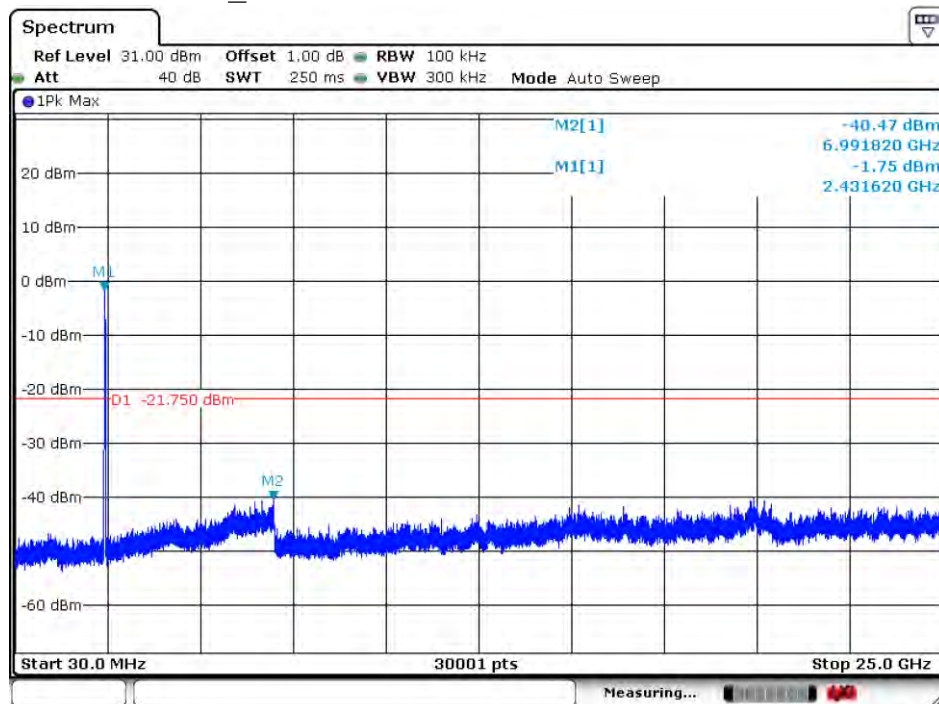
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4.8.1.1.10 802.11N40_Lowest Channel



Date: 13.NOV.2020 11:35:17

4.8.1.1.11 802.11 N40_Middle Channel



Date: 13.NOV.2020 11:35:50

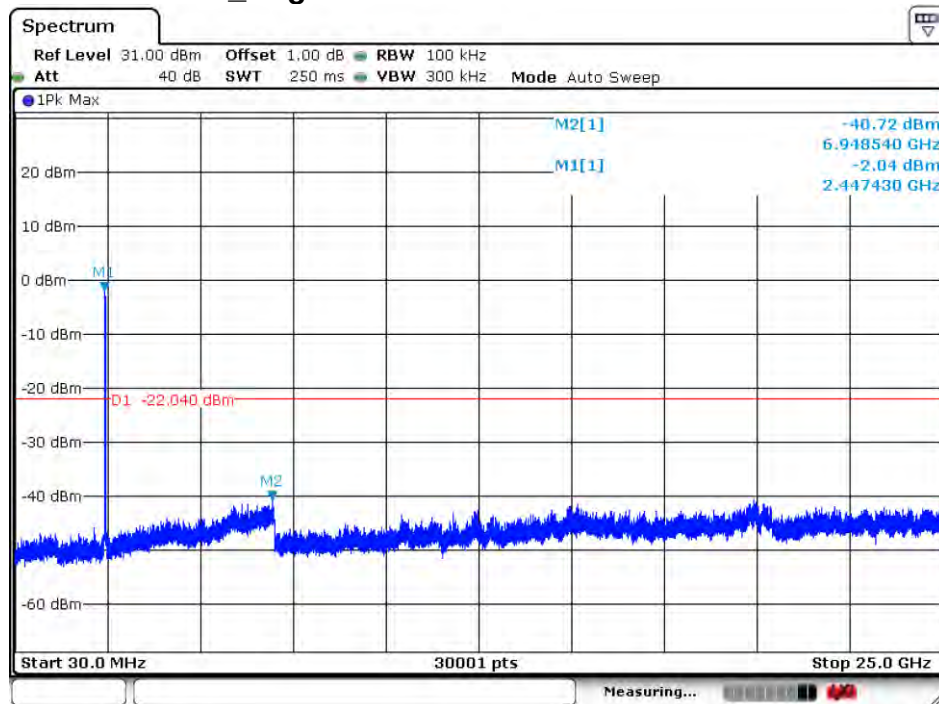


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4.8.1.1.12 802.11 N40_ Highest Channel



Date: 13.NOV.2020 11:36:32

Remark:

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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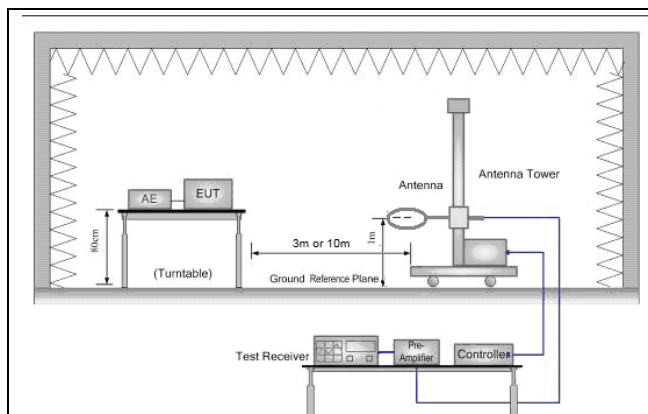


Figure 1. Below 30MHz

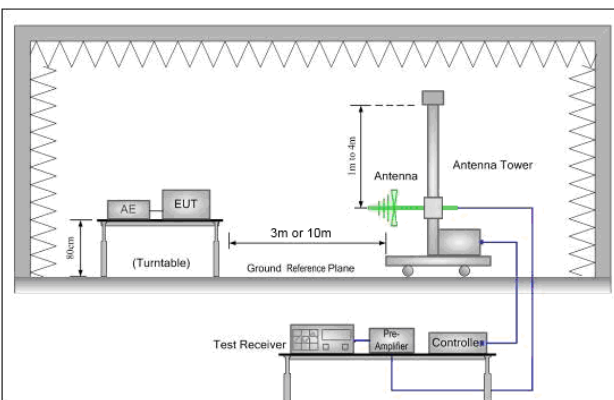


Figure 2. 30MHz to 1GHz

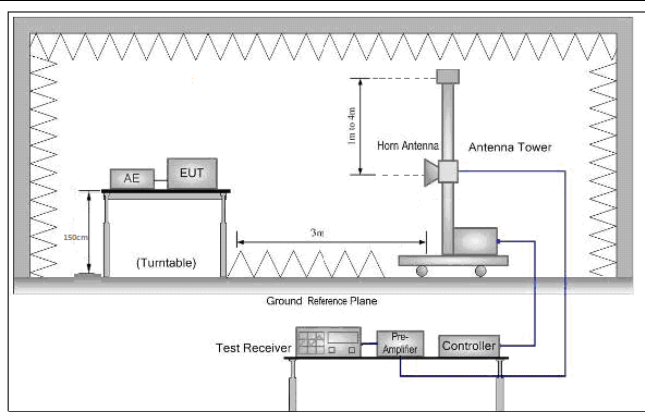


Figure 3. Above 1 GHz

Test Procedure:

- 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 + $20 \cdot \log(\text{Duty cycl}$ 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); 13.5Mbps of rate is the worst case of 802.11N(HT40) 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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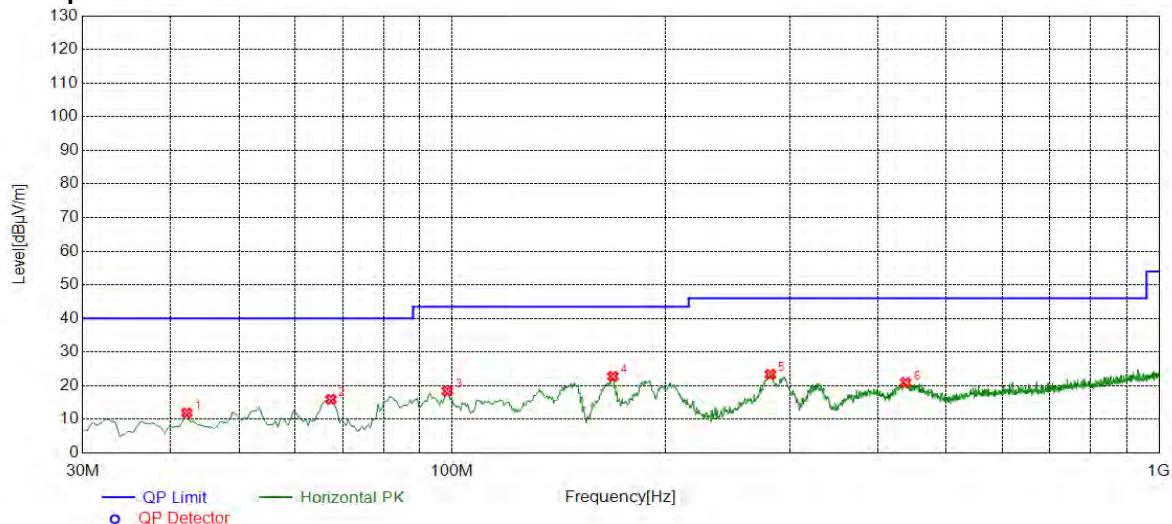
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4.9.1 Radiated emission below 1GHz

4.9.1.1 Charge + Transmitting

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	42.1311	11.92	-30.76	40.00	28.08	Horizontal
2	67.3637	15.96	-33.51	40.00	24.04	Horizontal
3	98.4192	18.41	-31.96	43.50	25.09	Horizontal
4	168.7794	22.78	-33.69	43.50	20.72	Horizontal
5	281.8409	23.36	-28.34	46.00	22.64	Horizontal
6	438.0890	20.95	-24.10	46.00	25.05	Horizontal

Final Data List

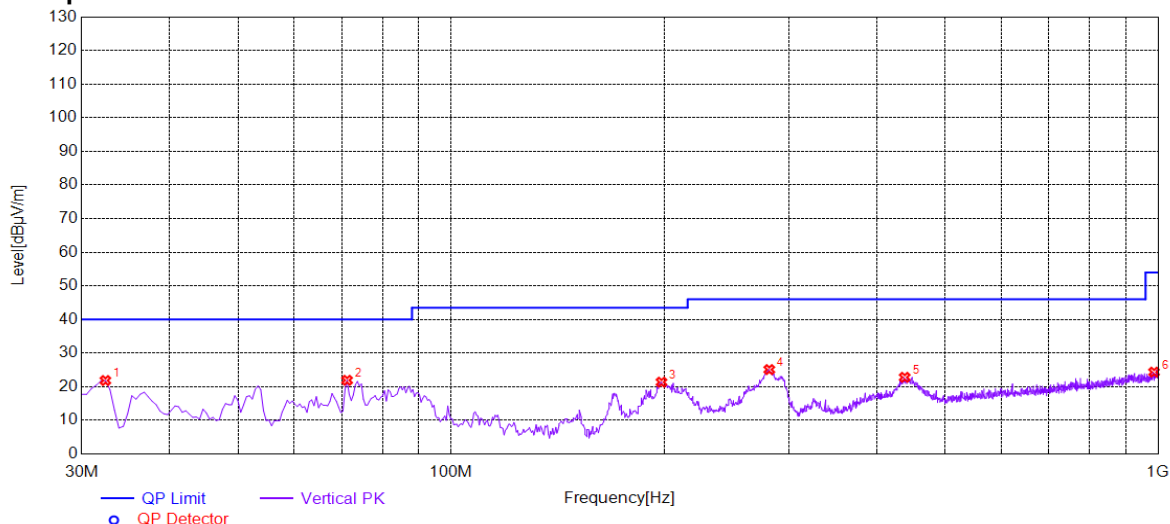


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Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	32.4262	21.86	-32.80	40.00	18.14	Vertical
2	71.2456	21.93	-34.37	40.00	18.07	Vertical
3	198.3792	21.37	-30.98	43.50	22.13	Vertical
4	281.8409	25.11	-28.34	46.00	20.89	Vertical
5	438.0890	22.81	-24.10	46.00	23.19	Vertical
6	986.8984	24.36	-14.03	54.00	29.64	Vertical

Final Data List



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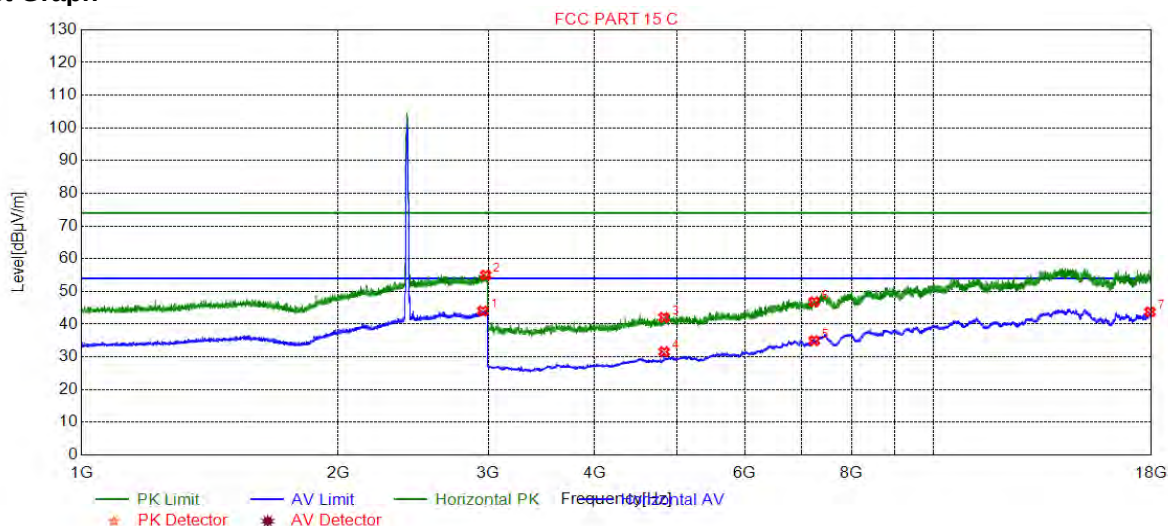
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4.9.2 Transmitter emission above 1GHz

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]	Polarity
1	2956.4891	44.03	9.65	54.00	9.97	Horizontal
2	2980.4951	55.03	9.54	74.00	18.97	Horizontal
3	4824.0000	42.08	-18.21	74.00	31.92	Horizontal
4	4825.6826	31.56	-18.21	54.00	22.44	Horizontal
5	7236.0000	34.96	-9.76	54.00	19.04	Horizontal
6	7236.0000	46.84	-9.76	74.00	27.16	Horizontal
7	17930.993	43.77	-1.30	54.00	10.23	Horizontal

Final Data List



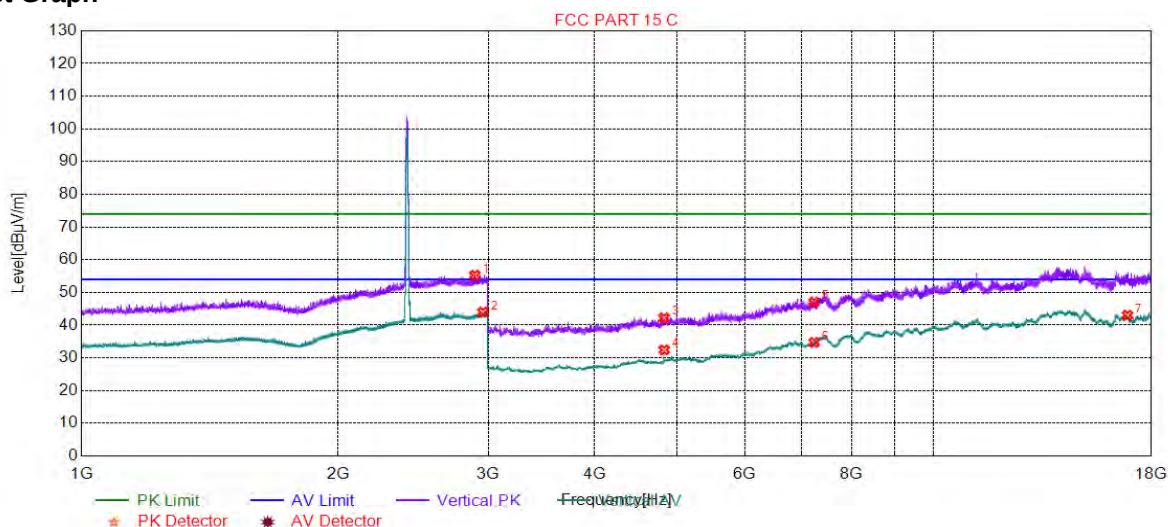
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4.9.2.2 802.11B_Channel 1

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2893.4734	55.29	9.15	74.00	18.71	Vertical
2	2956.9892	43.99	9.65	54.00	10.01	Vertical
3	4824.0000	42.23	-18.21	74.00	31.77	Vertical
4	4825.6826	32.45	-18.21	54.00	21.55	Vertical
5	7236.0000	47.05	-9.76	74.00	26.95	Vertical
6	7236.0000	34.72	-9.76	54.00	19.28	Vertical
7	16867.386	43.05	-0.48	54.00	10.95	Vertical

Final Data List



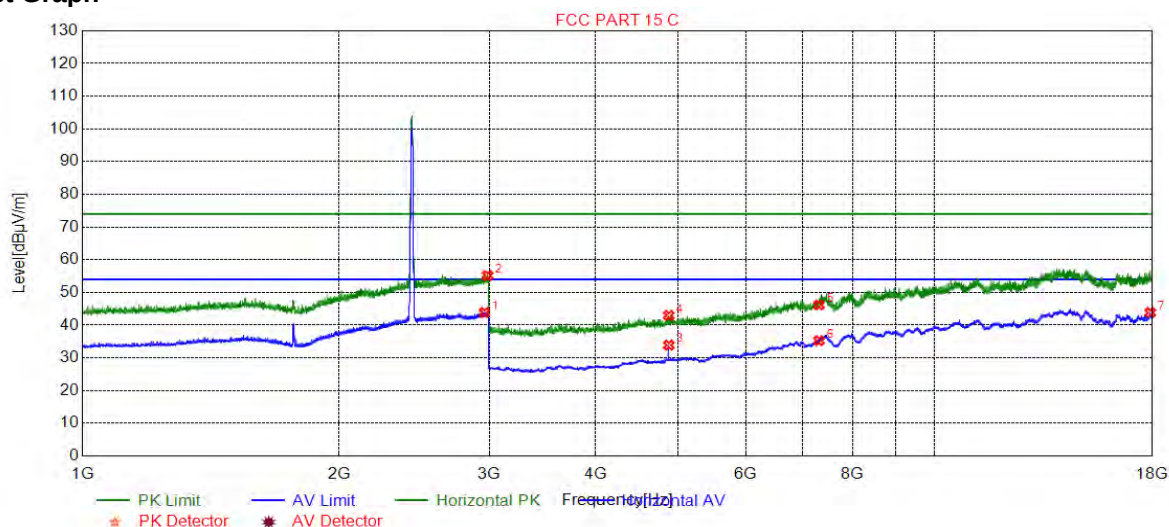
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4.9.2.3 802.11B_Channel 6

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2960.9902	43.89	9.63	54.00	10.11	Horizontal
2	2986.9967	55.18	9.51	74.00	18.82	Horizontal
3	4874.0000	33.91	-17.99	54.00	20.09	Horizontal
4	4874.0000	43.00	-17.99	74.00	31.00	Horizontal
5	7311.0000	46.19	-9.59	74.00	27.81	Horizontal
6	7311.0000	35.27	-9.59	54.00	18.73	Horizontal
7	17891.989	43.85	-1.42	54.00	10.15	Horizontal

Final Data List



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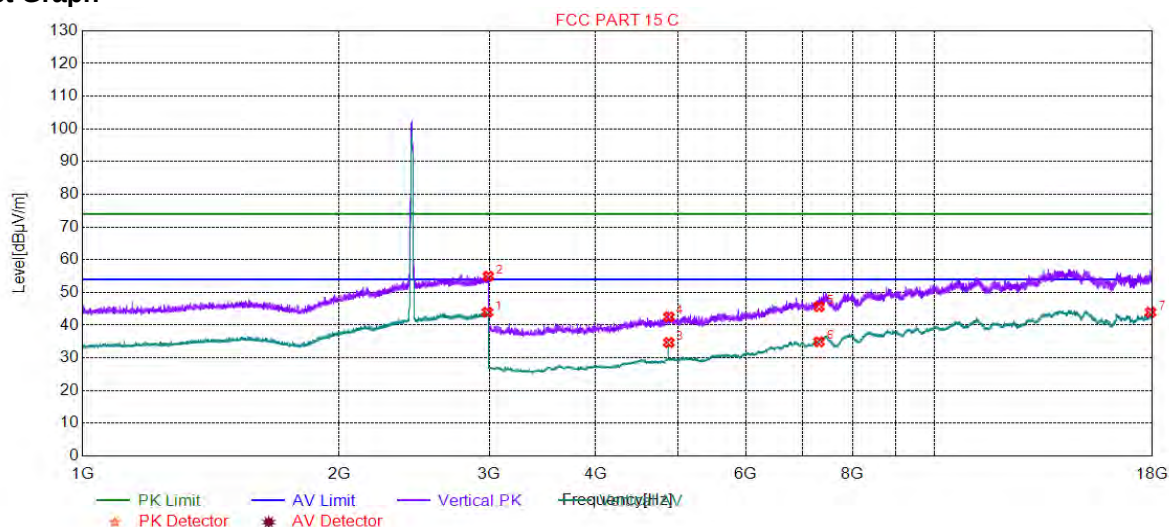
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4.9.2.4 802.11B_Channel 6

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2985.4964	43.96	9.52	54.00	10.04	Vertical
2	2992.9983	54.96	9.48	74.00	19.04	Vertical
3	4874.0000	34.70	-17.99	54.00	19.30	Vertical
4	4874.0000	42.55	-17.99	74.00	31.45	Vertical
5	7311.0000	45.66	-9.59	74.00	28.34	Vertical
6	7311.0000	34.92	-9.59	54.00	19.08	Vertical
7	17906.990	43.96	-1.31	54.00	10.04	Vertical

Final Data List



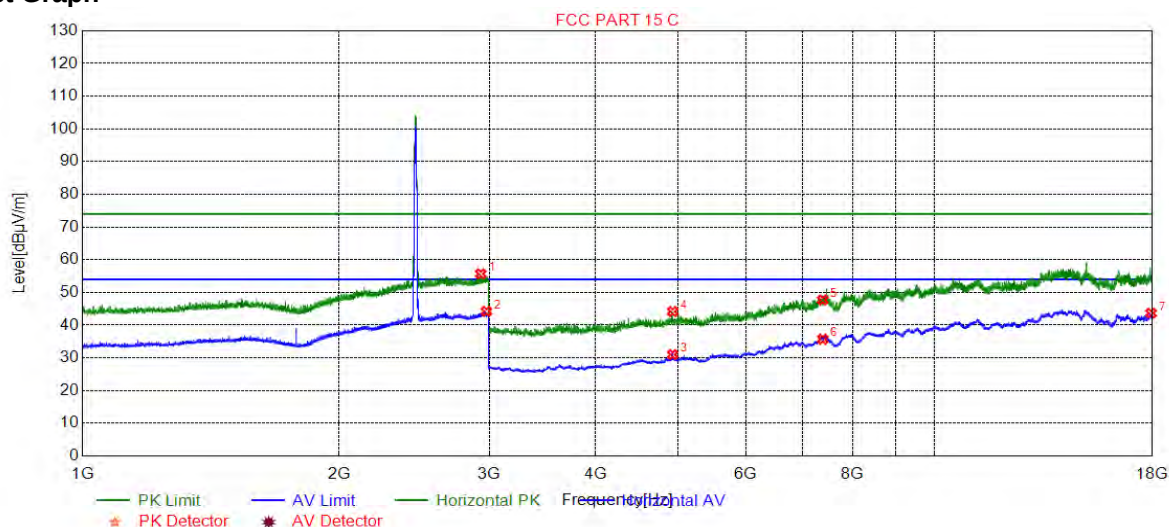
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4.9.2.5 802.11B_Channel 11

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2931.9830	55.70	9.49	74.00	18.30	Horizontal
2	2977.4944	44.23	9.55	54.00	9.77	Horizontal
3	4924.0000	31.03	-17.71	54.00	22.97	Horizontal
4	4924.0000	44.18	-17.71	74.00	29.82	Horizontal
5	7386.0000	47.70	-9.20	74.00	26.30	Horizontal
6	7386.0000	35.70	-9.20	54.00	18.30	Horizontal
7	17929.492	43.66	-1.30	54.00	10.34	Horizontal

Final Data List



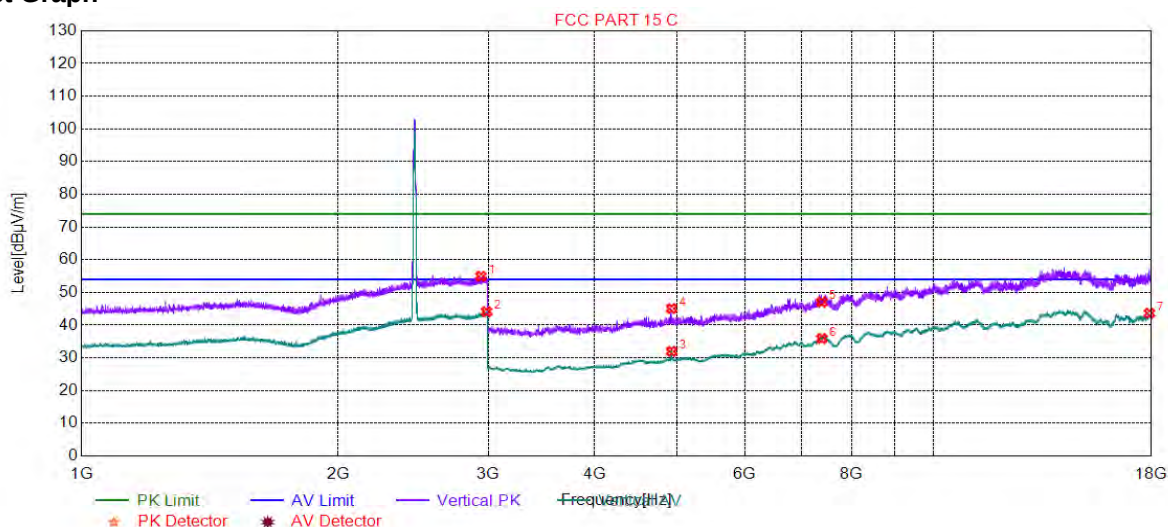
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4.9.2.6 802.11B_Channel 11

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2941.4854	54.95	9.59	74.00	19.05	Vertical
2	2986.9967	44.13	9.51	54.00	9.87	Vertical
3	4924.0000	32.00	-17.71	54.00	22.00	Vertical
4	4924.0000	45.11	-17.71	74.00	28.89	Vertical
5	7386.0000	47.05	-9.20	74.00	26.95	Vertical
6	7386.0000	35.90	-9.20	54.00	18.10	Vertical
7	17900.990	43.65	-1.31	54.00	10.35	Vertical

Final Data List



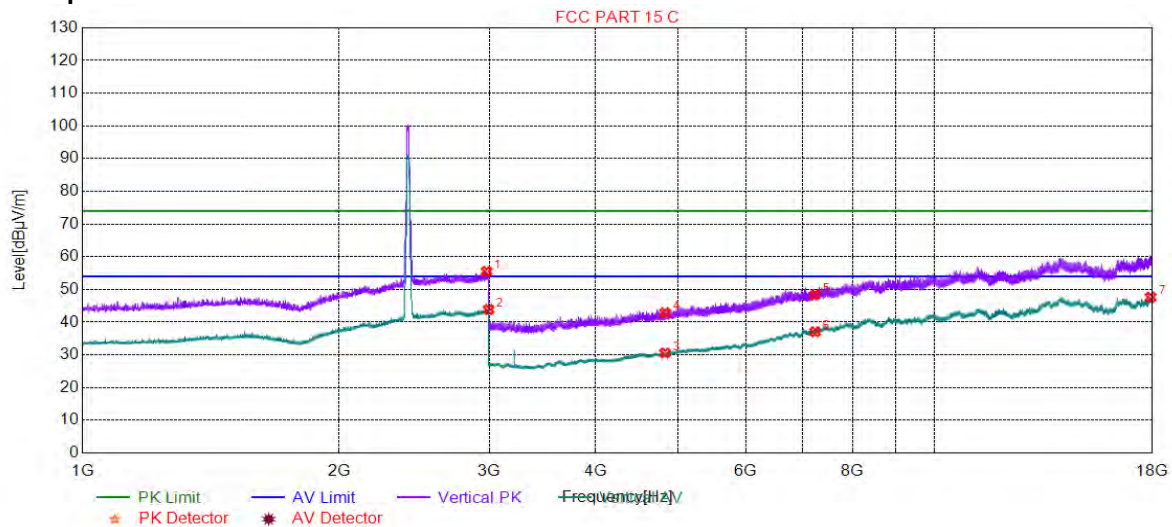
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4.9.2.7 802.11G_Channel 1

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2979.4949	55.52	9.54	74.00	18.48	Vertical
2	2995.9990	43.87	9.47	54.00	10.13	Vertical
3	4824.0000	30.59	-18.21	54.00	23.41	Vertical
4	4824.0000	42.88	-18.21	74.00	31.12	Vertical
5	7236.0000	48.38	-9.99	74.00	25.62	Vertical
6	7236.0000	37.04	-9.99	54.00	16.96	Vertical
7	17914.745	47.62	0.69	54.00	6.38	Vertical

Final Data List



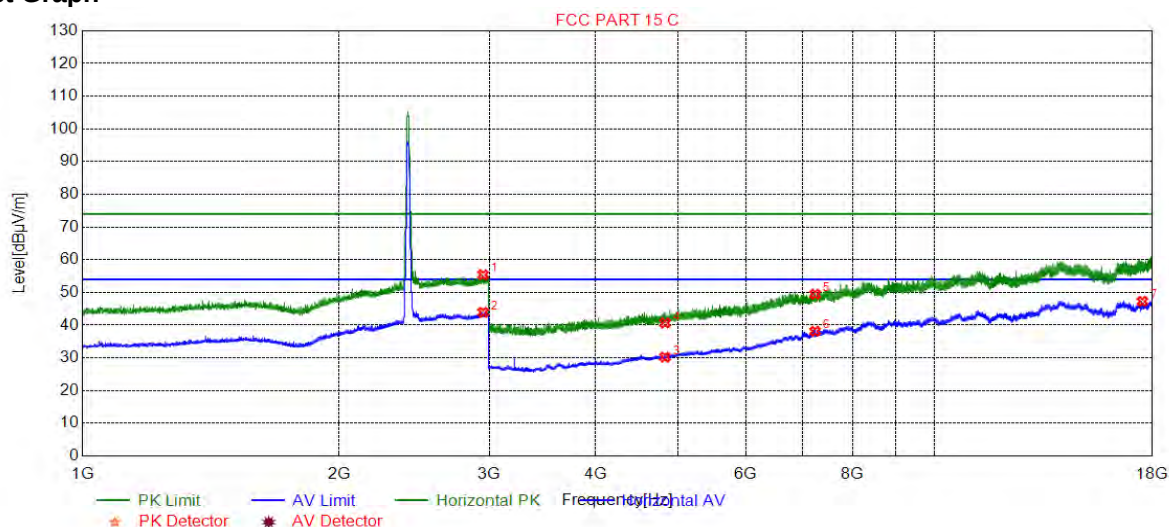
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4.9.2.8 802.11G_Channel 1

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2950.4876	55.42	9.68	74.00	18.58	Horizontal
2	2951.4879	43.94	9.67	54.00	10.06	Horizontal
3	4824.0000	30.25	-18.21	54.00	23.75	Horizontal
4	4824.0000	40.67	-18.21	74.00	33.33	Horizontal
5	7236.0000	49.48	-9.99	74.00	24.52	Horizontal
6	7236.0000	38.14	-9.99	54.00	15.86	Horizontal
7	17513.775	47.29	0.97	54.00	6.71	Horizontal

Final Data List



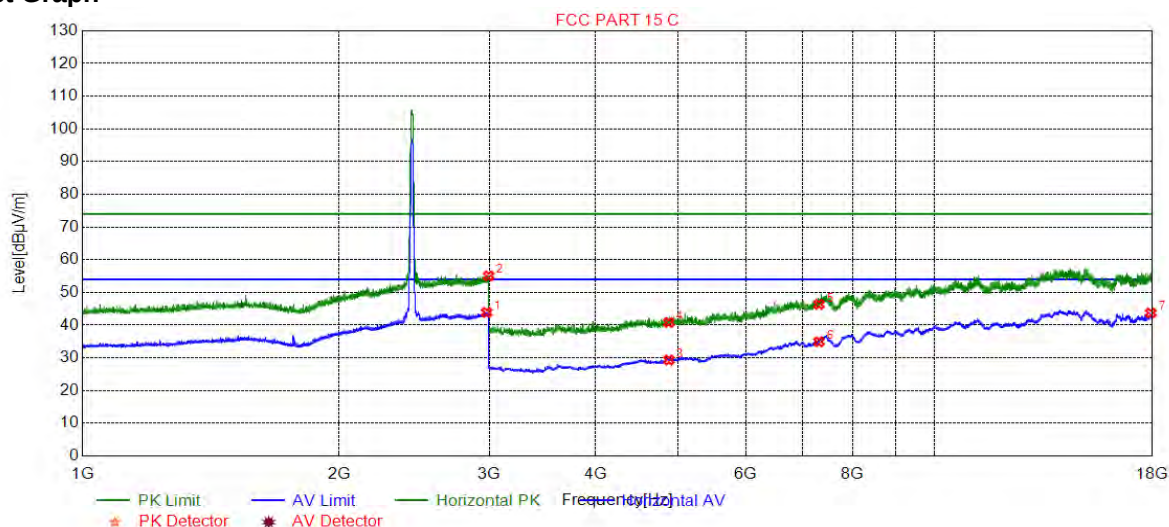
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4.9.2.9 802.11G_Channel 6

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2980.4951	43.91	9.54	54.00	10.09	Horizontal
2	2995.9990	55.07	9.47	74.00	18.93	Horizontal
3	4874.0000	29.35	-17.99	54.00	24.65	Horizontal
4	4874.0000	40.86	-17.99	74.00	33.14	Horizontal
5	7311.0000	46.37	-9.59	74.00	27.63	Horizontal
6	7311.0000	34.94	-9.59	54.00	19.06	Horizontal
7	17912.991	43.74	-1.31	54.00	10.26	Horizontal

Final Data List



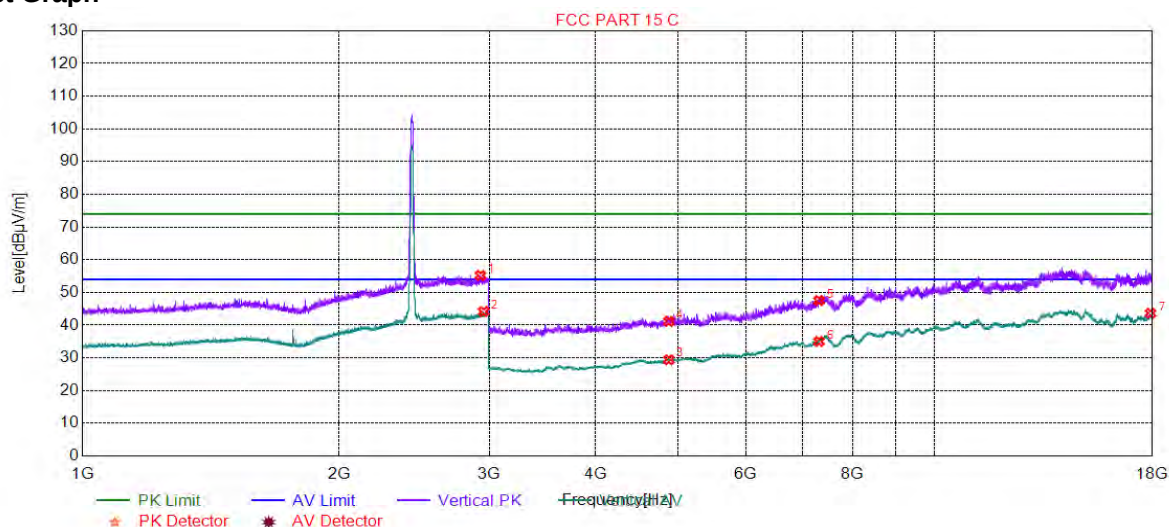
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4.9.2.10 802.11G_Channel 6

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2930.4826	55.21	9.47	74.00	18.79	Vertical
2	2954.9887	44.16	9.66	54.00	9.84	Vertical
3	4874.0000	29.42	-17.99	54.00	24.58	Vertical
4	4874.0000	41.16	-17.99	74.00	32.84	Vertical
5	7311.0000	47.54	-9.59	74.00	26.46	Vertical
6	7311.0000	35.04	-9.59	54.00	18.96	Vertical
7	17903.990	43.64	-1.31	54.00	10.36	Vertical

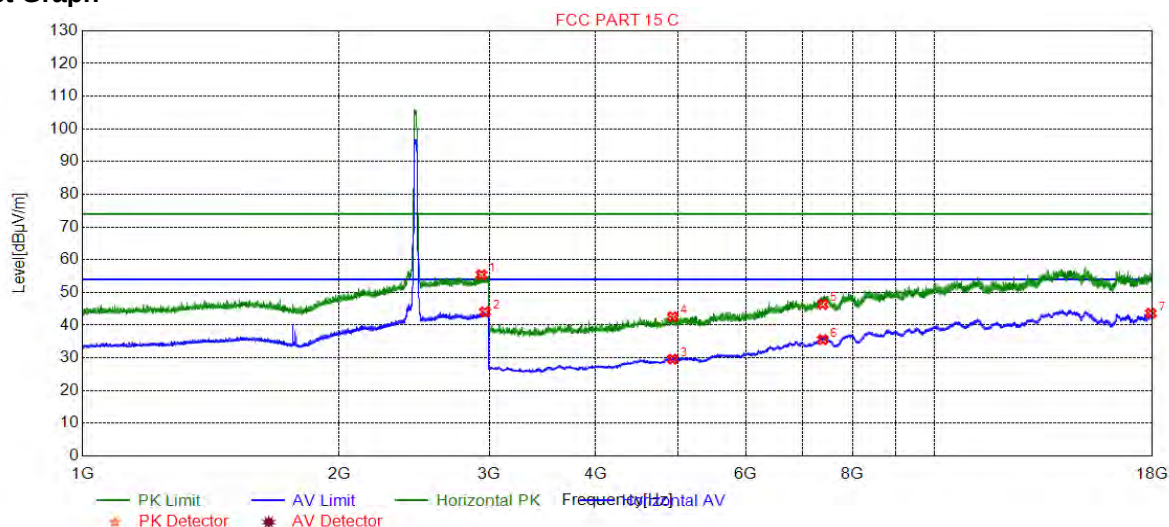
Final Data List





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]	Polarity
1	2936.9842	55.40	9.54	74.00	18.60	Horizontal
2	2965.9915	44.07	9.61	54.00	9.93	Horizontal
3	4924.0000	29.62	-17.71	54.00	24.38	Horizontal
4	4924.0000	42.61	-17.71	74.00	31.39	Horizontal
5	7386.0000	46.38	-9.20	74.00	27.62	Horizontal
6	7386.0000	35.57	-9.20	54.00	18.43	Horizontal
7	17914.491	43.62	-1.31	54.00	10.38	Horizontal

Final Data List



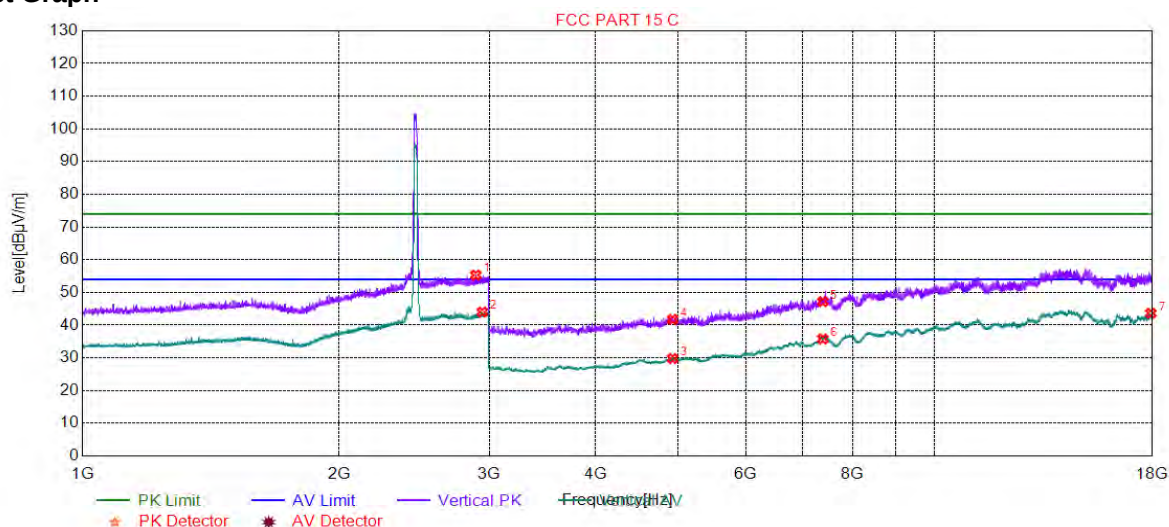
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4.9.2.12 802.11G_Channel 11

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2893.4734	55.33	9.15	74.00	18.67	Vertical
2	2943.9860	44.04	9.62	54.00	9.96	Vertical
3	4924.0000	29.80	-17.71	54.00	24.20	Vertical
4	4924.0000	41.77	-17.71	74.00	32.23	Vertical
5	7386.0000	47.19	-9.20	74.00	26.81	Vertical
6	7386.0000	35.81	-9.20	54.00	18.19	Vertical
7	17915.991	43.63	-1.31	54.00	10.37	Vertical

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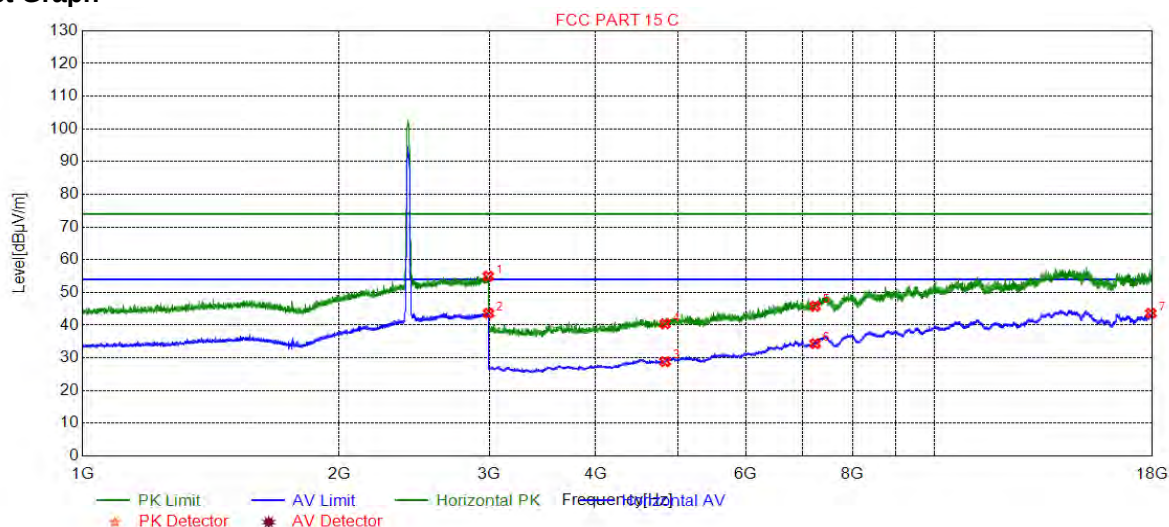
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4.9.2.13 802.11N20_Channel 1

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2991.9980	54.97	9.49	74.00	19.03	Horizontal
2	2994.4986	43.65	9.48	54.00	10.35	Horizontal
3	4824.0000	28.84	-18.21	54.00	25.16	Horizontal
4	4824.0000	40.42	-18.21	74.00	33.58	Horizontal
5	7236.0000	45.79	-9.76	74.00	28.21	Horizontal
6	7236.0000	34.38	-9.76	54.00	19.62	Horizontal
7	17917.491	43.63	-1.30	54.00	10.37	Horizontal

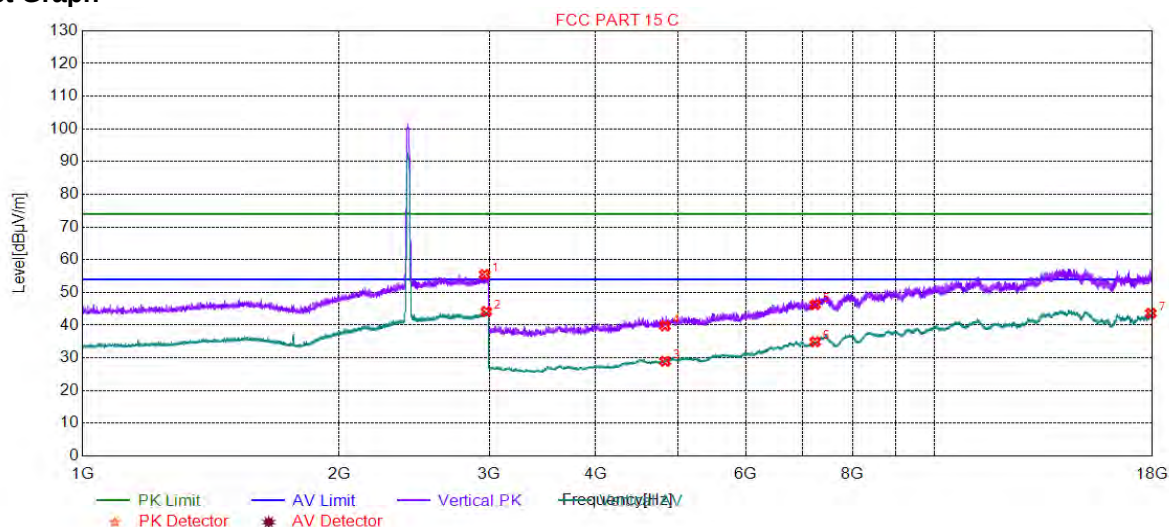
Final Data List





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]	Polarity
1	2962.9907	55.48	9.62	74.00	18.52	Vertical
2	2976.9942	44.20	9.56	54.00	9.80	Vertical
3	4824.0000	28.96	-18.21	54.00	25.04	Vertical
4	4824.0000	39.77	-18.21	74.00	34.23	Vertical
5	7236.0000	46.29	-9.76	74.00	27.71	Vertical
6	7236.0000	34.94	-9.76	54.00	19.06	Vertical
7	17915.991	43.63	-1.31	54.00	10.37	Vertical

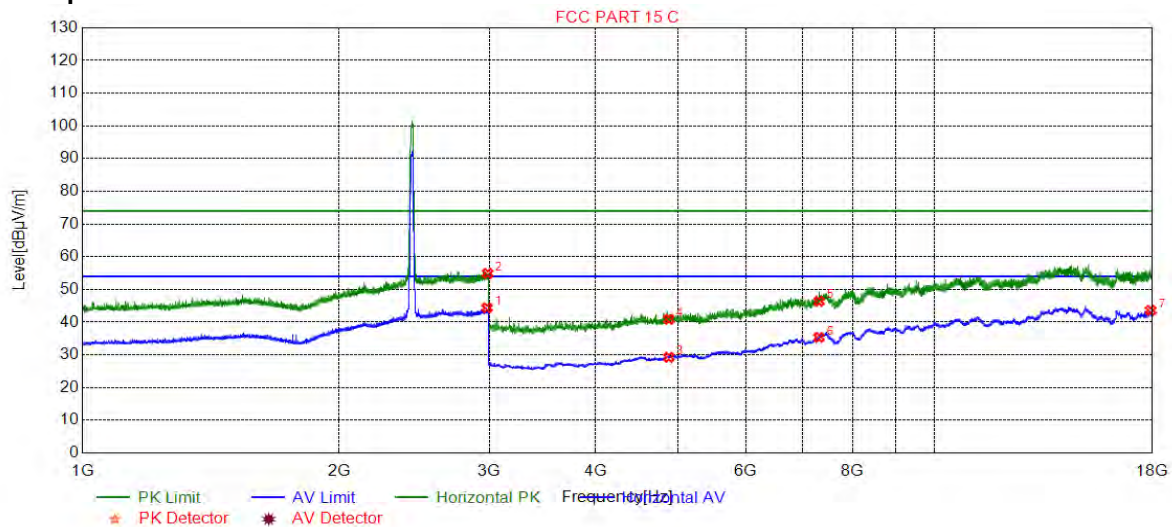
Final Data List





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]	Polarity
1	2982.4956	44.40	9.53	54.00	9.60	Horizontal
2	2987.9970	54.93	9.51	74.00	19.07	Horizontal
3	4874.0000	29.27	-17.99	54.00	24.73	Horizontal
4	4874.0000	40.90	-17.99	74.00	33.10	Horizontal
5	7311.0000	46.38	-9.59	74.00	27.62	Horizontal
6	7311.0000	35.36	-9.59	54.00	18.64	Horizontal
7	17911.491	43.60	-1.31	54.00	10.40	Horizontal

Final Data List



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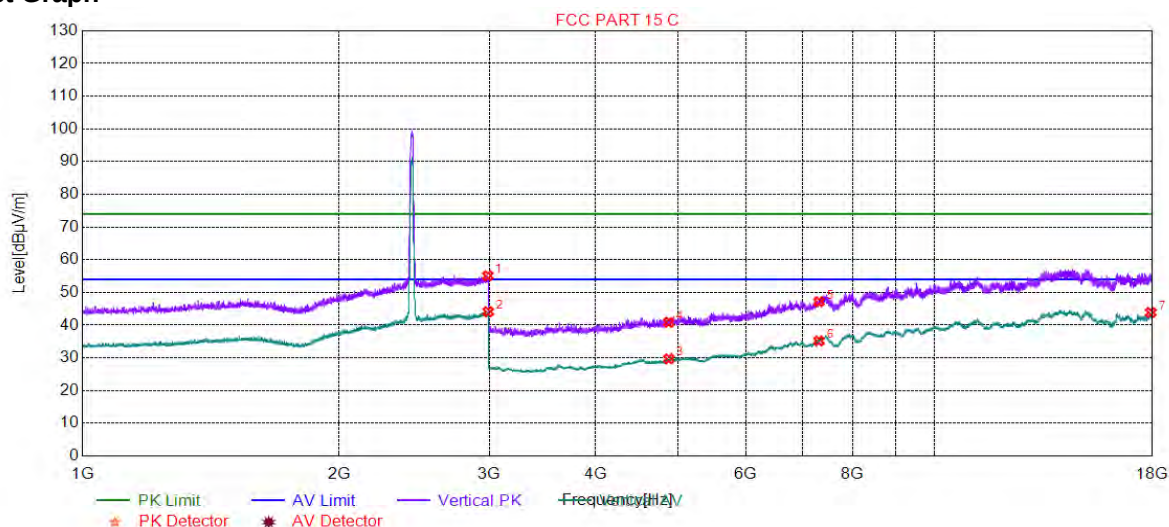
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4.9.2.16 802.11N20_Channel 6

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2988.9972	55.14	9.50	74.00	18.86	Vertical
2	2991.4979	44.14	9.49	54.00	9.86	Vertical
3	4874.0000	29.72	-17.99	54.00	24.28	Vertical
4	4874.0000	40.88	-17.99	74.00	33.12	Vertical
5	7311.0000	47.18	-9.59	74.00	26.82	Vertical
6	7311.0000	35.18	-9.59	54.00	18.82	Vertical
7	17915.991	43.89	-1.31	54.00	10.11	Vertical

Final Data List



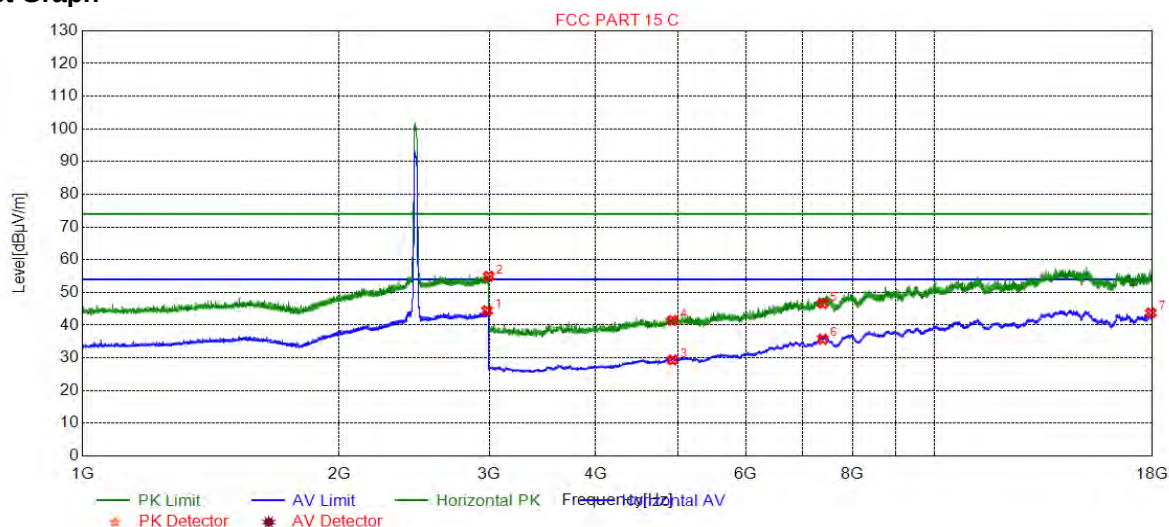
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4.9.2.17 802.11N20_Channel 11

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2982.9957	44.46	9.53	54.00	9.54	Horizontal
2	2996.4991	54.95	9.47	74.00	19.05	Horizontal
3	4924.0000	29.36	-17.71	54.00	24.64	Horizontal
4	4924.0000	41.47	-17.71	74.00	32.53	Horizontal
5	7386.0000	46.65	-9.20	74.00	27.35	Horizontal
6	7386.0000	35.73	-9.20	54.00	18.27	Horizontal
7	17917.491	43.76	-1.30	54.00	10.24	Horizontal

Final Data List



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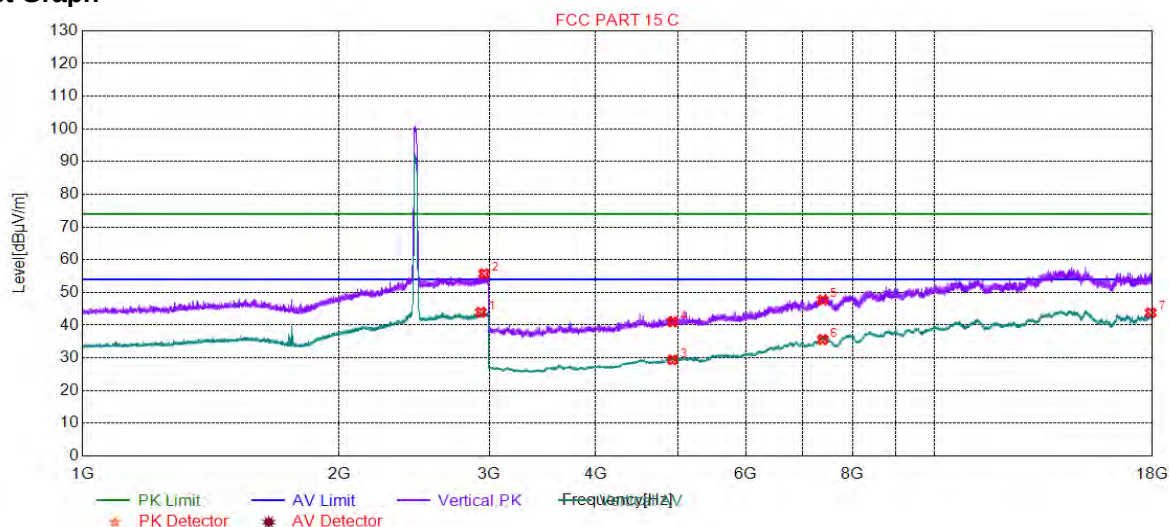
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4.9.2.18 802.11N20_Channel 11

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2933.4834	43.95	9.50	54.00	10.05	Vertical
2	2958.9897	55.74	9.64	74.00	18.26	Vertical
3	4924.0000	29.39	-17.71	54.00	24.61	Vertical
4	4924.0000	41.01	-17.71	74.00	32.99	Vertical
5	7386.0000	47.66	-9.20	74.00	26.34	Vertical
6	7386.0000	35.61	-9.20	54.00	18.39	Vertical
7	17909.991	43.82	-1.31	54.00	10.18	Vertical

Final Data List



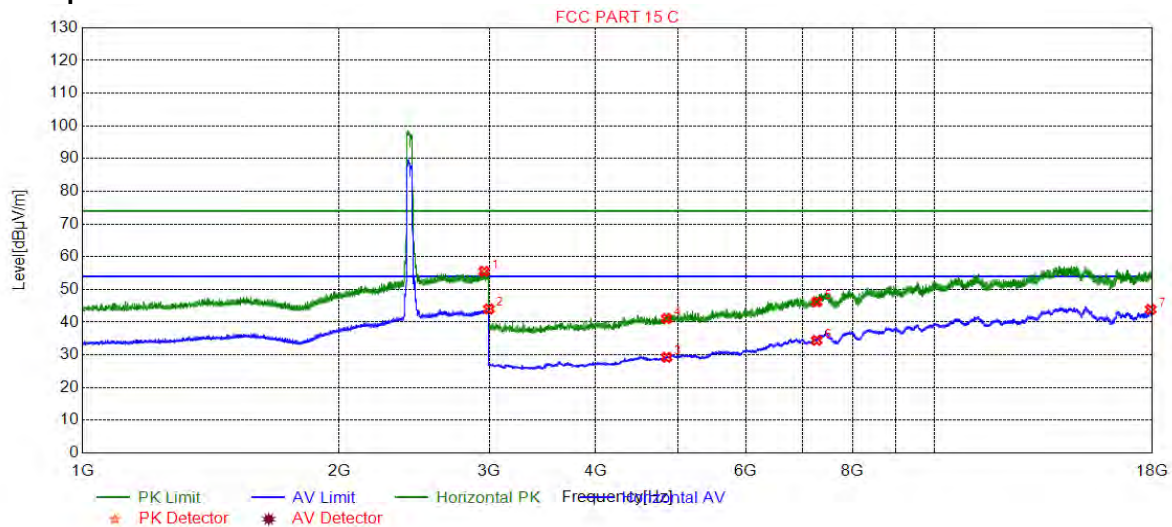
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4.9.2.19 802.11N40_Channel 3

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2958.4896	55.54	9.64	74.00	18.46	Horizontal
2	2997.4994	44.03	9.46	54.00	9.97	Horizontal
3	4844.0000	29.27	-18.12	54.00	24.73	Horizontal
4	4844.0000	41.10	-18.12	74.00	32.90	Horizontal
5	7266.0000	46.21	-9.71	74.00	27.79	Horizontal
6	7266.0000	34.45	-9.71	54.00	19.55	Horizontal
7	17911.491	43.92	-1.31	54.00	10.08	Horizontal

Final Data List



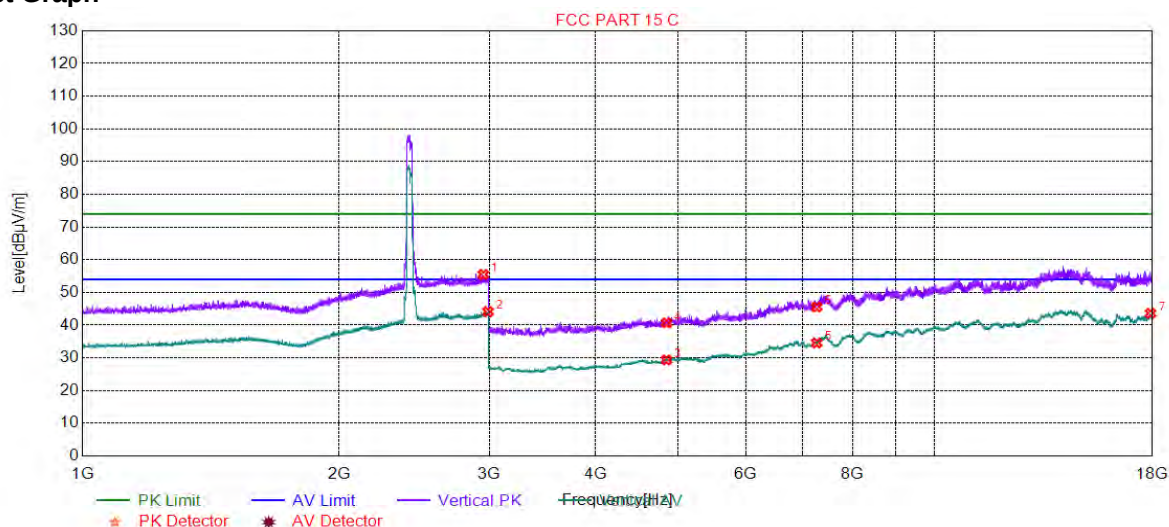
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4.9.2.20 802.11N40_Channel 3

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2952.4881	55.48	9.67	74.00	18.52	Vertical
2	2990.4976	44.12	9.49	54.00	9.88	Vertical
3	4844.0000	29.38	-18.12	54.00	24.62	Vertical
4	4844.0000	40.69	-18.12	74.00	33.31	Vertical
5	7266.0000	34.57	-9.71	54.00	19.43	Vertical
6	7266.0000	45.56	-9.71	74.00	28.44	Vertical
7	17903.990	43.61	-1.31	54.00	10.39	Vertical

Final Data List



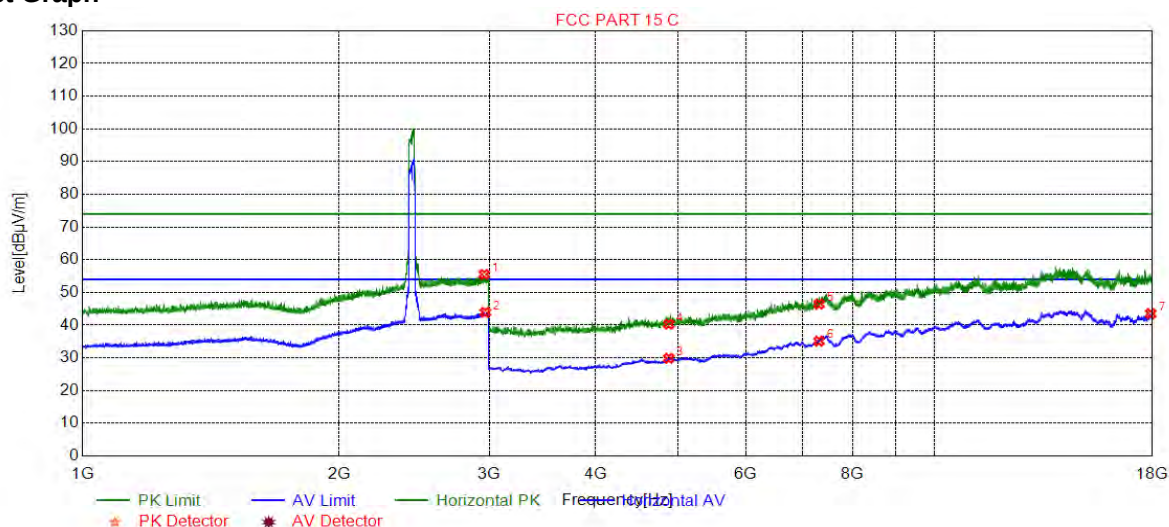
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4.9.2.21 802.11N40_Channel 6

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2959.4899	55.54	9.64	74.00	18.46	Horizontal
2	2968.4921	43.93	9.59	54.00	10.07	Horizontal
3	4874.0000	29.87	-17.99	54.00	24.13	Horizontal
4	4874.0000	40.28	-17.99	74.00	33.72	Horizontal
5	7311.0000	46.46	-9.59	74.00	27.54	Horizontal
6	7311.0000	35.12	-9.59	54.00	18.88	Horizontal
7	17909.991	43.52	-1.31	54.00	10.48	Horizontal

Final Data List



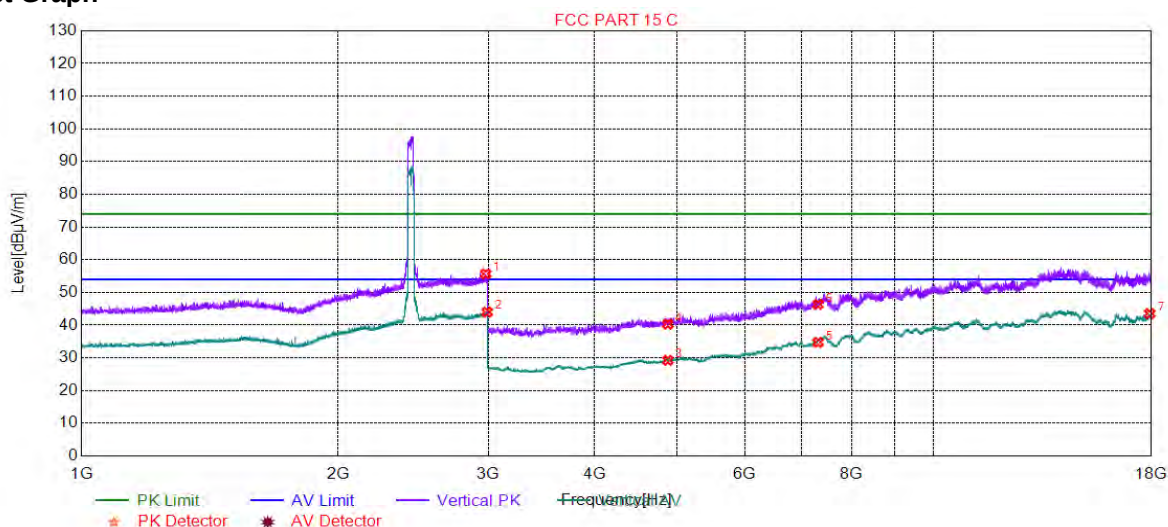
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4.9.2.22 802.11N40_Channel 6

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2980.4951	55.71	9.54	74.00	18.29	Vertical
2	2990.9977	44.01	9.49	54.00	9.99	Vertical
3	4874.0000	29.27	-17.99	54.00	24.73	Vertical
4	4874.0000	40.31	-17.99	74.00	33.69	Vertical
5	7311.0000	34.75	-9.59	54.00	19.25	Vertical
6	7311.0000	46.36	-9.59	74.00	27.64	Vertical
7	17914.491	43.53	-1.31	54.00	10.47	Vertical

Final Data List



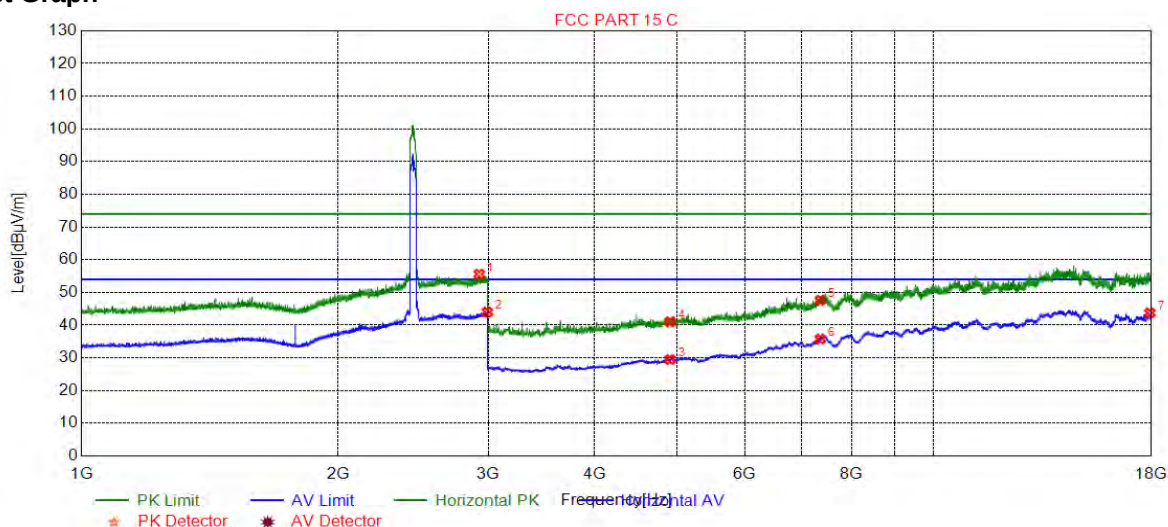
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4.9.2.23 802.11N40_Channel 9

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2928.4821	55.57	9.45	74.00	18.43	Horizontal
2	2992.9983	44.00	9.48	54.00	10.00	Horizontal
3	4904.0000	29.48	-17.84	54.00	24.52	Horizontal
4	4904.0000	41.03	-17.84	74.00	32.97	Horizontal
5	7356.0000	47.60	-9.36	74.00	26.40	Horizontal
6	7356.0000	35.76	-9.36	54.00	18.24	Horizontal
7	17917.491	43.76	-1.30	54.00	10.24	Horizontal

Final Data List



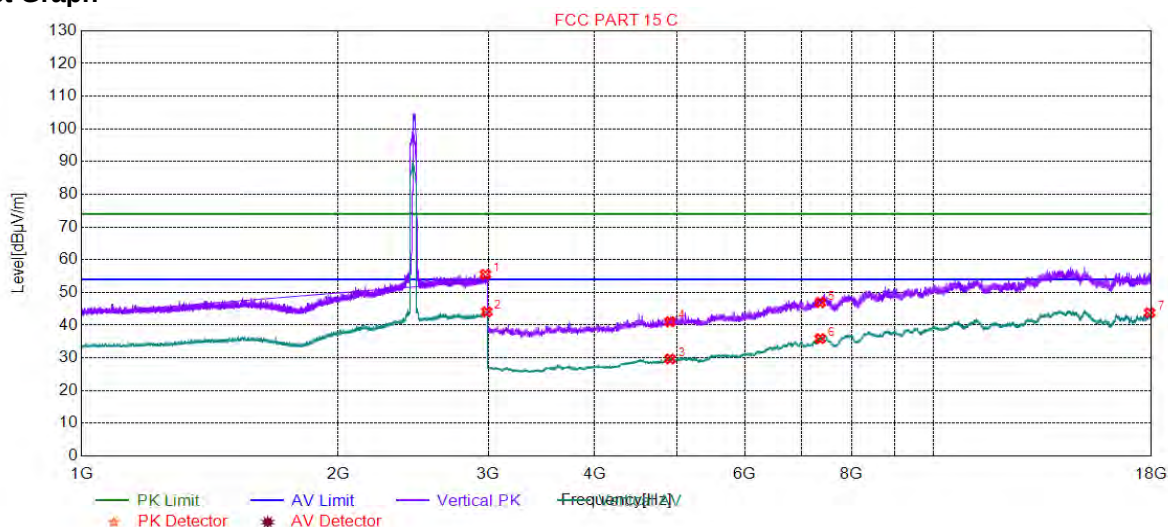
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4.9.2.24 802.11N40_Channel 9

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2976.9942	55.54	9.56	74.00	18.46	Vertical
2	2988.4971	44.09	9.50	54.00	9.91	Vertical
3	4904.0000	29.70	-17.84	54.00	24.30	Vertical
4	4904.0000	41.04	-17.84	74.00	32.96	Vertical
5	7356.0000	46.93	-9.36	74.00	27.07	Vertical
6	7356.0000	35.89	-9.36	54.00	18.11	Vertical
7	17909.991	43.82	-1.31	54.00	10.18	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 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:			

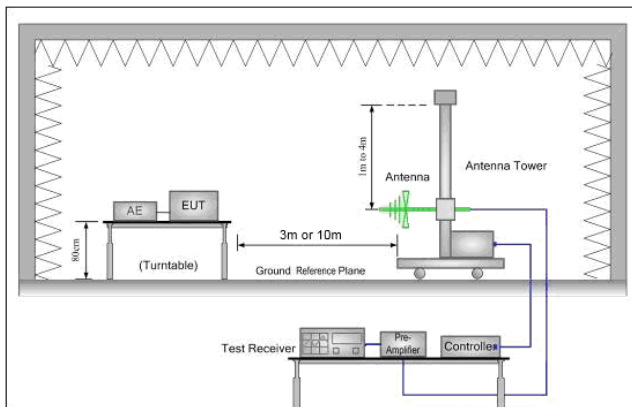


Figure 1. 30MHz to 1GHz

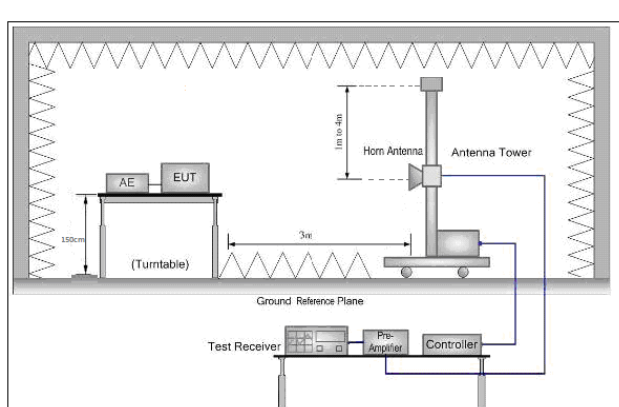


Figure 2. Above 1 GHz



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); 13.5Mbps of rate is the worst case of 802.11N(HT40). Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass



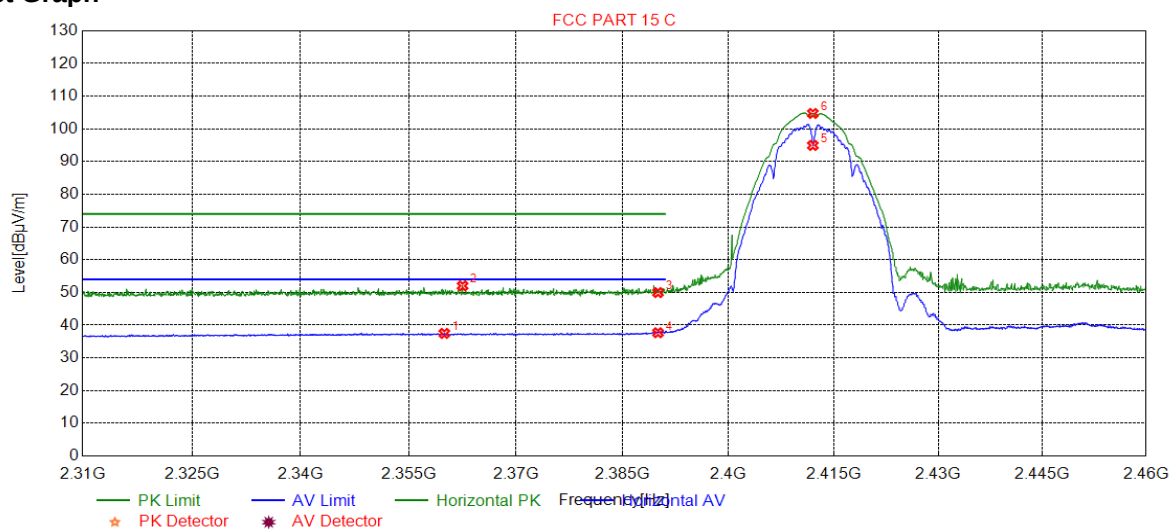


Test plot as follows:

4.10.1 Test plots

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]	Polarity
1	2359.9750	37.49	7.80	54.00	16.51	Horizontal
2	2362.5263	52.03	7.80	74.00	21.97	Horizontal
3	2390.0000	49.97	7.77	74.00	24.03	Horizontal
4	2390.0000	37.69	7.77	54.00	16.31	Horizontal
5	2412.0000	94.96	7.81	0.00	-94.96	Horizontal
6	2412.0000	104.75	7.81	0.00	-104.75	Horizontal

Final Data List



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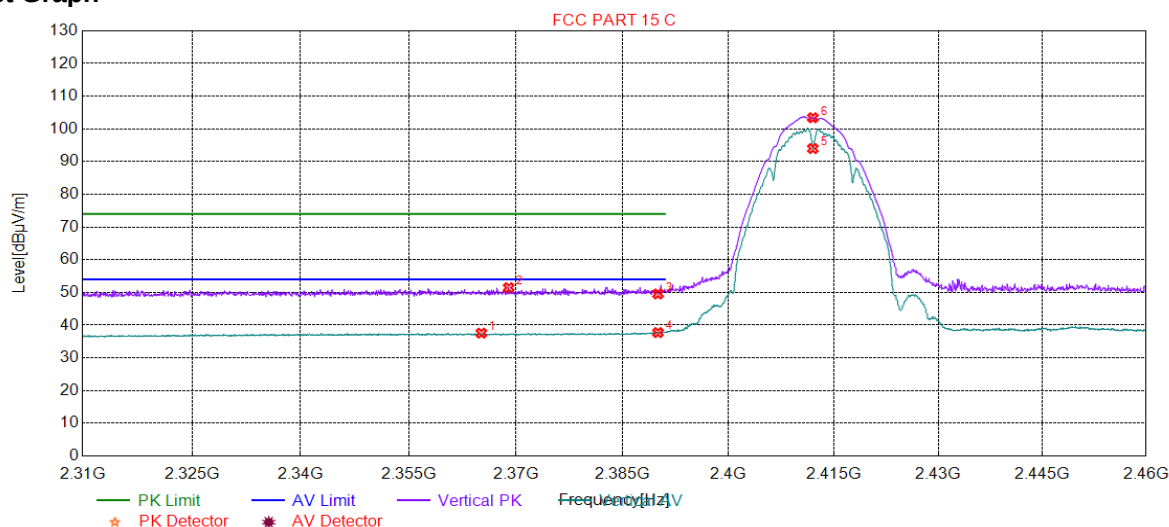
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4.10.1.2 802.11B_Channel 1

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2365.1526	37.57	7.79	54.00	16.43	Vertical
2	2368.9795	51.47	7.79	74.00	22.53	Vertical
3	2390.0000	49.56	7.77	74.00	24.44	Vertical
4	2390.0000	37.75	7.77	54.00	16.25	Vertical
5	2412.0000	94.00	7.81	0.00	-94.00	Vertical
6	2412.0000	103.42	7.81	0.00	-103.42	Vertical

Final Data List



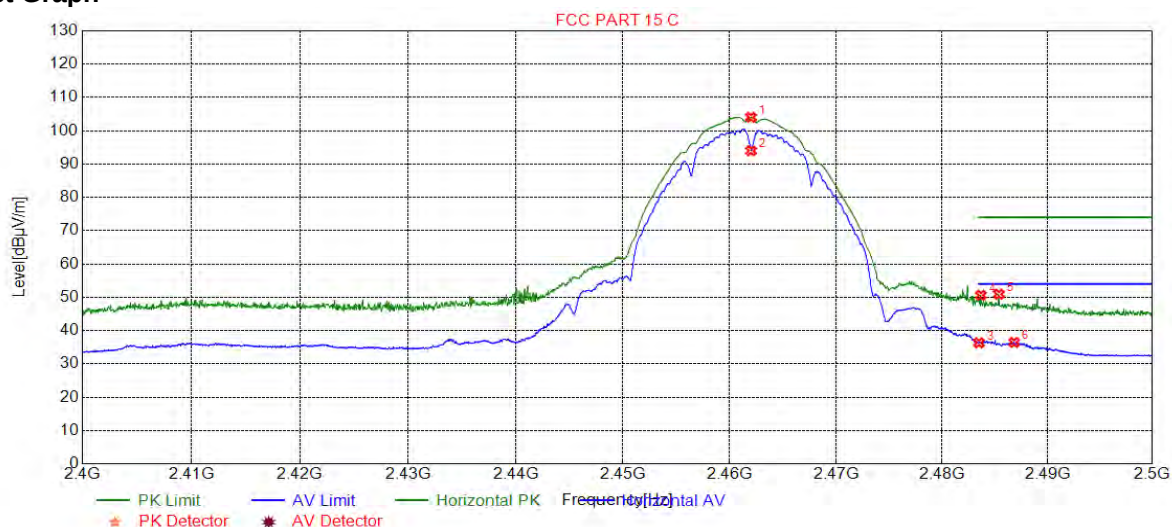
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4.10.1.3 802.11B_Channel 11

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2462.0000	104.04	7.98	0.00	-104.04	Horizontal
2	2462.0000	94.00	7.98	0.00	-94.00	Horizontal
3	2483.5000	36.37	8.01	54.00	17.63	Horizontal
4	2483.6918	50.65	8.01	74.00	23.35	Horizontal
5	2485.3927	50.93	8.01	74.00	23.07	Horizontal
6	2486.8434	36.48	8.01	54.00	17.52	Horizontal

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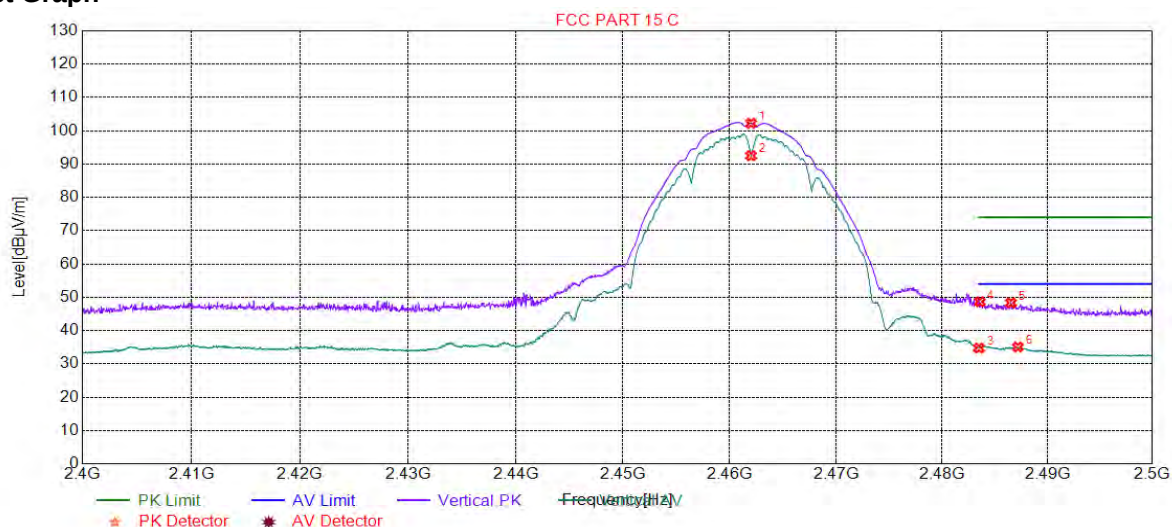
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4.10.1.4 802.11B_Channel 11

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2462.0000	102.23	7.98	0.00	-102.23	Vertical
2	2462.0000	92.51	7.98	0.00	-92.51	Vertical
3	2483.5000	34.80	8.01	54.00	19.20	Vertical
4	2483.5918	48.68	8.01	74.00	25.32	Vertical
5	2486.5433	48.38	8.01	74.00	25.62	Vertical
6	2487.1936	35.09	8.01	54.00	18.91	Vertical

Final Data List



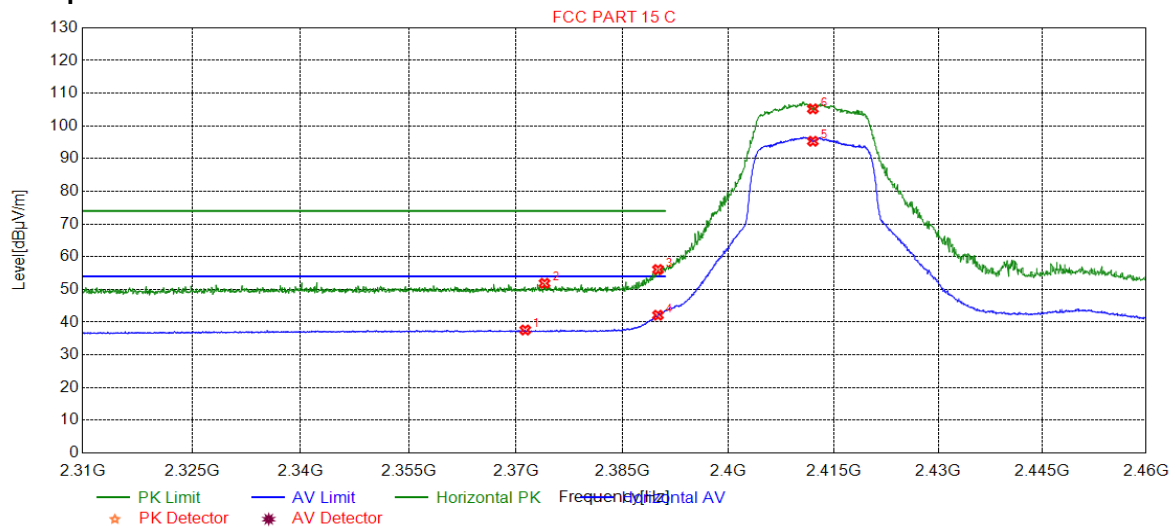
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4.10.1.5 802.11G_Channel 1

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2371.3057	37.61	7.79	54.00	16.39	Horizontal
2	2374.0070	51.88	7.79	74.00	22.12	Horizontal
3	2390.0000	56.10	7.77	74.00	17.90	Horizontal
4	2390.0000	42.14	7.77	54.00	11.86	Horizontal
5	2412.0000	95.32	7.81	0.00	-95.32	Horizontal
6	2412.0000	105.23	7.81	0.00	-105.23	Horizontal

Final Data List



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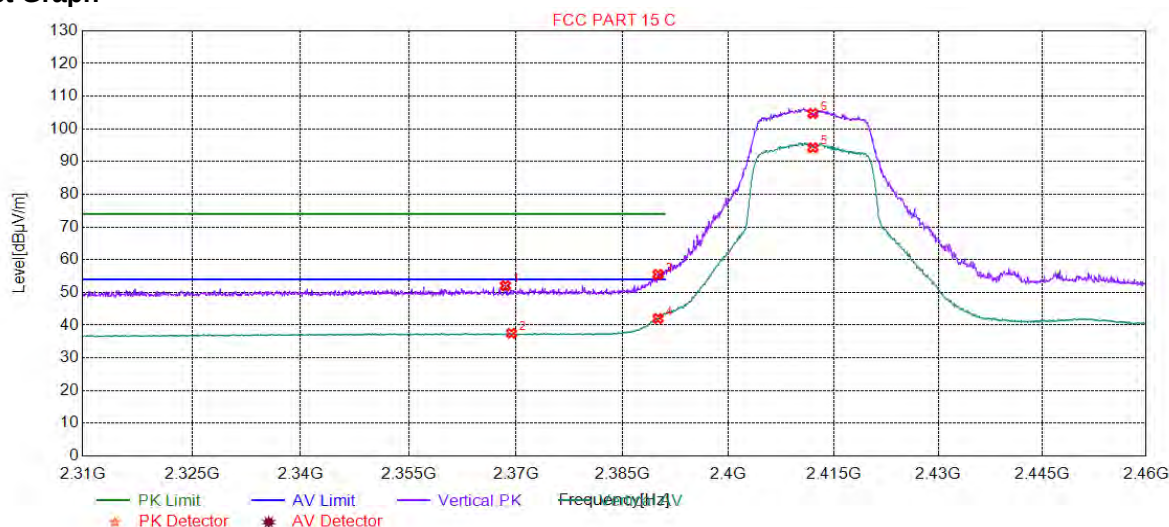
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4.10.1.6 802.11G_Channel 1

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2368.5293	52.08	7.79	74.00	21.92	Vertical
2	2369.3547	37.52	7.79	54.00	16.48	Vertical
3	2390.0000	55.52	7.77	74.00	18.48	Vertical
4	2390.0000	42.06	7.77	54.00	11.94	Vertical
5	2412.0000	94.26	7.81	0.00	-94.26	Vertical
6	2412.0000	104.74	7.81	0.00	-104.74	Vertical

Final Data List



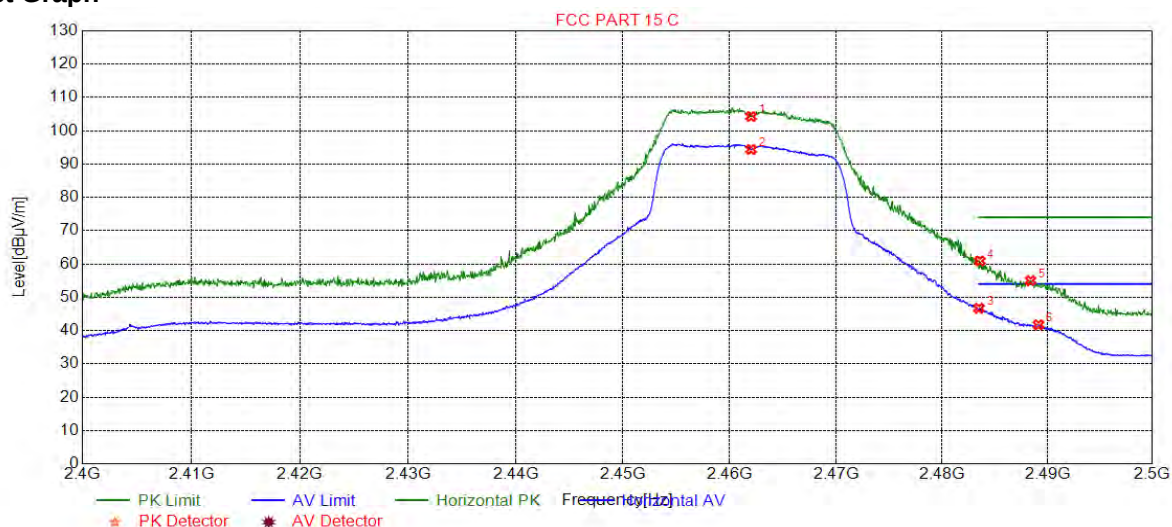
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4.10.1.7 802.11G_Channel 11

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2462.0000	104.29	7.98	0.00	-104.29	Horizontal
2	2462.0000	94.39	7.98	0.00	-94.39	Horizontal
3	2483.5000	46.74	8.01	54.00	7.26	Horizontal
4	2483.5918	60.93	8.01	74.00	13.07	Horizontal
5	2488.3942	55.03	8.02	74.00	18.97	Horizontal
6	2489.1446	41.77	8.02	54.00	12.23	Horizontal

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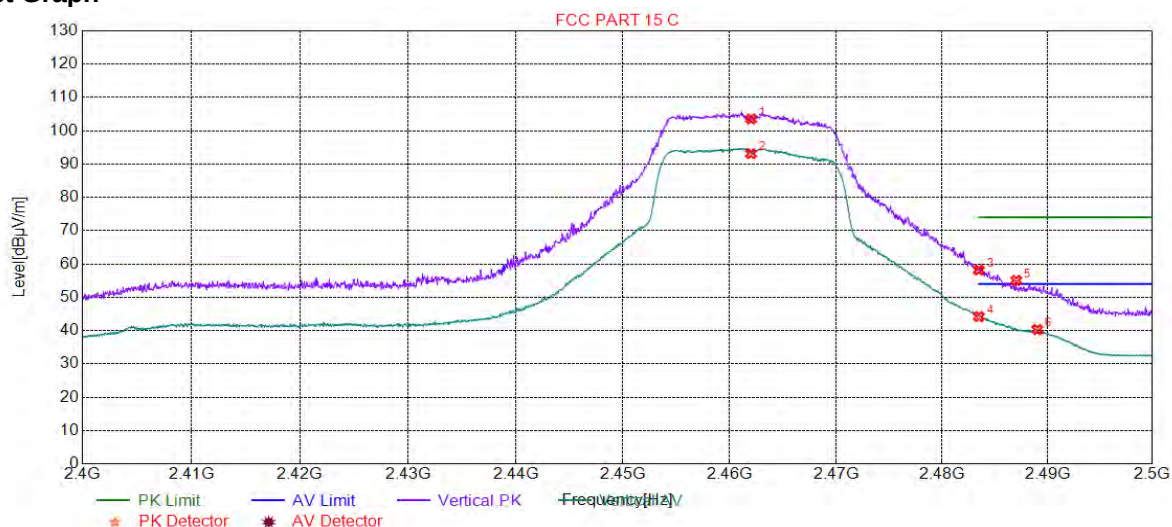
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4.10.1.8 802.11G_Channel 11

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2462.0000	103.53	7.98	0.00	-103.53	Vertical
2	2462.0000	93.12	7.98	0.00	-93.12	Vertical
3	2483.5000	58.20	8.01	74.00	15.80	Vertical
4	2483.5000	44.24	8.01	54.00	9.76	Vertical
5	2487.0435	55.09	8.01	74.00	18.91	Vertical
6	2489.0445	40.32	8.02	54.00	13.68	Vertical

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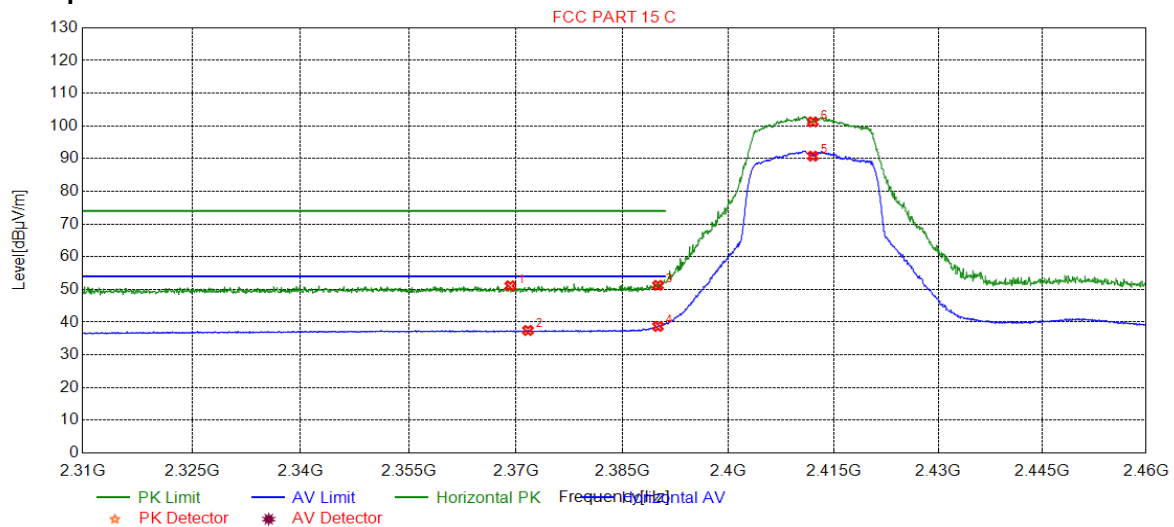
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4.10.1.9 802.11N20_Channel 1

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2369.2046	51.11	7.79	74.00	22.89	Horizontal
2	2371.6808	37.49	7.79	54.00	16.51	Horizontal
3	2390.0000	51.28	7.77	74.00	22.72	Horizontal
4	2390.0000	38.71	7.77	54.00	15.29	Horizontal
5	2412.0000	90.78	7.81	0.00	-90.78	Horizontal
6	2412.0000	101.26	7.81	0.00	-101.26	Horizontal

Final Data List



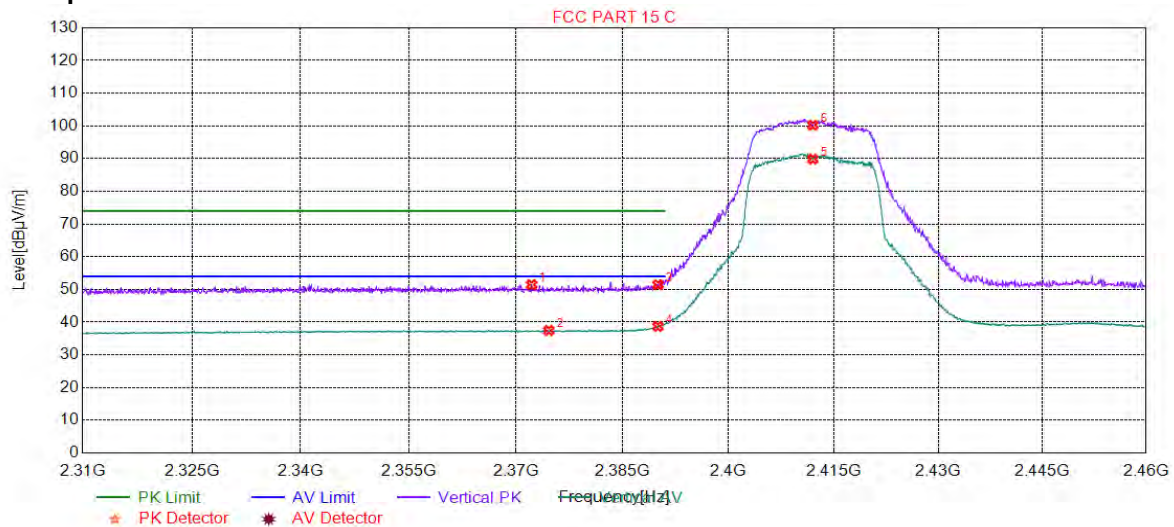
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4.10.1.10 802.11N20_Channel 1

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2372.2061	51.46	7.79	74.00	22.54	Vertical
2	2374.6073	37.46	7.79	54.00	16.54	Vertical
3	2390.0000	51.46	7.77	74.00	22.54	Vertical
4	2390.0000	38.70	7.77	54.00	15.30	Vertical
5	2412.0000	89.86	7.81	0.00	-89.86	Vertical
6	2412.0000	100.24	7.81	0.00	-100.24	Vertical

Final Data List



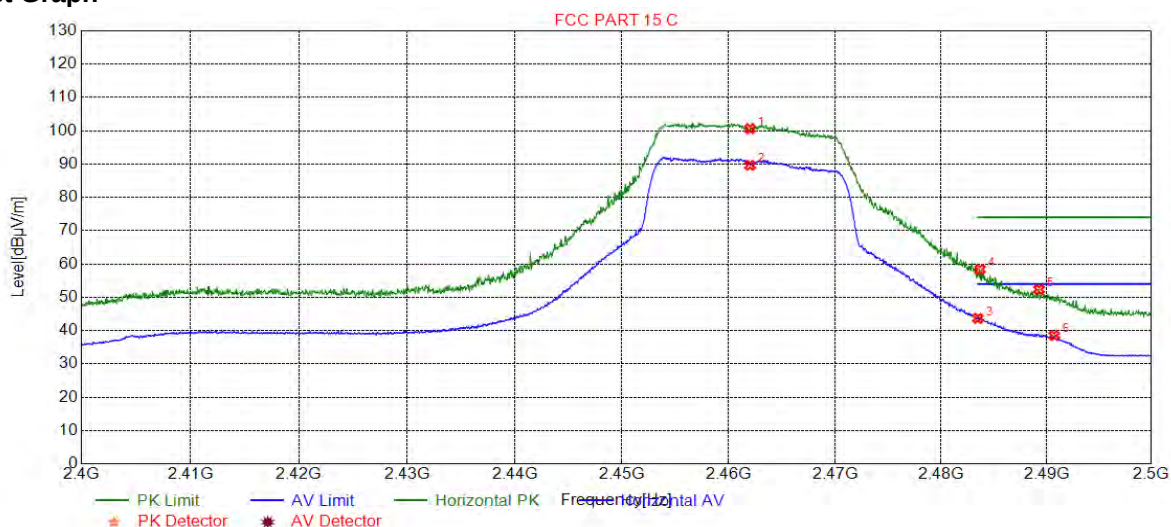
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4.10.1.11 802.11N20_Channel 11

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2462.0000	100.61	7.98	0.00	-100.61	Horizontal
2	2462.0000	89.63	7.98	0.00	-89.63	Horizontal
3	2483.5000	43.68	8.01	54.00	10.32	Horizontal
4	2483.6918	58.43	8.01	74.00	15.57	Horizontal
5	2489.2946	52.35	8.02	74.00	21.65	Horizontal
6	2490.7454	38.54	8.02	54.00	15.46	Horizontal

Final Data List



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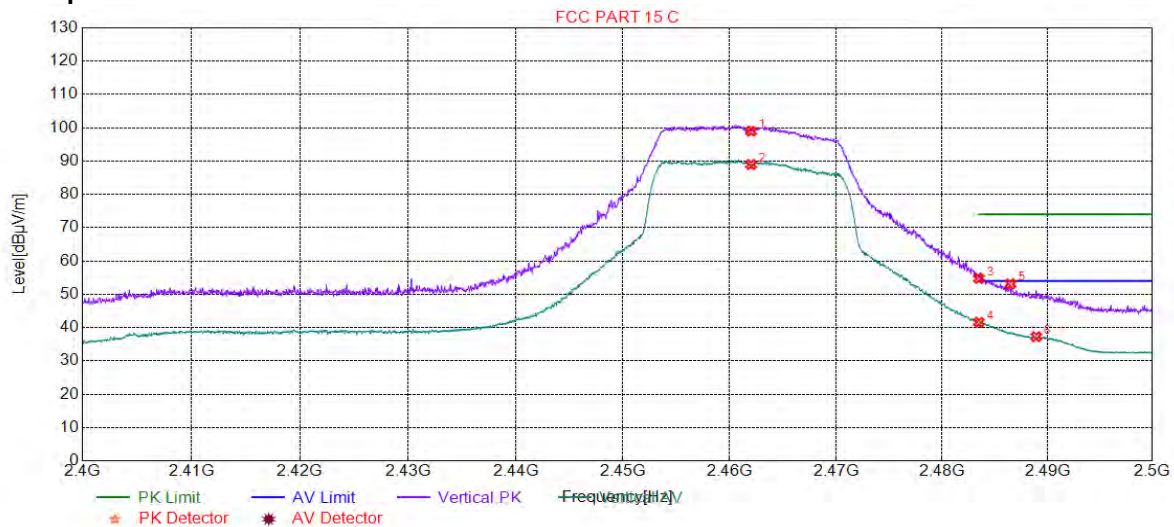
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4.10.1.12 802.11N20_Channel 11

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2462.0000	98.97	7.98	0.00	-98.97	Vertical
2	2462.0000	88.96	7.98	0.00	-88.96	Vertical
3	2483.5000	54.76	8.01	74.00	19.24	Vertical
4	2483.5000	41.62	8.01	54.00	12.38	Vertical
5	2486.4932	53.14	8.01	74.00	20.86	Vertical
6	2488.9445	37.29	8.02	54.00	16.71	Vertical

Final Data List



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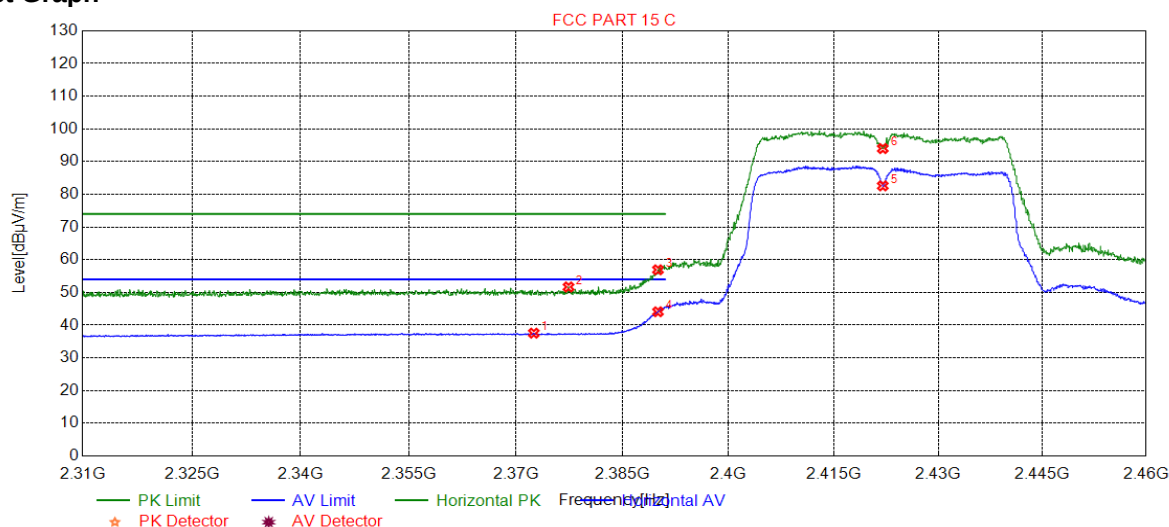
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4.10.1.13 802.11N40_Channel 3

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2372.5063	37.57	7.79	54.00	16.43	Horizontal
2	2377.3837	51.69	7.78	74.00	22.31	Horizontal
3	2390.0000	56.94	7.77	74.00	17.06	Horizontal
4	2390.0000	44.11	7.77	54.00	9.89	Horizontal
5	2422.0000	82.60	7.85	0.00	-82.60	Horizontal
6	2422.0000	94.01	7.85	0.00	-94.01	Horizontal

Final Data List



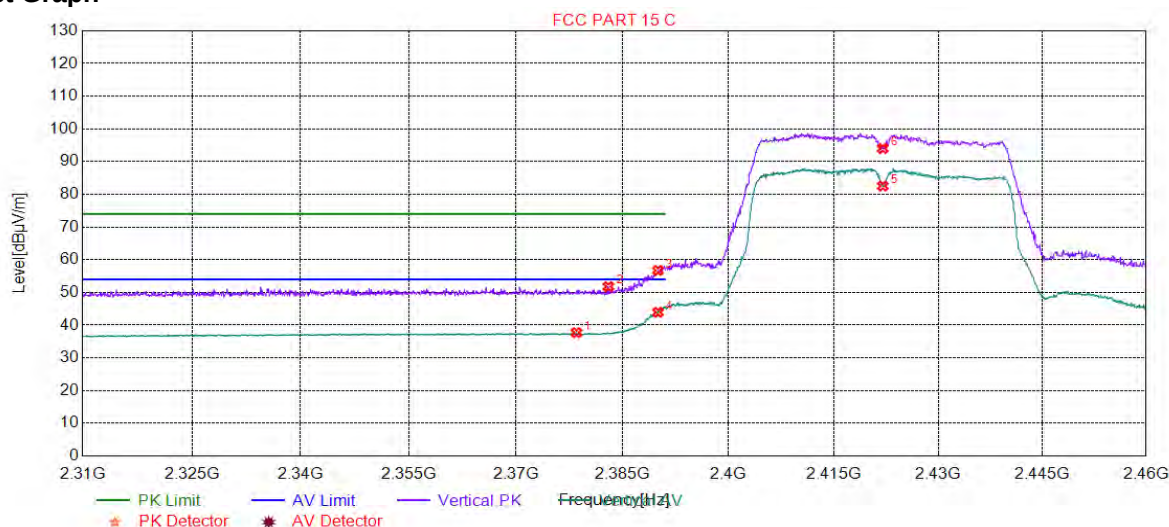
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4.10.1.14 802.11N40_Channel 3

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2378.5093	37.73	7.78	54.00	16.27	Vertical
2	2383.0115	51.81	7.78	74.00	22.19	Vertical
3	2390.0000	56.74	7.77	74.00	17.26	Vertical
4	2390.0000	43.95	7.77	54.00	10.05	Vertical
5	2422.0000	82.53	7.85	0.00	-82.53	Vertical
6	2422.0000	94.00	7.85	0.00	-94.00	Vertical

Final Data List



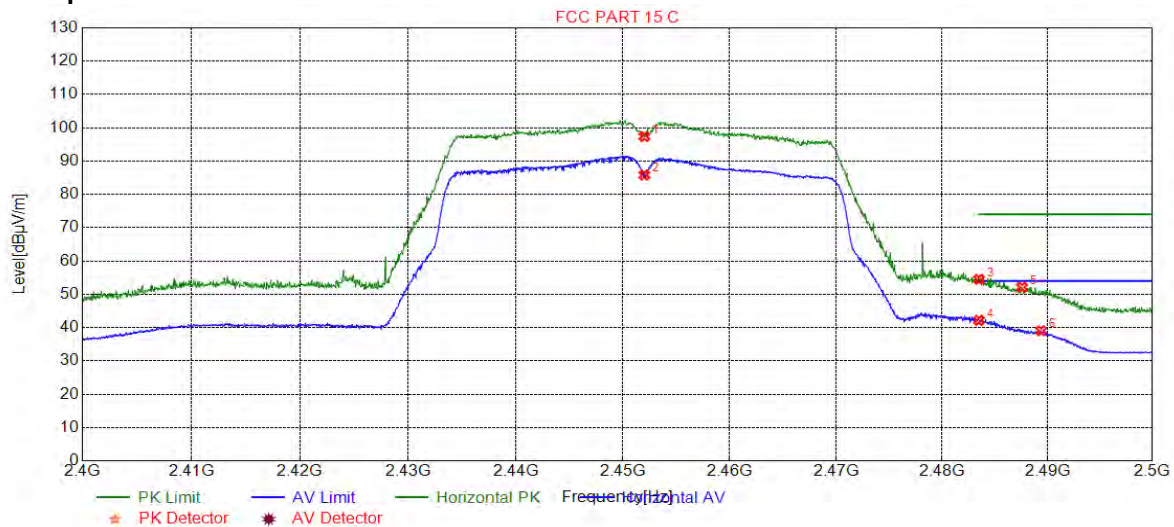
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4.10.1.15 802.11N40_Channel 9

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2452.0000	97.38	7.97	0.00	-97.38	Horizontal
2	2452.0000	85.84	7.97	0.00	-85.84	Horizontal
3	2483.5000	54.49	8.01	74.00	19.51	Horizontal
4	2483.5000	42.21	8.01	54.00	11.79	Horizontal
5	2487.5938	52.15	8.02	74.00	21.85	Horizontal
6	2489.3947	39.12	8.02	54.00	14.88	Horizontal

Final Data List



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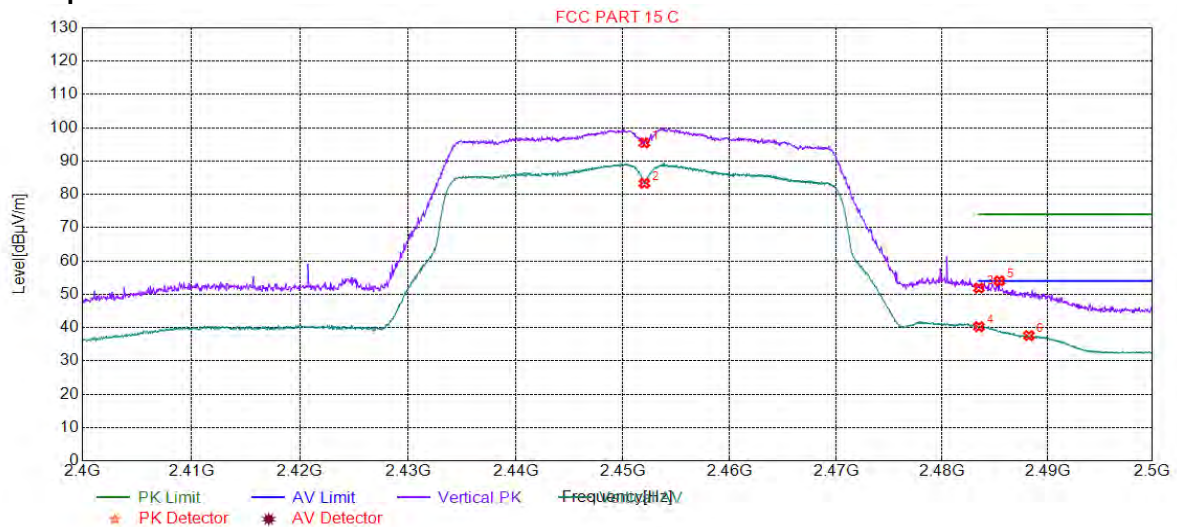
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4.10.1.16 802.11N40_Channel 9

Test Graph



Suspected List

Suspected List						
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2452.0000	95.47	7.97	0.00	-95.47	Vertical
2	2452.0000	83.32	7.97	0.00	-83.32	Vertical
3	2483.5000	51.92	8.01	74.00	22.08	Vertical
4	2483.5000	40.30	8.01	54.00	13.70	Vertical
5	2485.4427	54.03	8.01	74.00	19.97	Vertical
6	2488.2441	37.64	8.02	54.00	16.36	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:

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.



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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.Duedate
				(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	2020/10/27	2021/10/27
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	2020-09-11	2021-09-10
Artificial network	ROHDE&SCHWARZ	ENV216	XAW01-04-01	2020-08-04	2021-08-03
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	2020-09-11	2021-09-10
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	2020-10-26	2021-10-25
Amplifier	Tonscend	TAP01018048	XAW01-41-02	2020-10-26	2021-10-25
Amplifier	Tonscend	TAP18040048	XAW01-41-03	2019-12-03	2020-12-02
Amplifier	Shanghai Steed	YX28980930	XAW01-41-06	2020-10-26	2021-10-25
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



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7 Photographs - EUT Constructional Details

Refer to Appendix A - Photographs of Set-Up for ZR/2020/90059.

The End



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