FCC TEST REPORT

Application No:	ZR/2020/50042
Applicant:	Xiaomi Communications Co., Ltd.
Address of Applicant:	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085
Manufacturer:	Xiaomi Communications Co., Ltd.
Address of Manufacturer	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085
EUT Description:	Mobile Phone
Model No.:	M2006C3LVG
Trade Mark:	Redmi
FCC ID:	2AFZZC3LVG
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:	2020/6/10
Date of Test:	2020/6/10 to 2020/7/4
Date of Issue:	2021/4/27
Test Result:	**PASS ***

. * In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Derek Yang
Wireless Laboratory Manager

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1 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		2020/7/4		Original
02		2021/4/27	Eason Wang	1. Add test site Information 2.Modify data conversion error of antenna height 3.Update equipment list

*This report supersedes our previous report ZR/2020/5004202, issued on 2020/7/4, which is hereby deemed null and void.

Authorized for issue by:		
Prepared By		Eason Wang **(Eason Wang) /Engineer**
Checked By		David Chen **(David Chen) /Reviewer**

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2 Test Summary

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

Remark:

All test were performed by Lab A and 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:	Xiaomi Communications Co., Ltd.
Address of Applicant:	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085
Manufacturer:	Xiaomi Communications Co., Ltd.
Address of Manufacturer:	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085

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::	Mobile Phone
Model No.:	M2006C3LVG
Trade Mark:	Redmi
Hardware Version:	P2
Software Version:	MIUI 12
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 MHz + N * 5 MHz, where: -fc = "Operating Frequency" in MHz, -N = "Channel Number" with the range from 1 to 11 for the 20 MHz channel bandwidth, or 3 to 9 for the 40 MHz channel bandwidth.
Type of Modulation:	IEEE for 802.11B: DSSS IEEE for 802.11G : OFDM IEEE for 802.11N(HT20) : OFDM 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	☒ AC/DC Adapter; ☒ Battery ☐ PoE:; ☐ Other:
Accsessories	AC Adapter 1:Model :MDY-09-EQ; Input:100-240V,0.35A;Output:5V,2A AC Adapter 2:Model :MDY-09-EQ; Input:100-240V,0.35A;Output:5V,2A Li-ion Battery: Model :BN56;3.85V,4900mAh USB: Model :H52210; 0.8 meter, shielded cable, with-out ferrite core

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				

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5	2432MHz	8	2447MHz	

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 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded. 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2. 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.		

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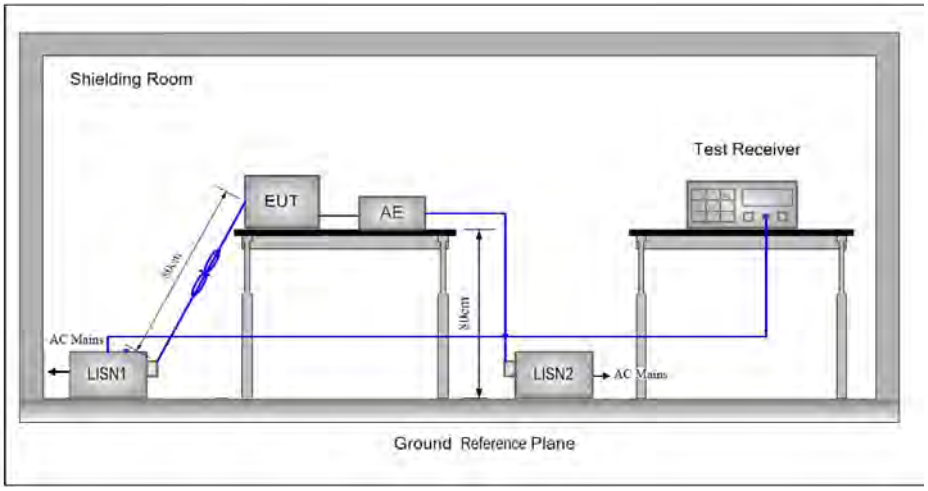
Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates at lowest, middle and highest channel. Charge + Transmitting mode.
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate of 802.11B at lowest channel is the worst case. Charge + Transmitting mode. Only the worst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

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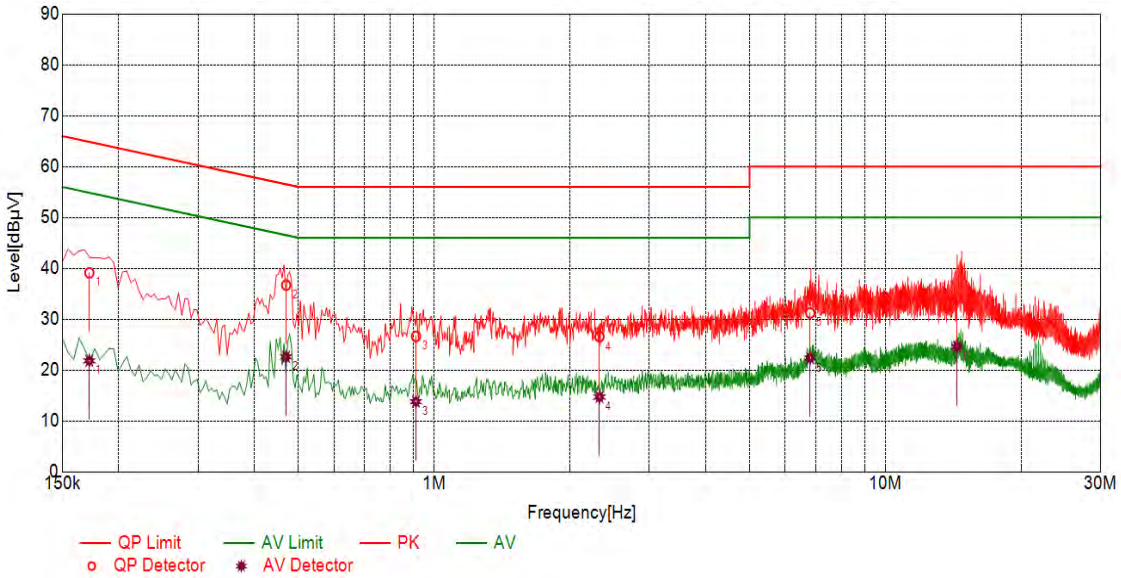
Measurement Data
An initial pre-scan was performed on the live and neutral lines with peak detector.
Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.
Live Line:



Test Graph

Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Value	QP Limit	QP Margin	AV Value	AV Limit	AV Margin	Type
1	0.1722	10.10	39.11	64.85	25.74	21.82	54.85	33.03	L
2	0.4700	10.10	36.70	56.51	19.81	22.59	46.51	23.92	L
3	0.9117	10.10	26.63	56.00	29.37	13.79	46.00	32.21	L
4	2.3253	10.10	26.56	56.00	29.44	14.70	46.00	31.30	L
5	6.8143	10.10	31.23	60.00	28.77	22.35	50.00	27.65	L
6	14.4204	10.11	34.14	60.00	25.86	24.59	50.00	25.41	L

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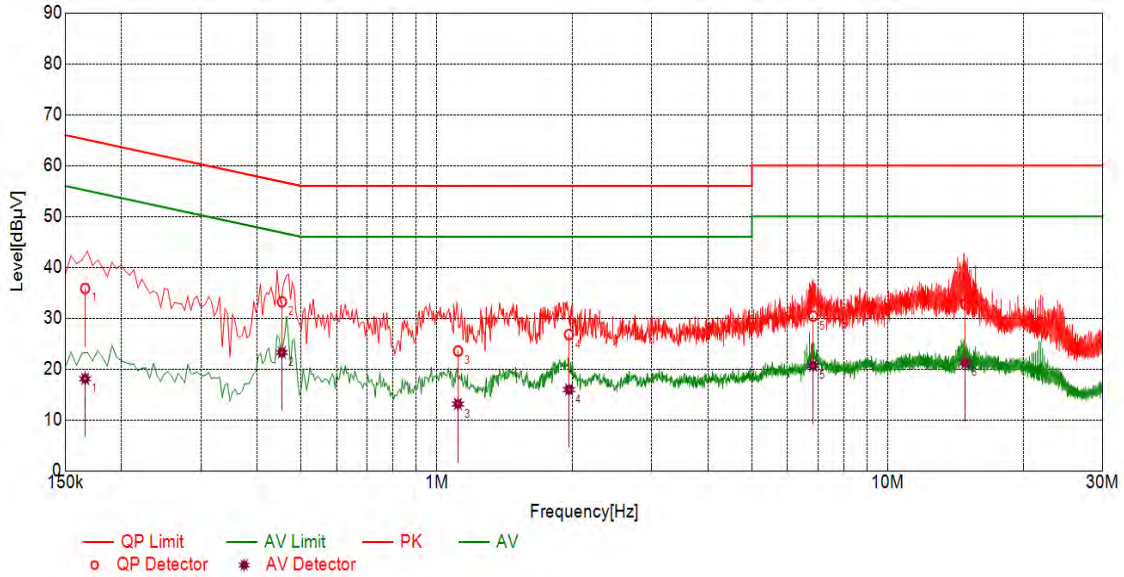
Neutral Line:



Test Graph

Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Value	QP Limit	QP Margin	AV Value	AV Limit	AV Margin	Type
1	0.1661	10.10	35.85	65.15	29.30	18.09	55.15	37.06	N
2	0.4535	10.10	33.21	56.81	23.60	23.27	46.81	23.54	N
3	1.1149	10.10	23.55	56.00	32.45	13.13	46.00	32.87	N
4	1.9648	10.10	26.79	56.00	29.21	15.98	46.00	30.02	N
5	6.8337	10.10	30.41	60.00	29.59	20.69	50.00	29.31	N
6	14.8655	10.11	32.77	60.00	27.23	21.23	50.00	28.77	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

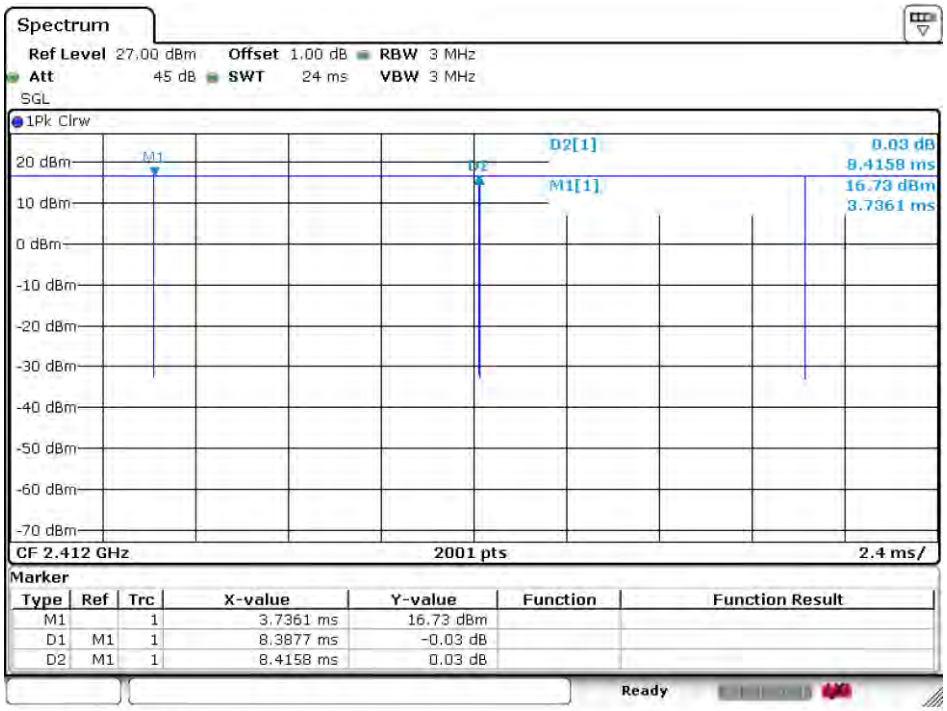
4.3.1 Test Results

Test Mode	TX Freq. [MHz]	Duty cycle [%]
11B	Ant 1: CH1,CH6,CH11	99.67
11G	Ant 1: CH1,CH6,CH11	95.78
11N20	Ant 1: CH1,CH6,CH11	96.13
11N40	Ant 1: CH3,CH6,CH9	89.58

4.3.1 Test Plots

4.3.1.1 ANT1

4.3.1.1.1 11B



Date: 12.JUN.2020 04:30:29

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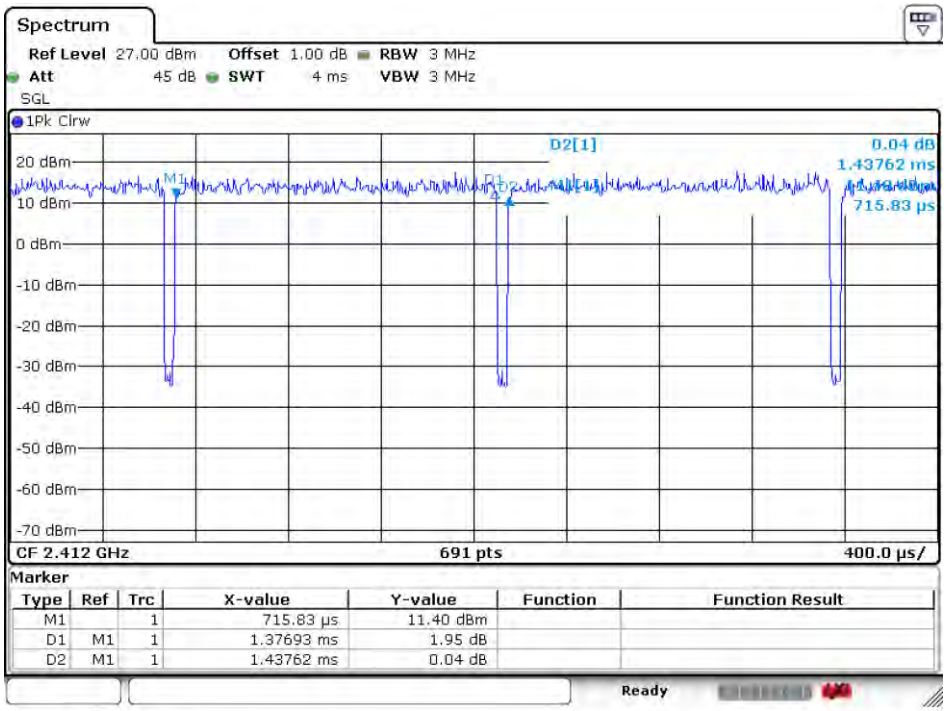
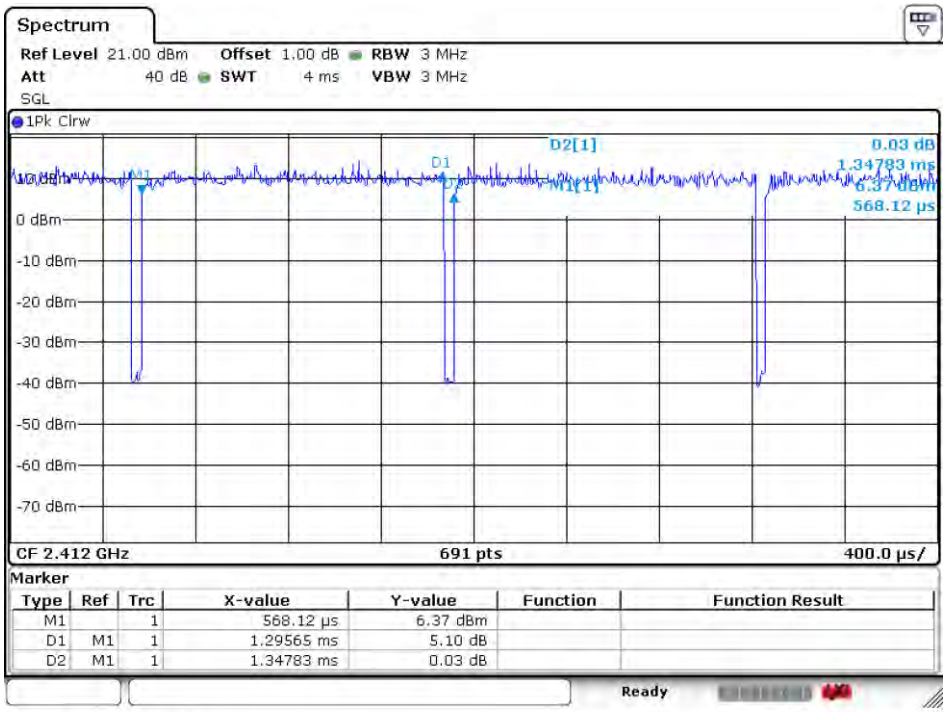
4.3.1.1.2 11G



Date: 12.JUN.2020 04:31:14

4.3.1.1.3 11N20



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4.3.1.1.4 11N40

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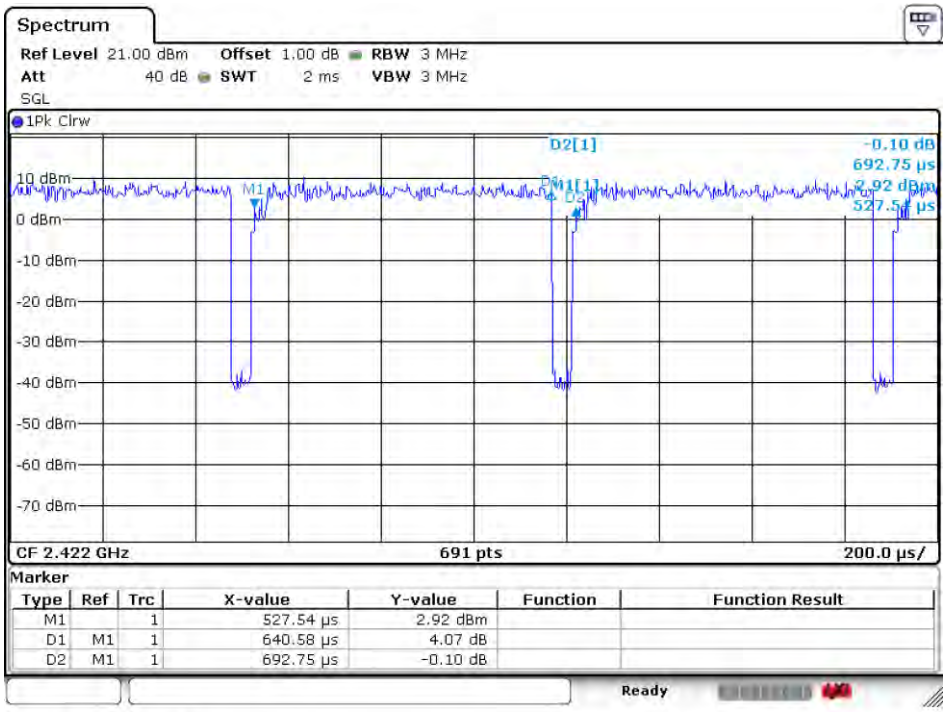

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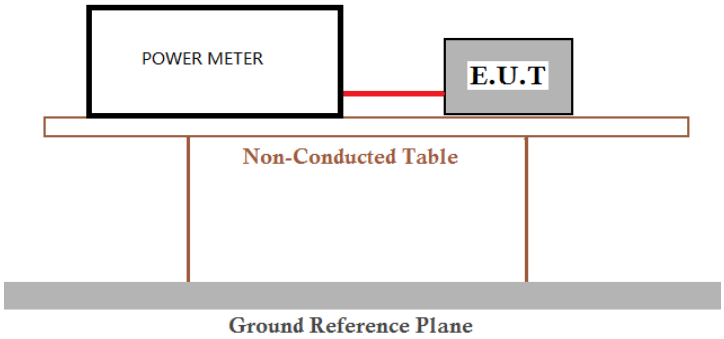
4.4 Conducted Output Power

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

Measurement Data of Peak Power:

Mode	Test Channel	Peak Output Power (dBm)	Limit (dBm)	Result
802.11B	Lowest	19.21	30.00	Pass
	Middle	19.58	30.00	Pass
	Highest	19.03	30.00	Pass
802.11G	Lowest	21.66	30.00	Pass
	Middle	21.87	30.00	Pass
	Highest	21.39	30.00	Pass
802.11N20	Lowest	19.47	30.00	Pass
	Middle	19.60	30.00	Pass
	Highest	19.35	30.00	Pass
802.11N40	Lowest	19.88	30.00	Pass
	Middle	19.75	30.00	Pass
	Highest	19.53	30.00	Pass

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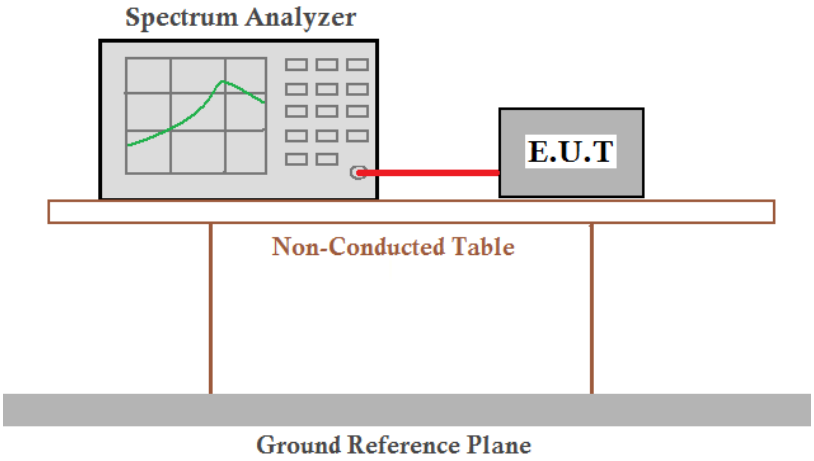
4.5 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth

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	12.76	8.55	≥500	Pass
	Middle	13.02	8.55	≥500	Pass
	Highest	12.98	9.03	≥500	Pass
802.11G	Lowest	16.63	15.67	≥500	Pass
	Middle	16.93	15.89	≥500	Pass
	Highest	16.76	15.98	≥500	Pass
802.11N20	Lowest	17.63	16.05	≥500	Pass
	Middle	17.80	16.32	≥500	Pass
	Highest	17.71	17.28	≥500	Pass
802.11N40	Lowest	35.77	35.04	≥500	Pass
	Middle	36.30	35.72	≥500	Pass
	Highest	36.30	35.86	≥500	Pass

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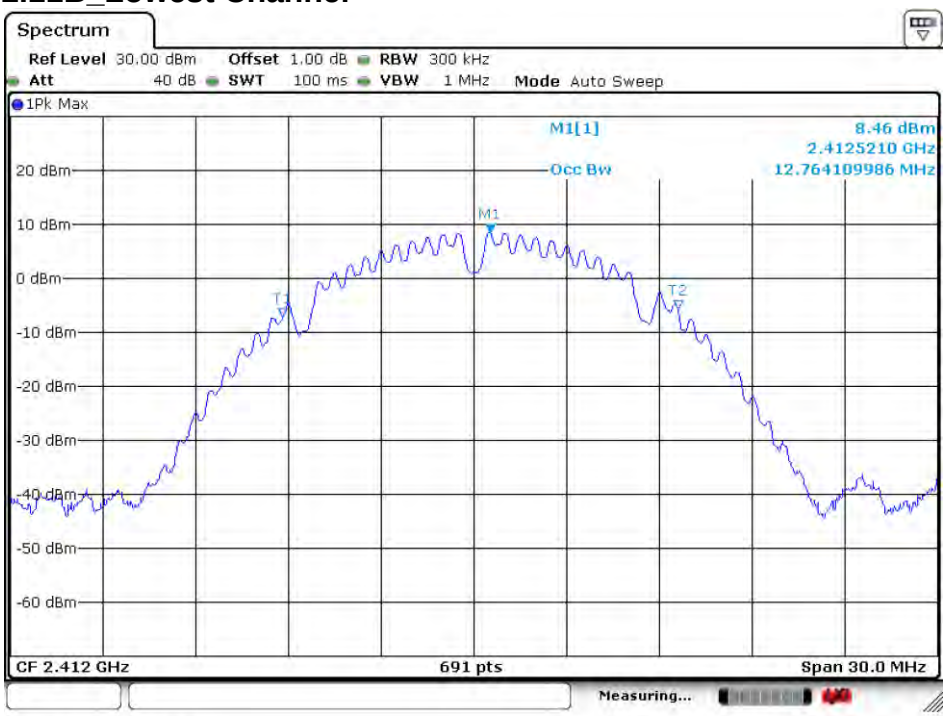
4.5.2 Test plots

4.5.2.1 ANT1

4.5.2.1.1 802.11B_Lowest Channel



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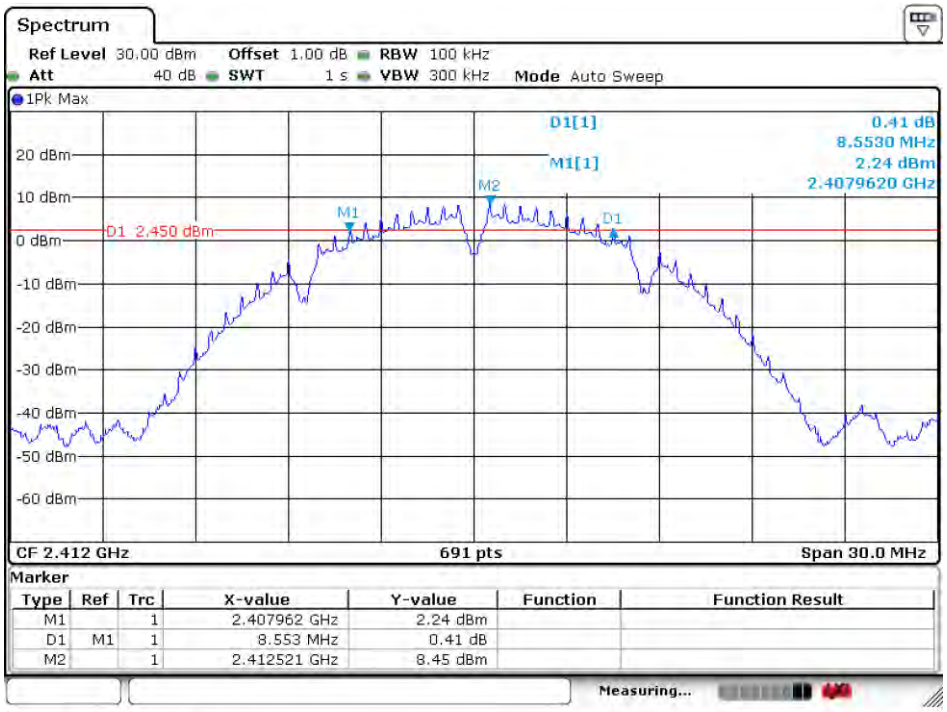

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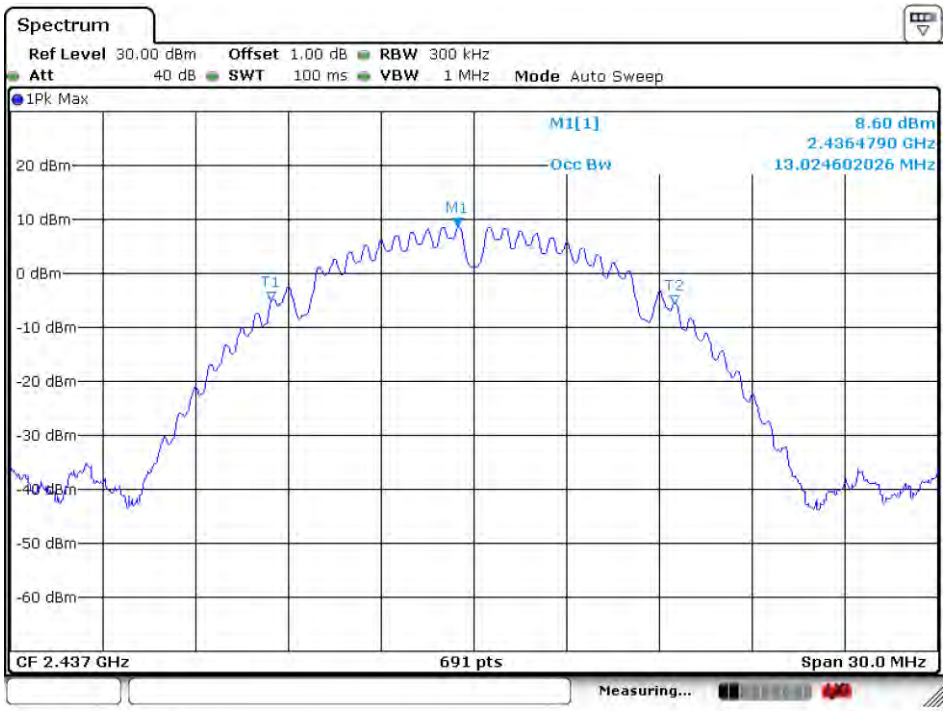
4.5.2.1.2 802.11B_ Middle Channel



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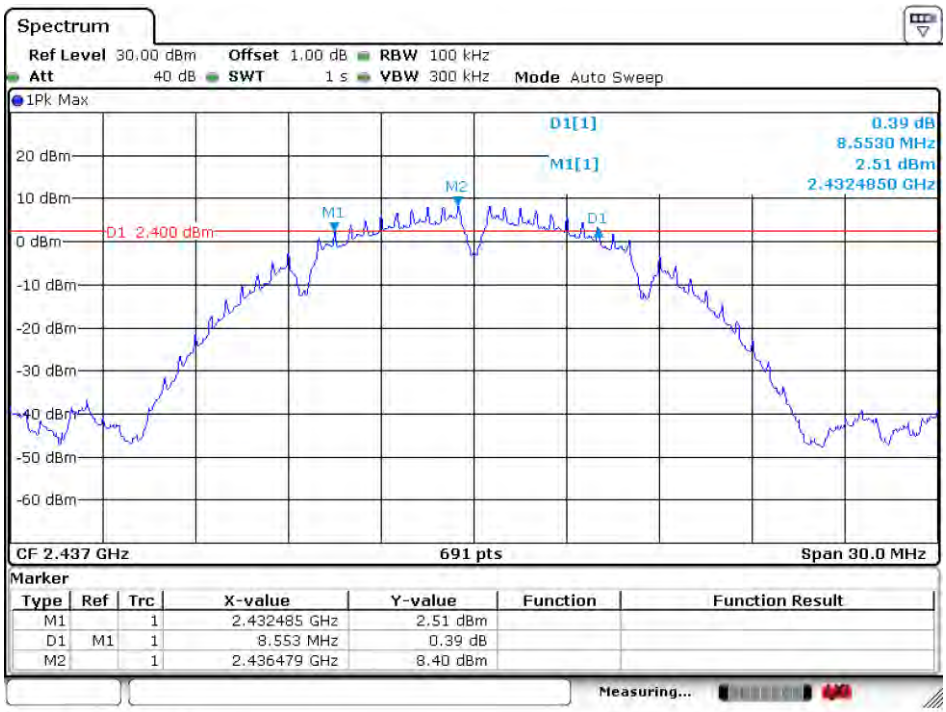

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.432485 GHz	2.51 dBm		
D1	M1	1	8.553 MHz	0.39 dB		
M2		1	2.436479 GHz	8.40 dBm		

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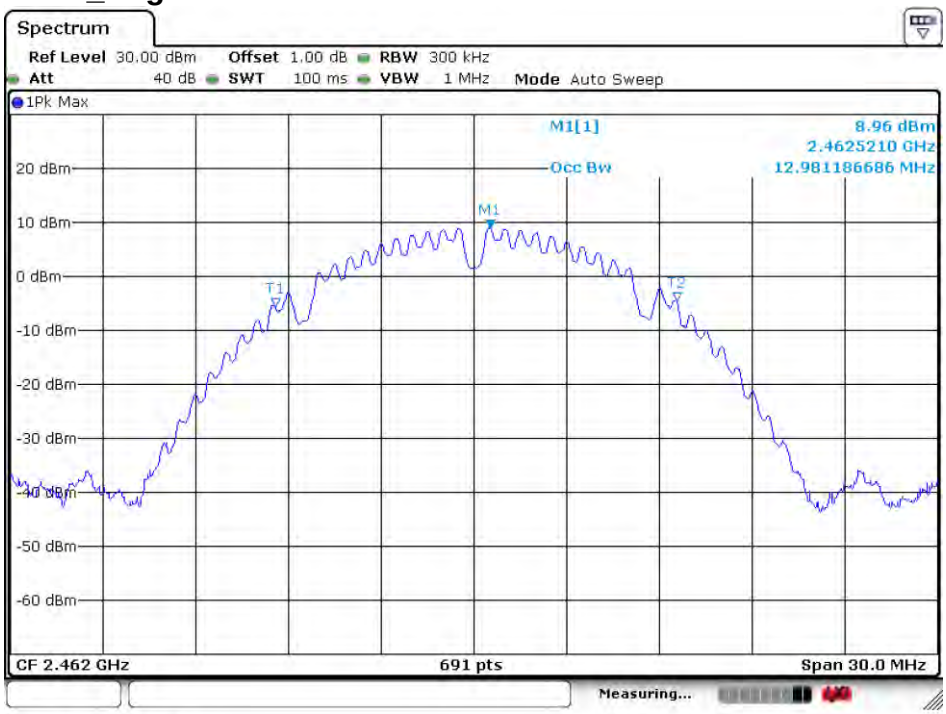
4.5.2.1.3 802.11B_ Highest Channel



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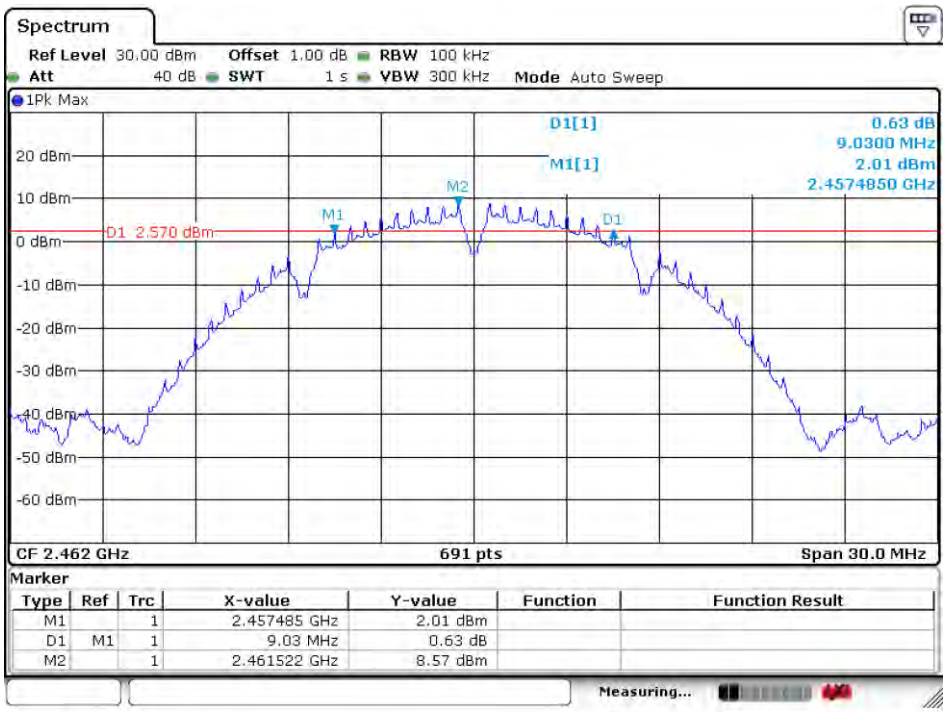

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Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.457485 GHz	2.01 dBm		
D1	M1	1	9.03 MHz	0.63 dB		
M2		1	2.461522 GHz	8.57 dBm		

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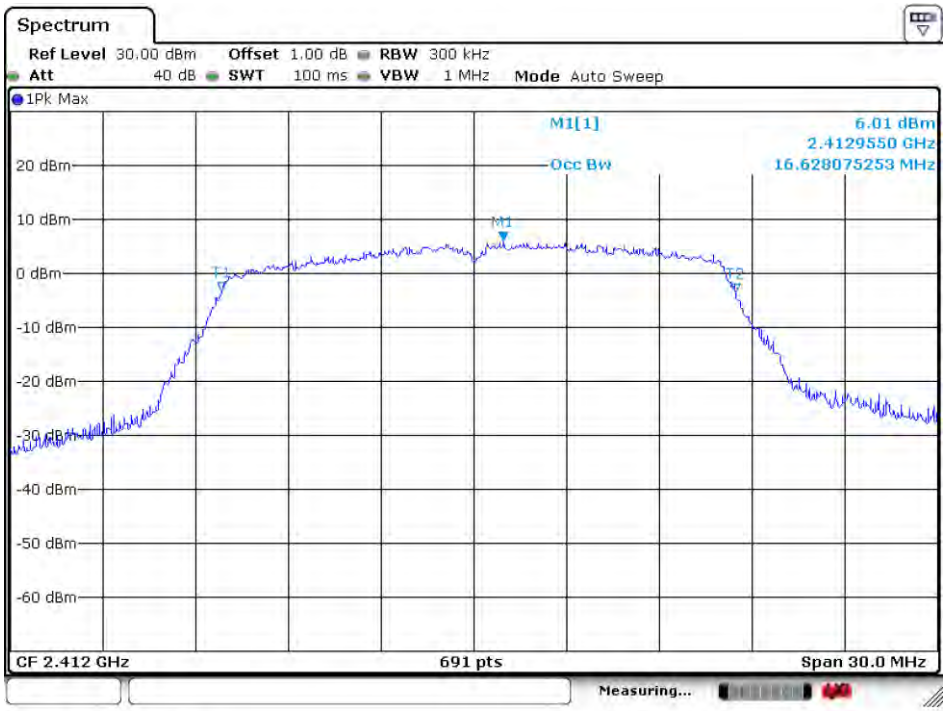
4.5.2.1.4 802.11G_Lowest Channel



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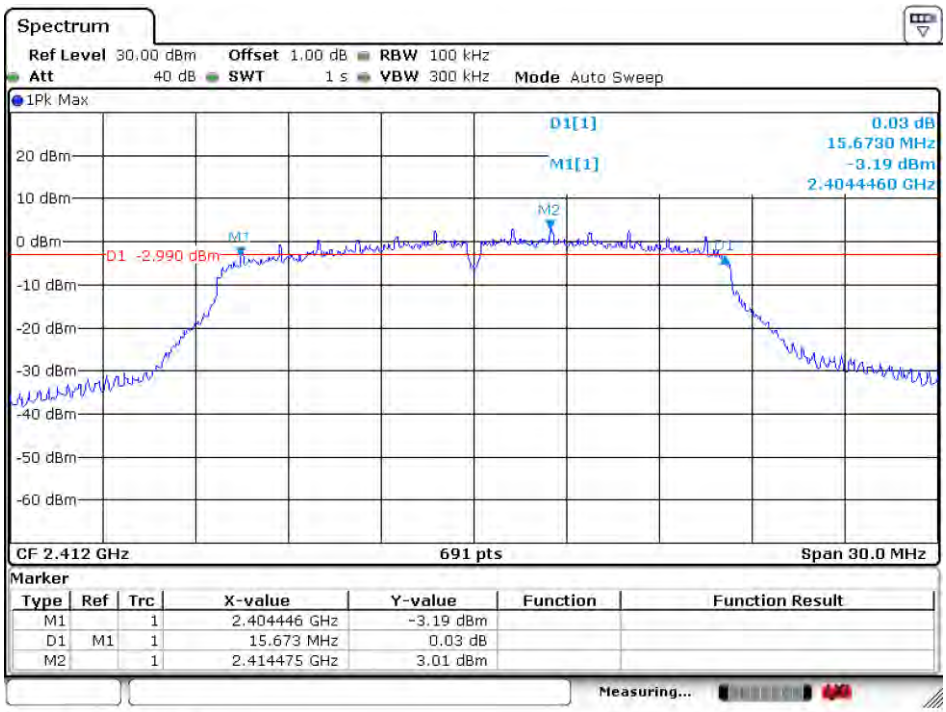

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.404446 GHz	-3.19 dBm		
D1	M1	1	15.673 MHz	0.03 dB		
M2		1	2.414475 GHz	3.01 dBm		

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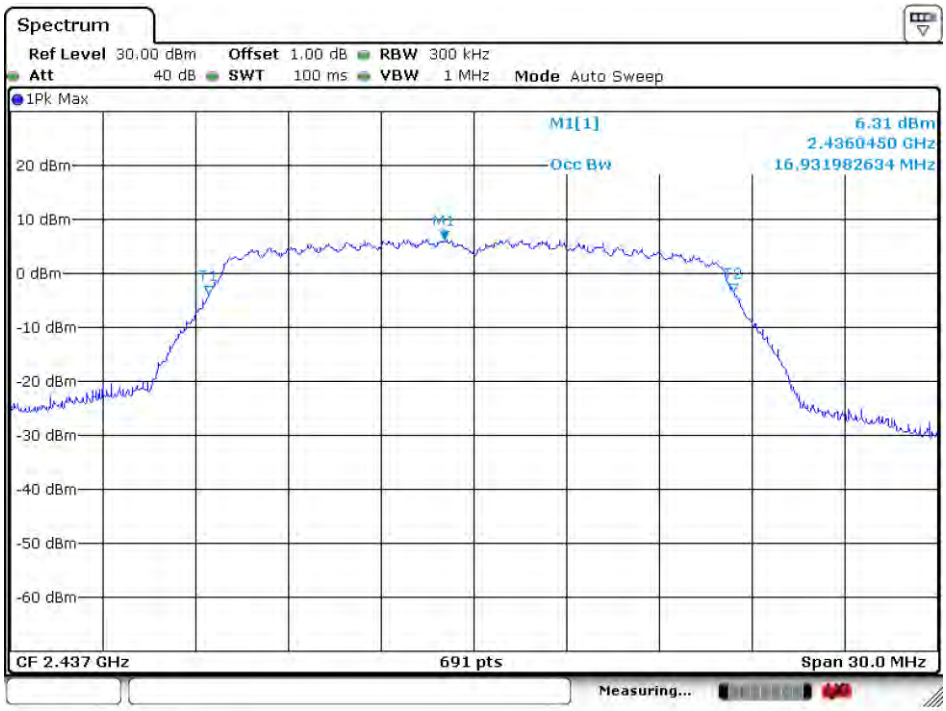
4.5.2.1.5 802.11G_ Middle Channel



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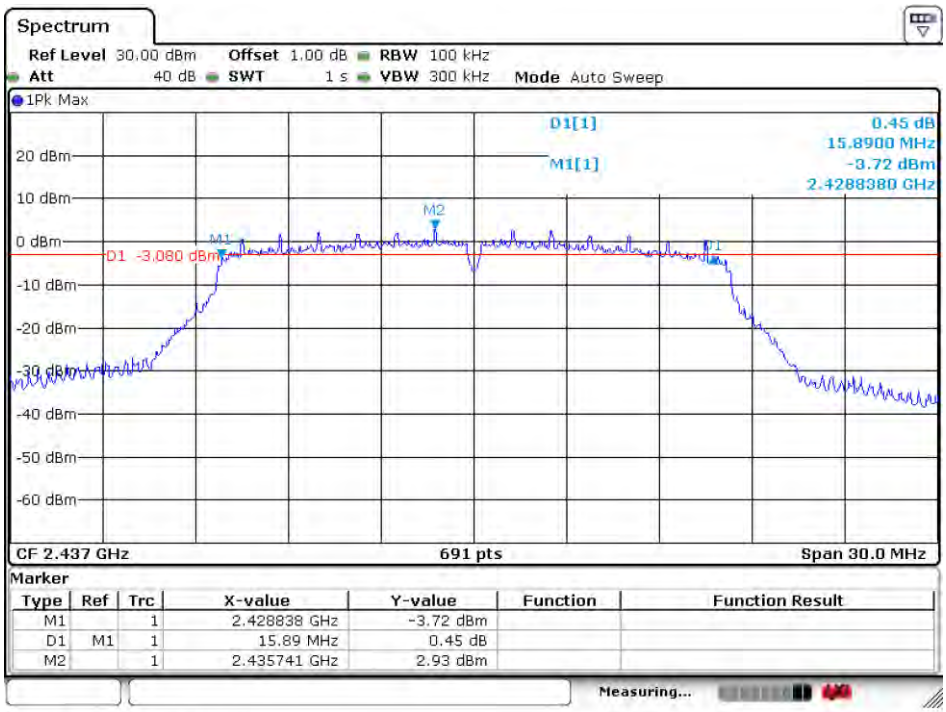

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.428838 GHz	-3.72 dBm		
D1	M1	1	15.89 MHz	0.45 dB		
M2		1	2.435741 GHz	2.93 dBm		

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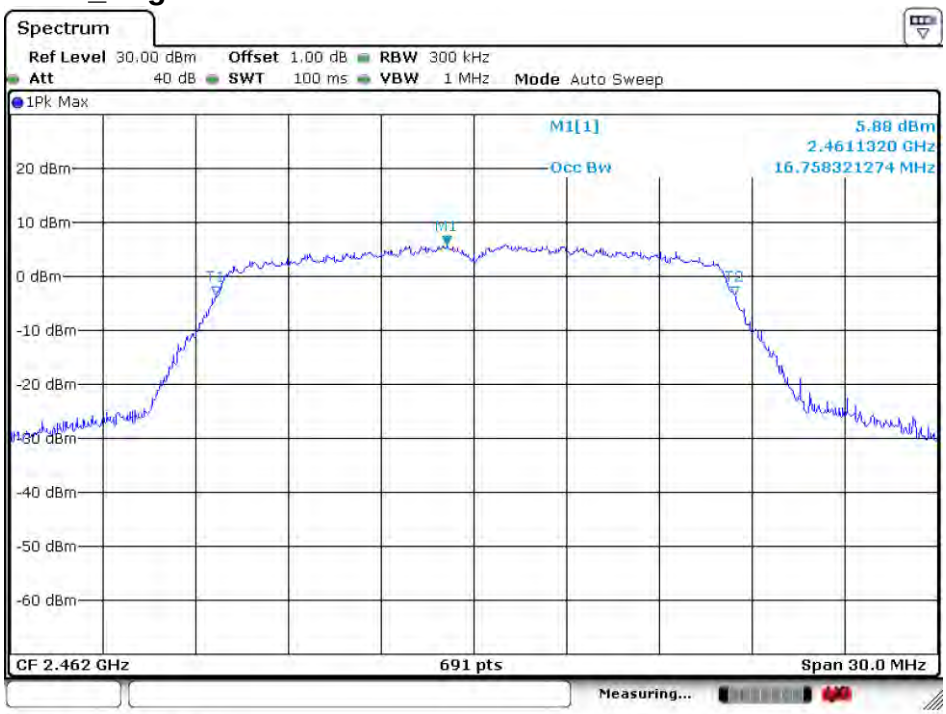
4.5.2.1.6 802.11G_ Highest Channel



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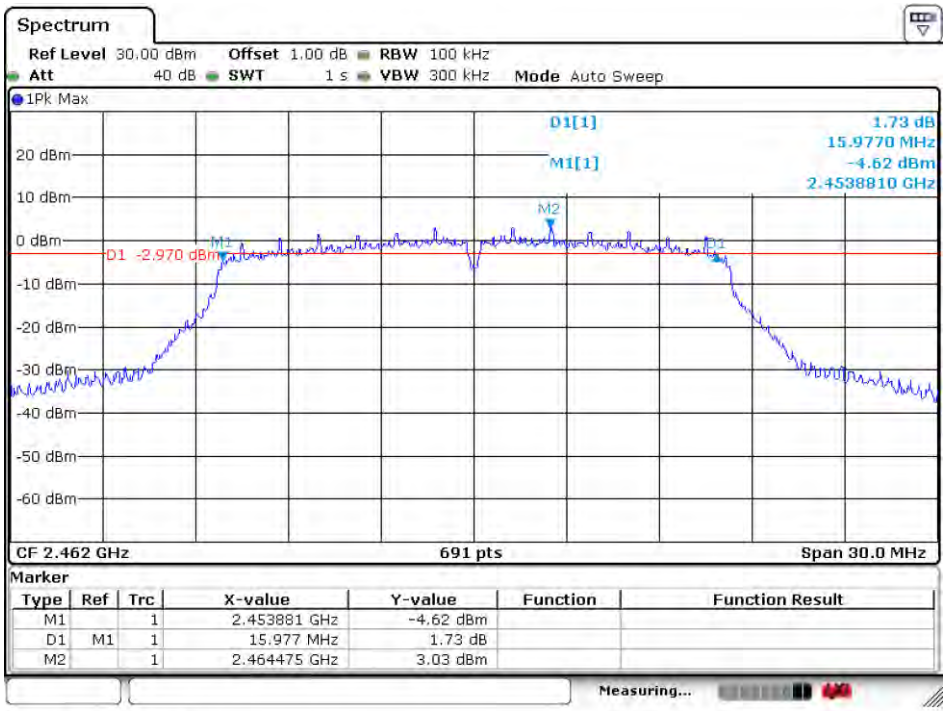

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Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.453881 GHz	-4.62 dBm		
D1	M1	1	15.977 MHz	1.73 dB		
M2		1	2.464475 GHz	3.03 dBm		

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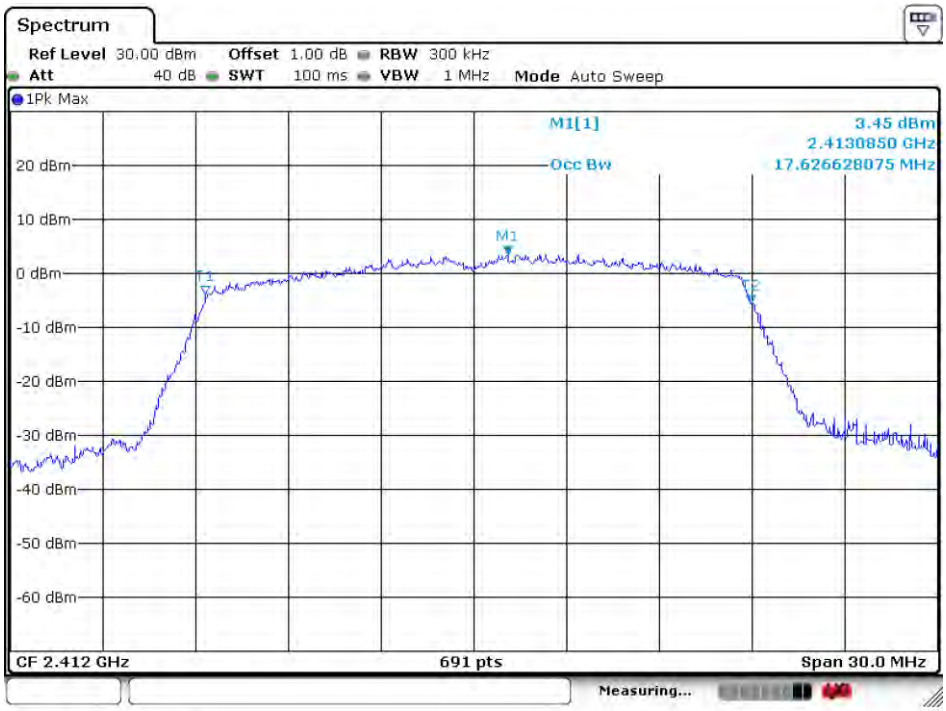
4.5.2.1.7 802.11N20_Lowest Channel



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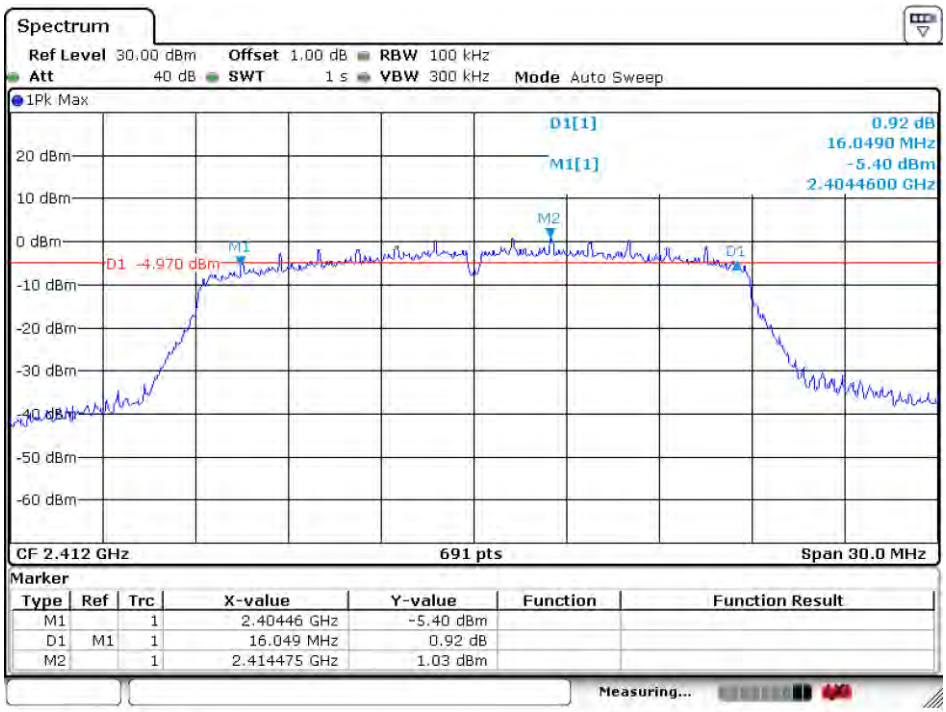

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Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40446 GHz	-5.40 dBm		
D1	M1	1	16.049 MHz	0.92 dB		
M2		1	2.414475 GHz	1.03 dBm		

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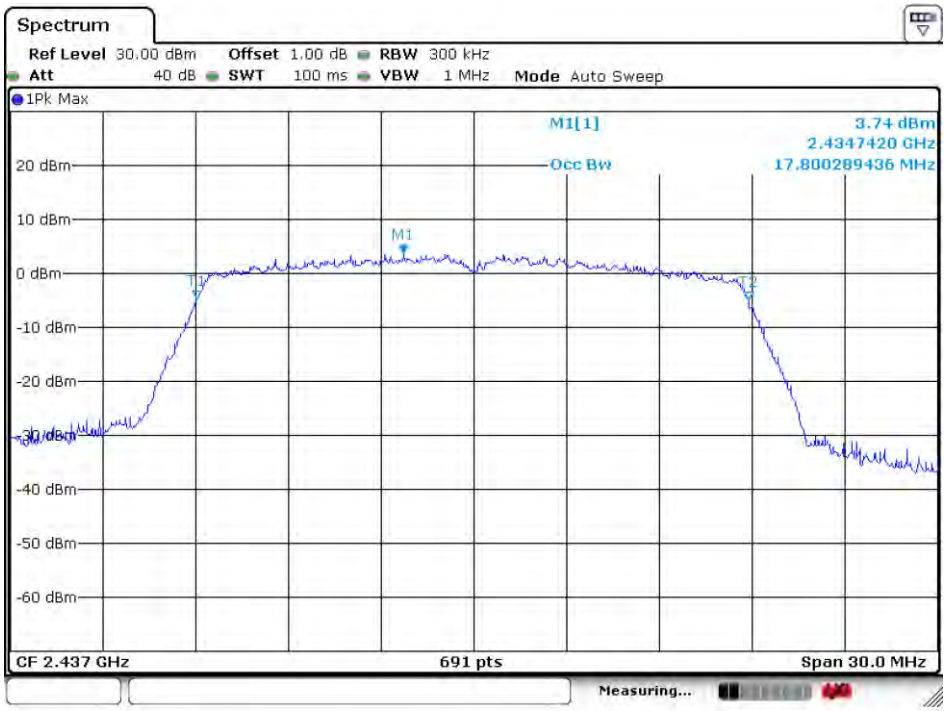
4.5.2.1.8 802.11 N20_ Middle Channel



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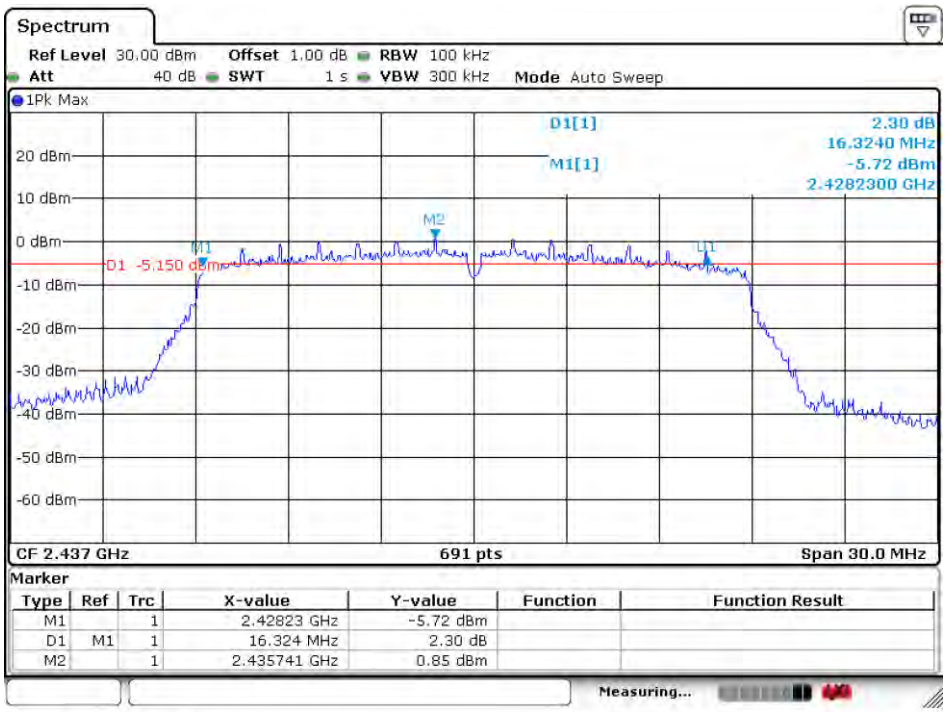

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Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.42823 GHz	-5.72 dBm		
D1	M1	1	16.324 MHz	2.30 dB		
M2		1	2.435741 GHz	0.85 dBm		

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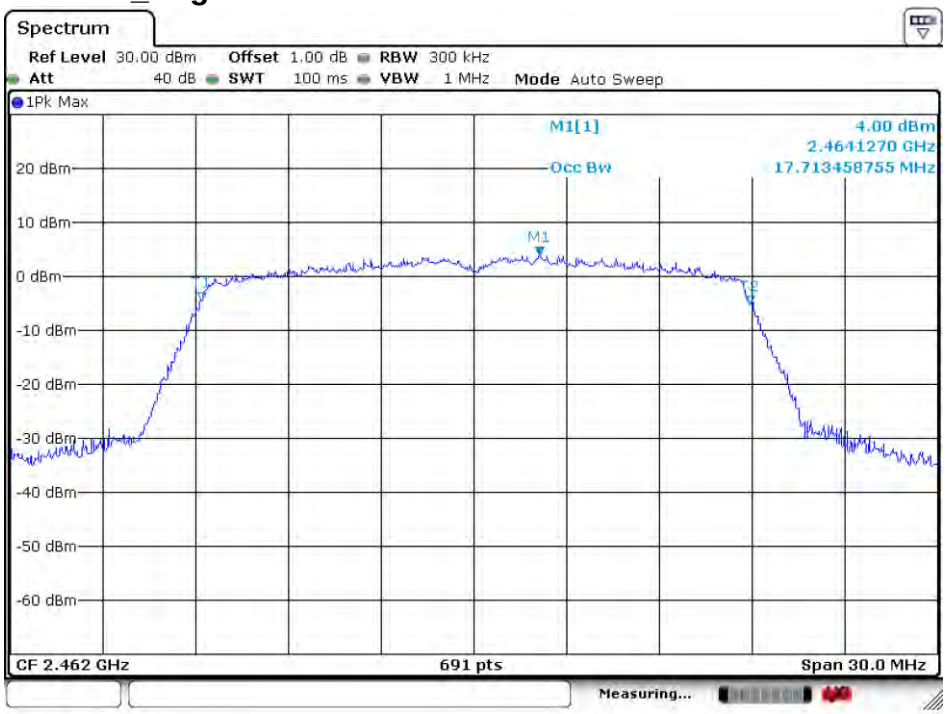
4.5.2.1.9 802.11 N20_ Highest Channel



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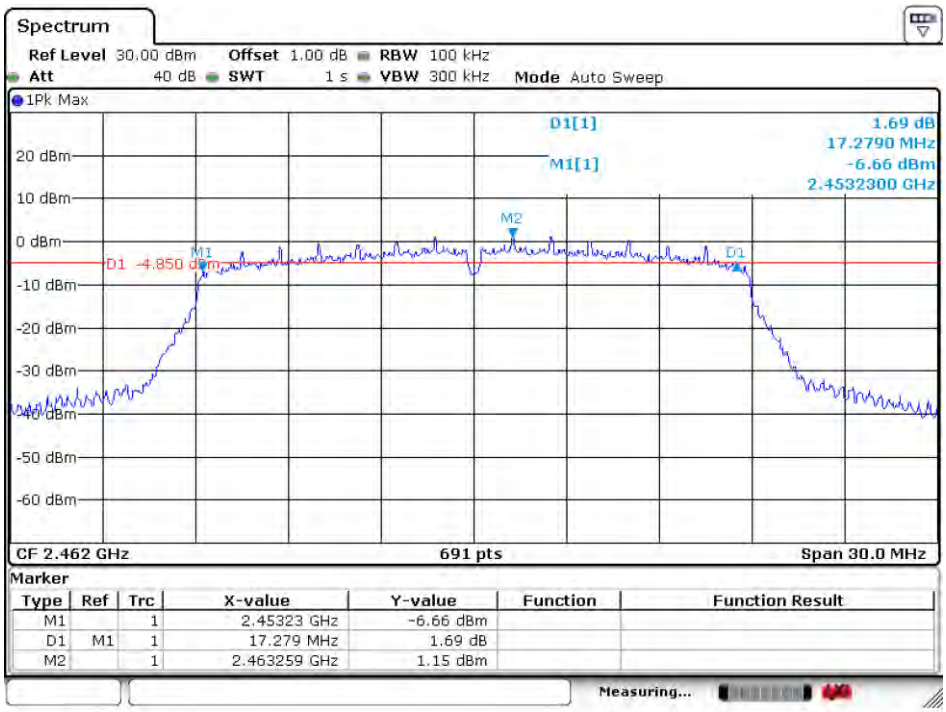

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.45323 GHz	-6.66 dBm		
D1	M1	1	17.279 MHz	1.69 dB		
M2		1	2.463259 GHz	1.15 dBm		

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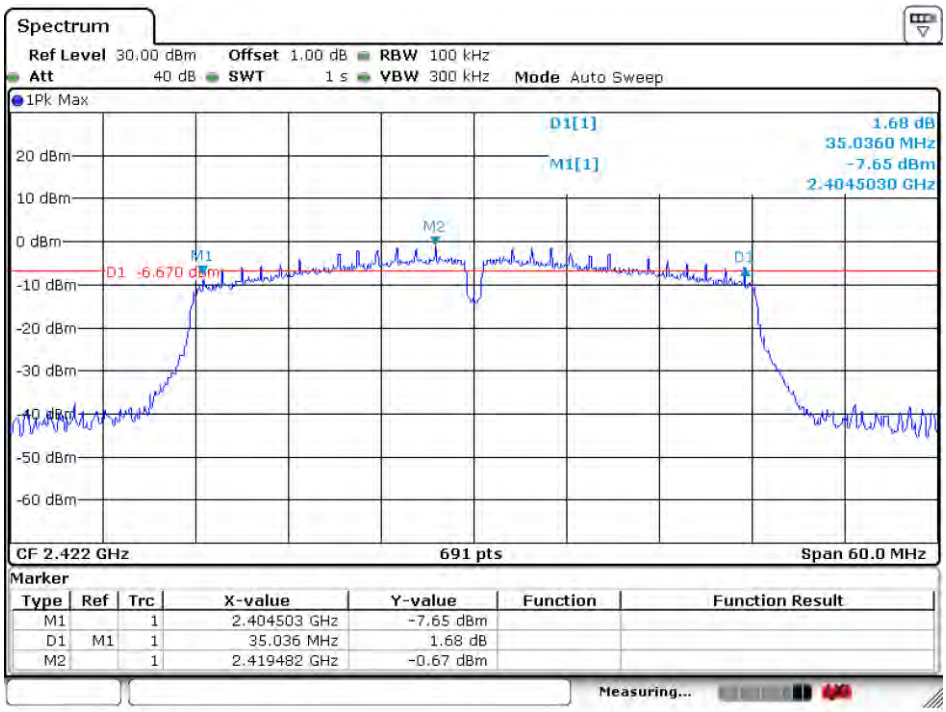
4.5.2.1.10 802.11N40_Lowest Channel

Date: 12.JUN.2020 03:25:38



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.404503 GHz	-7.65 dBm		
D1	M1	1	35.036 MHz	1.68 dB		
M2		1	2.419482 GHz	-0.67 dBm		

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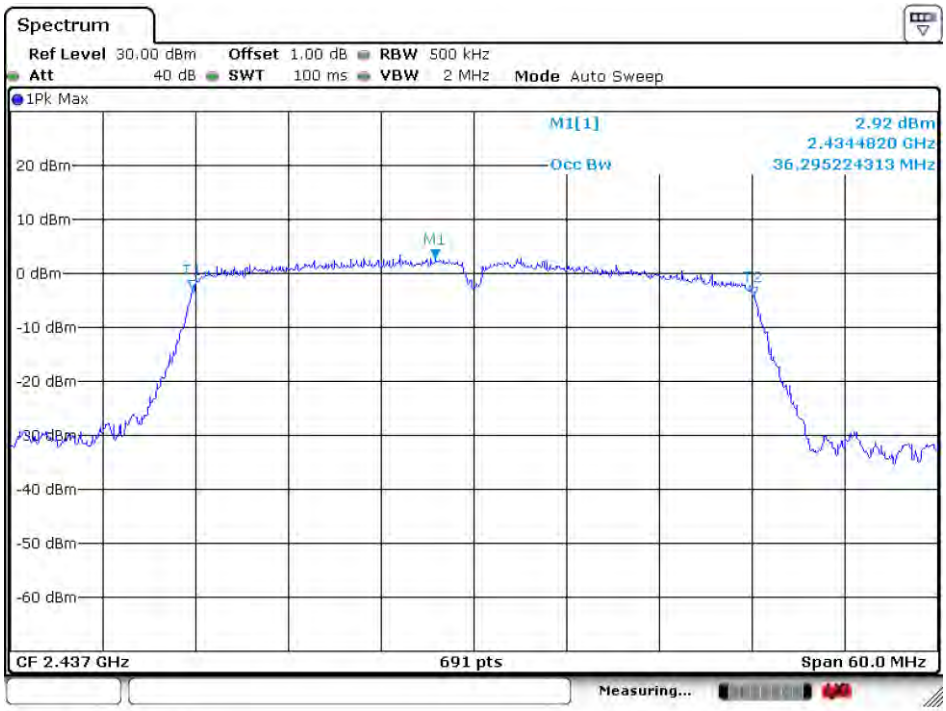
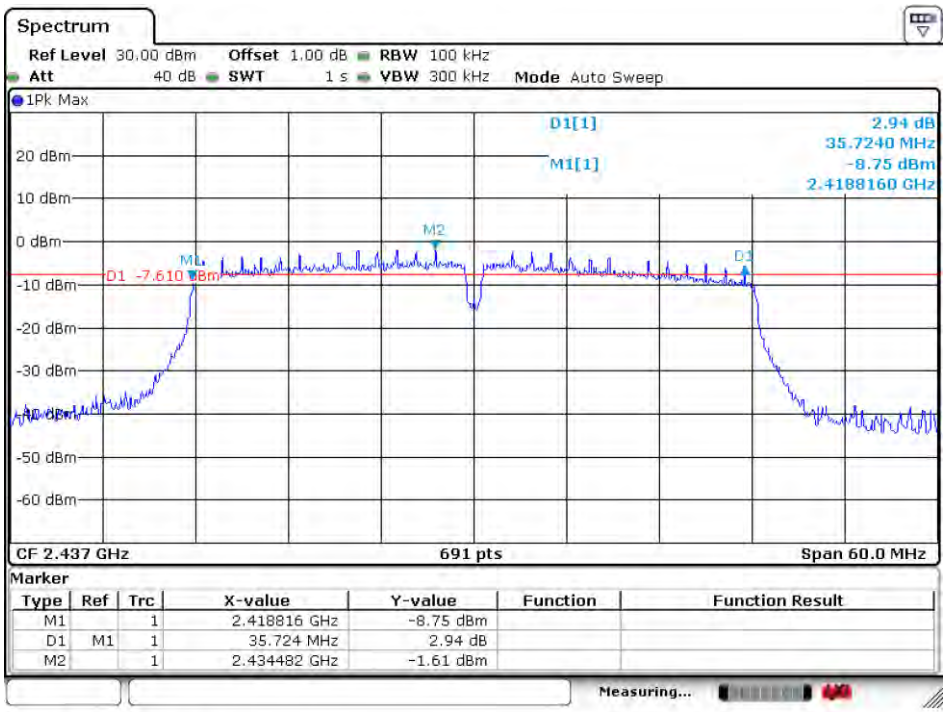
4.5.2.1.11 802.11 N40_ Middle Channel



Date: 12.JUN.2020 03:25:59



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.418816 GHz	-8.75 dBm		
D1	M1	1	35.724 MHz	2.94 dB		
M2		1	2.434482 GHz	-1.61 dBm		

Date: 12.JUN.2020 03:22:11

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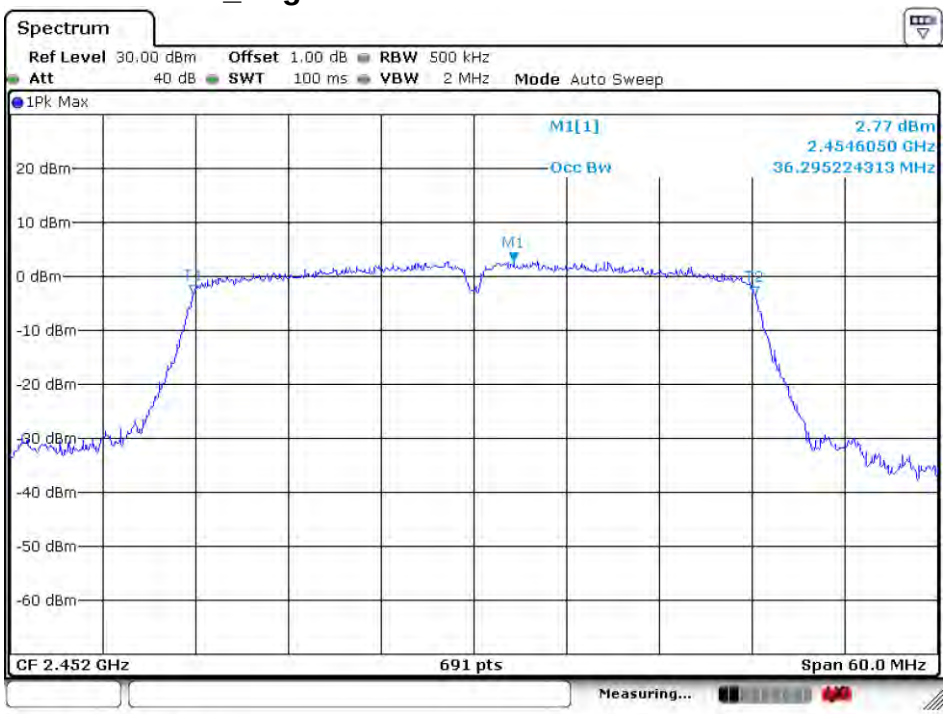
4.5.2.1.12 802.11 N40_ Highest Channel



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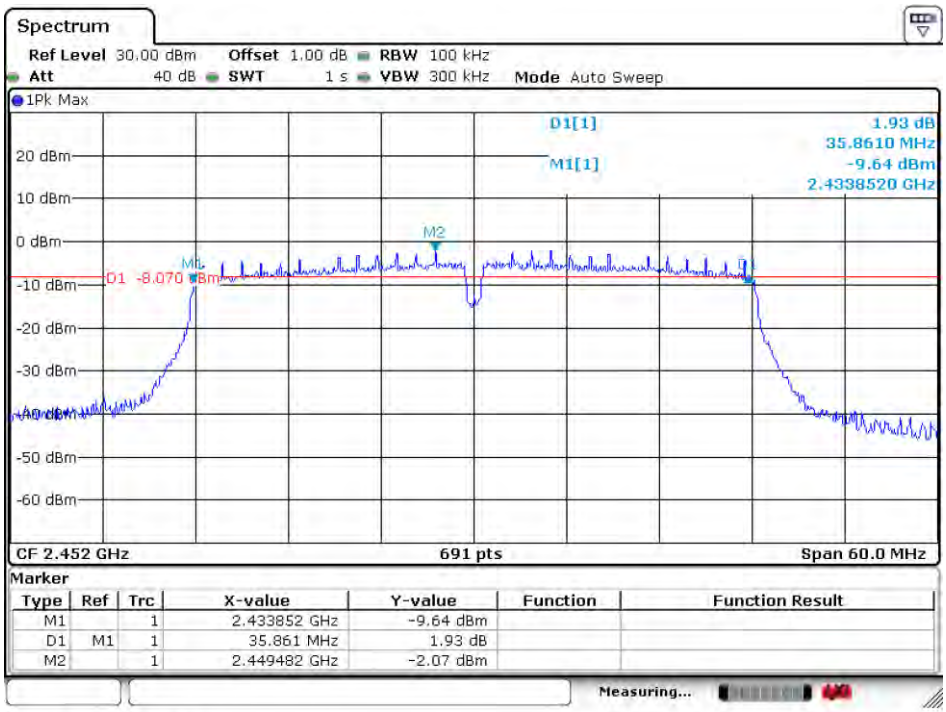

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.433852 GHz	-9.64 dBm		
D1	M1	1	35.861 MHz	1.93 dB		
M2		1	2.449482 GHz	-2.07 dBm		

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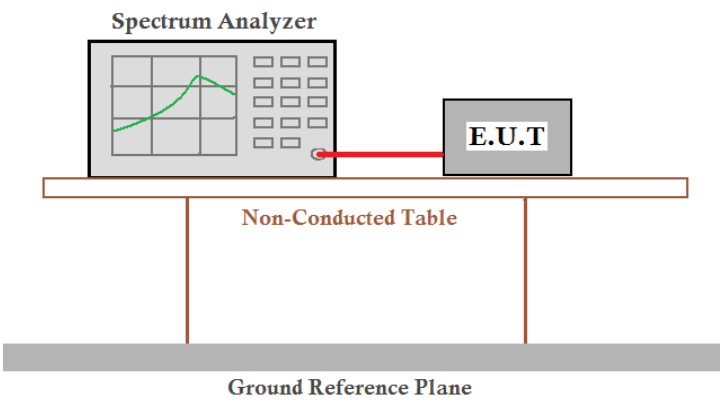
4.6 Power Spectral Density

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	-3.83	≤8.00	Pass
	Middle	-3.46	≤8.00	Pass
	Highest	-3.87	≤8.00	Pass
802.11G	Lowest	-9.34	≤8.00	Pass
	Middle	-8.91	≤8.00	Pass
	Highest	-8.68	≤8.00	Pass
802.11N20	Lowest	-10.92	≤8.00	Pass
	Middle	-11.54	≤8.00	Pass
	Highest	-11.87	≤8.00	Pass
802.11N40	Lowest	-13.74	≤8.00	Pass
	Middle	-14.43	≤8.00	Pass
	Highest	-15.43	≤8.00	Pass

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4.6.2 Test plots

4.6.2.1 ANT1

4.6.2.1.1 802.11B_Lowest Channel

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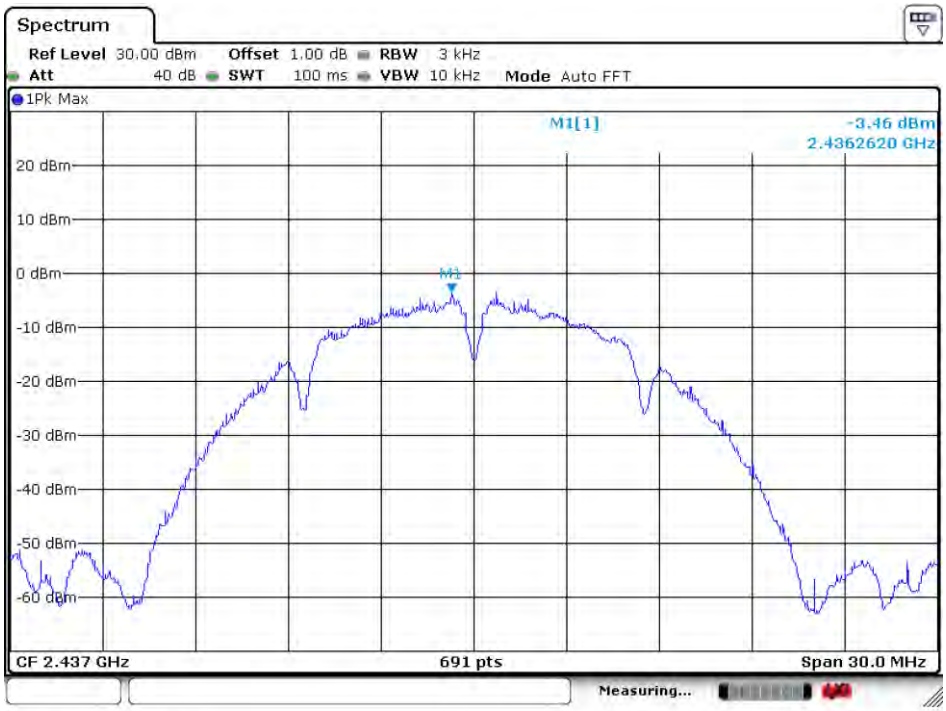
4.6.2.1.2 802.11B_ Middle Channel



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4.6.2.1.3 802.11B_ Highest Channel

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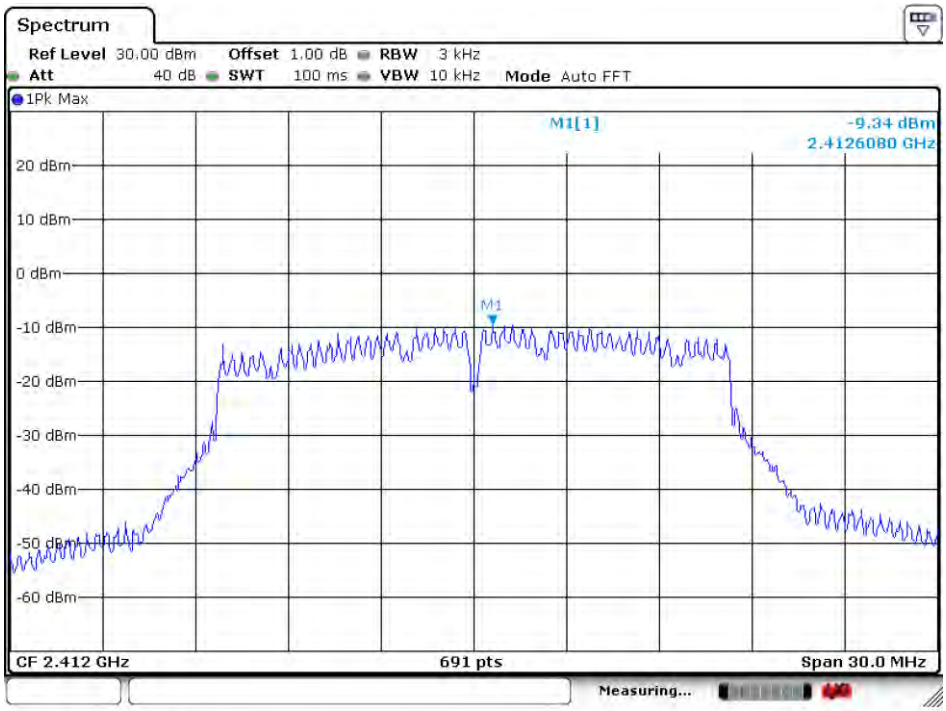
4.6.2.1.4 802.11G_Lowest Channel



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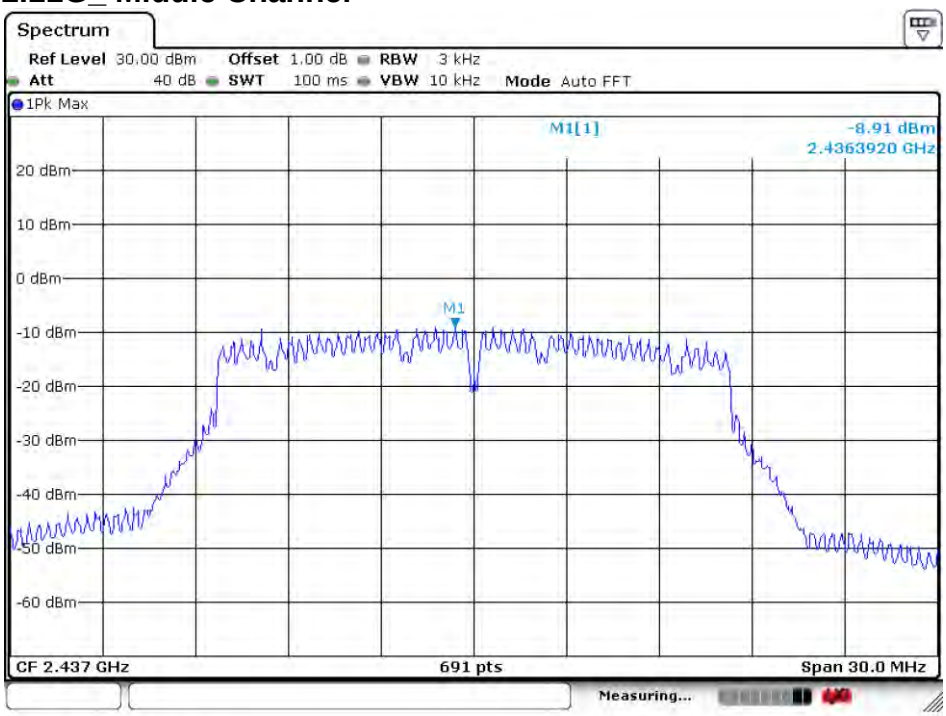
4.6.2.1.5 802.11G_ Middle Channel



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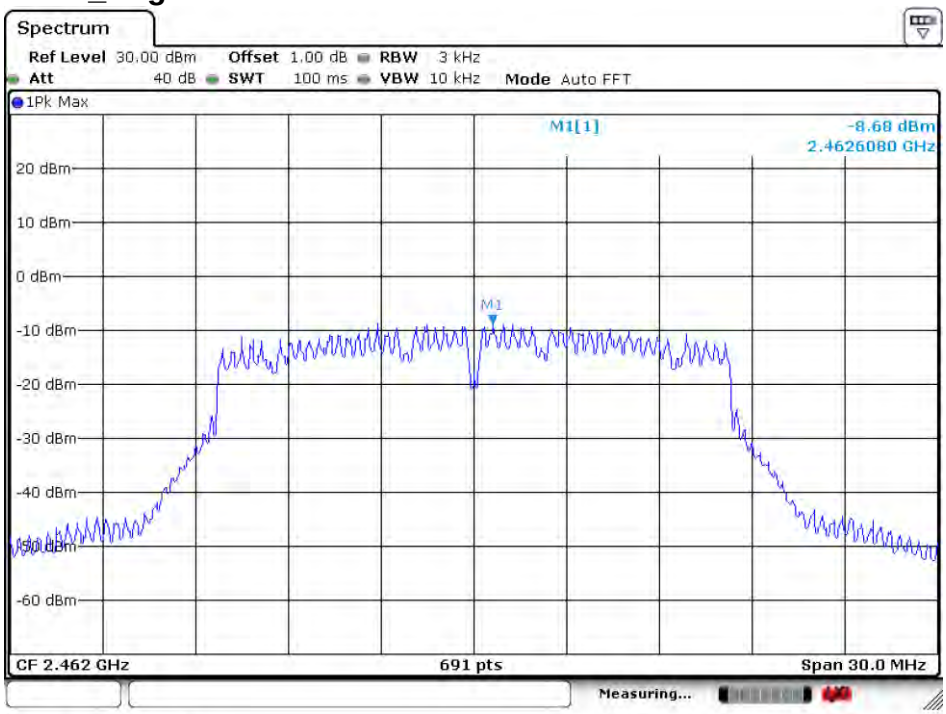
4.6.2.1.6 802.11G_ Highest Channel



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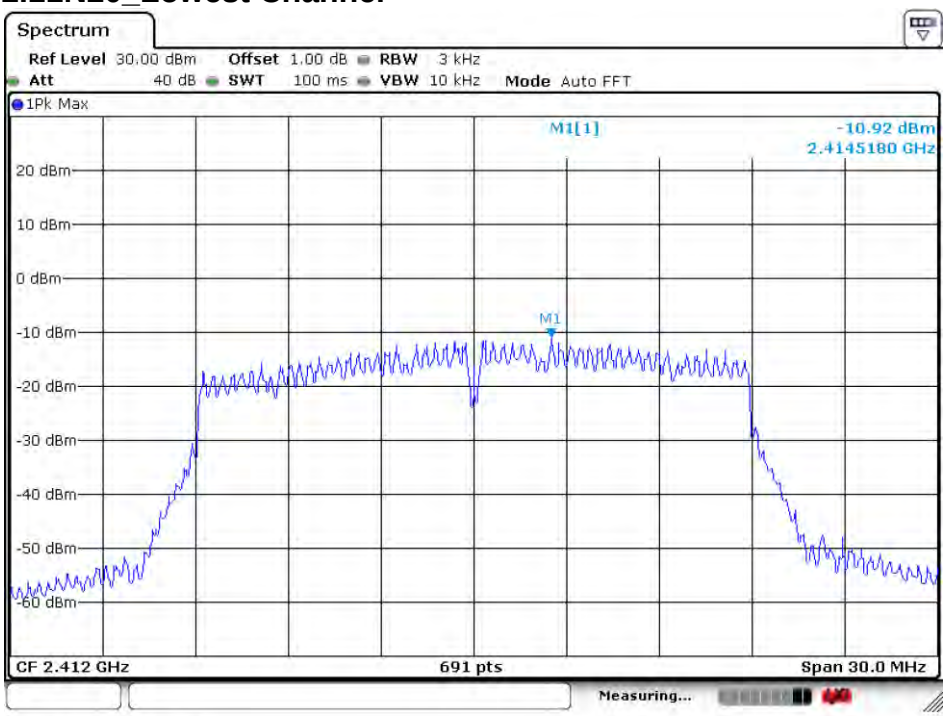
4.6.2.1.7 802.11N20_Lowest Channel



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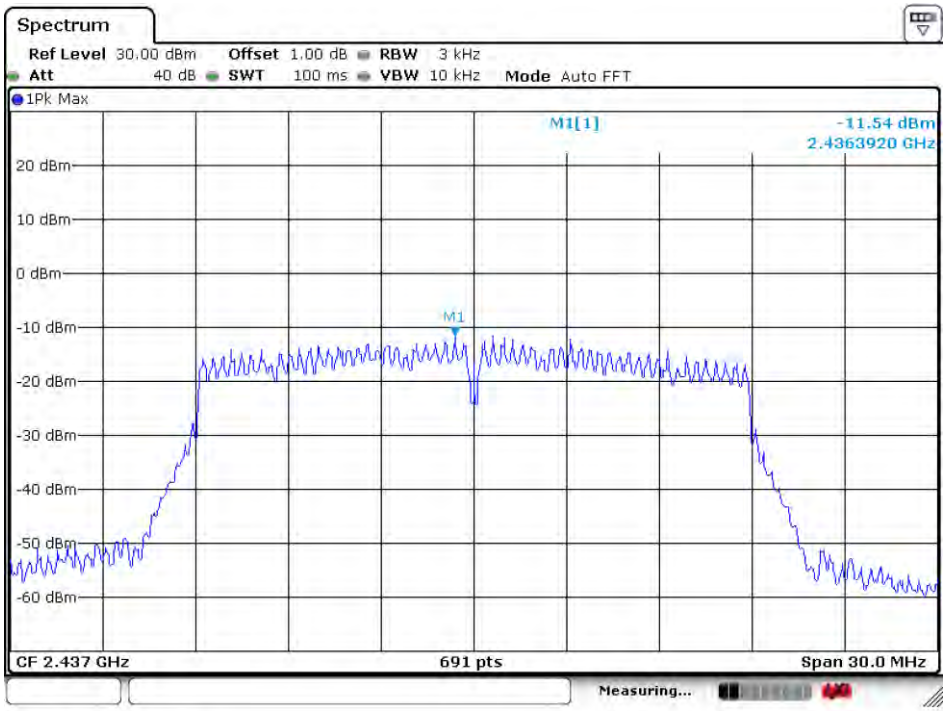
4.6.2.1.8 802.11 N20_ Middle Channel



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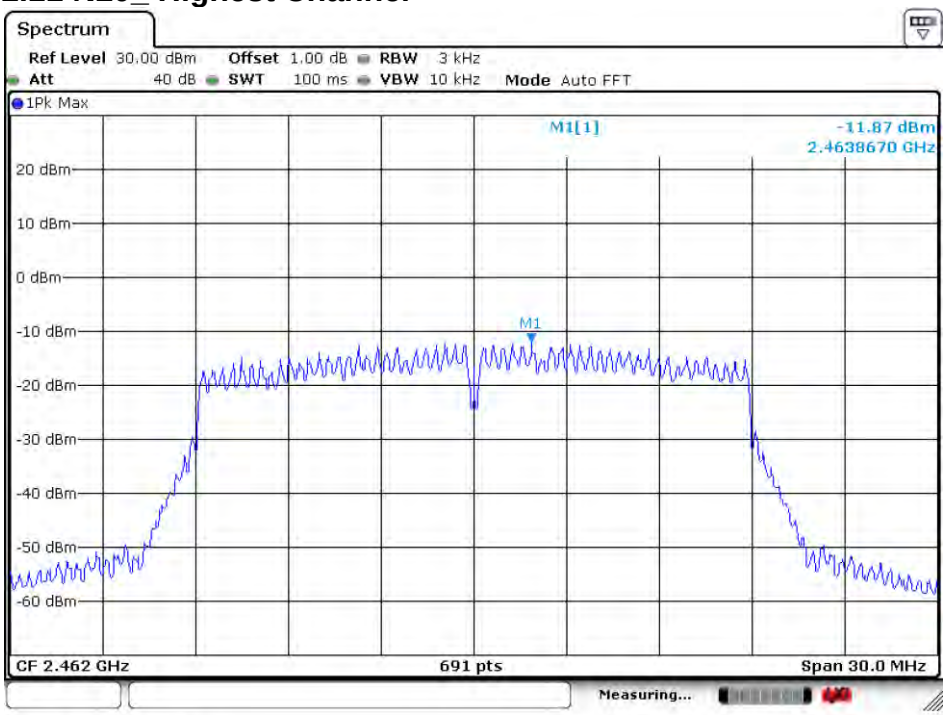
4.6.2.1.9 802.11 N20_ Highest Channel



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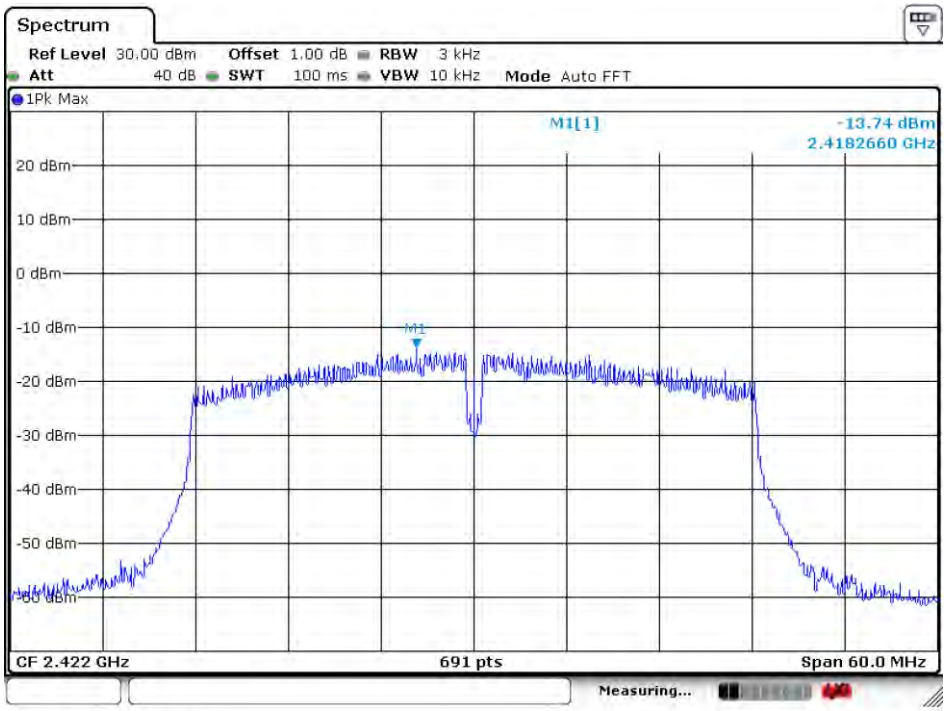
4.6.2.1.10 802.11N40_Lowest Channel



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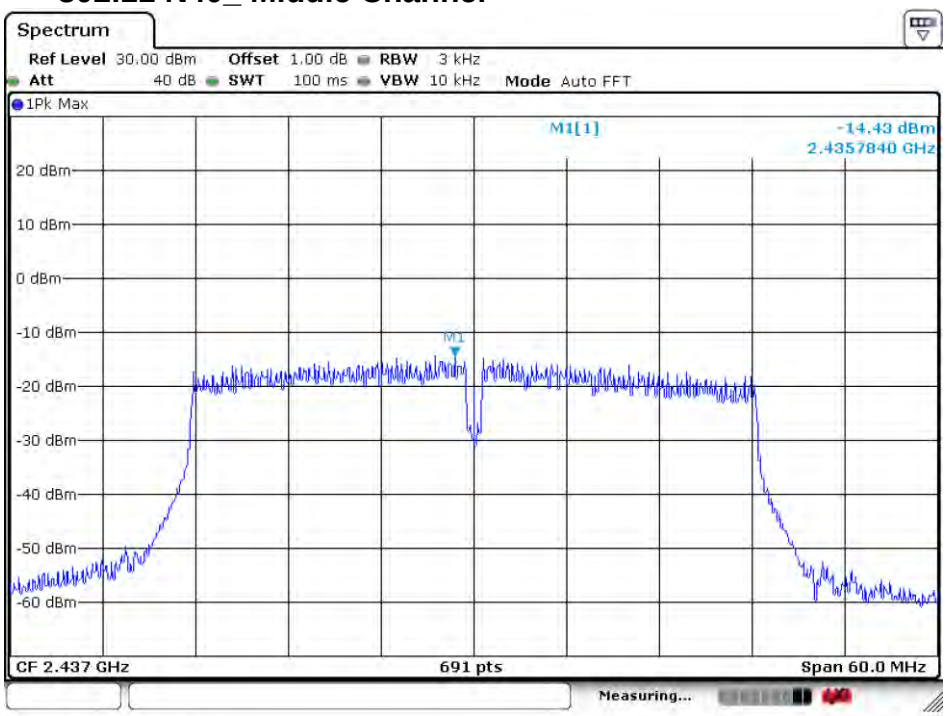
4.6.2.1.11 802.11 N40_ Middle Channel



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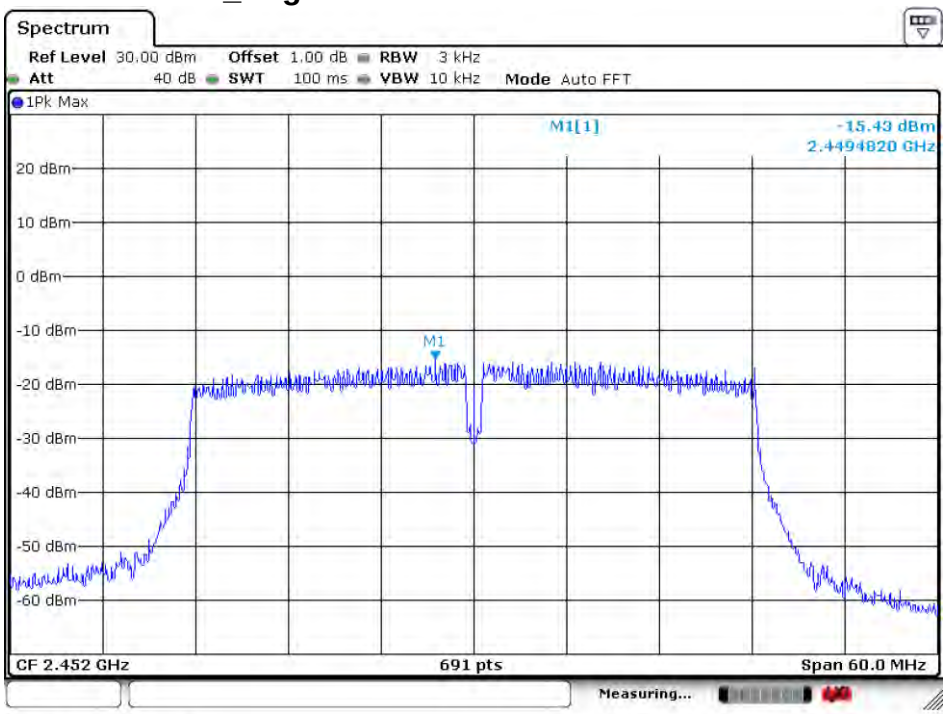
4.6.2.1.12 802.11 N40_ Highest Channel



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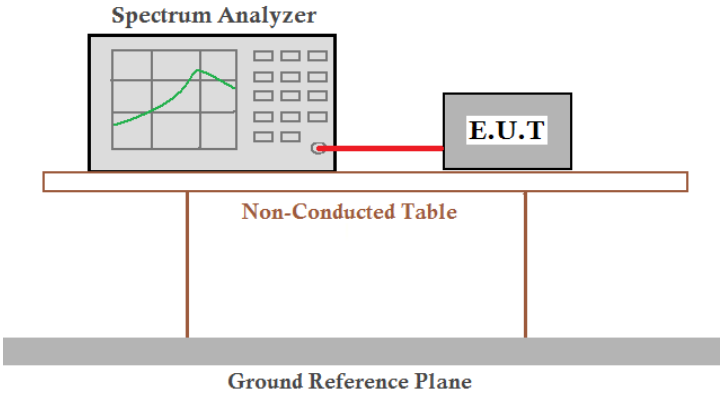
4.7 Band-edge for RF Conducted Emissions

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

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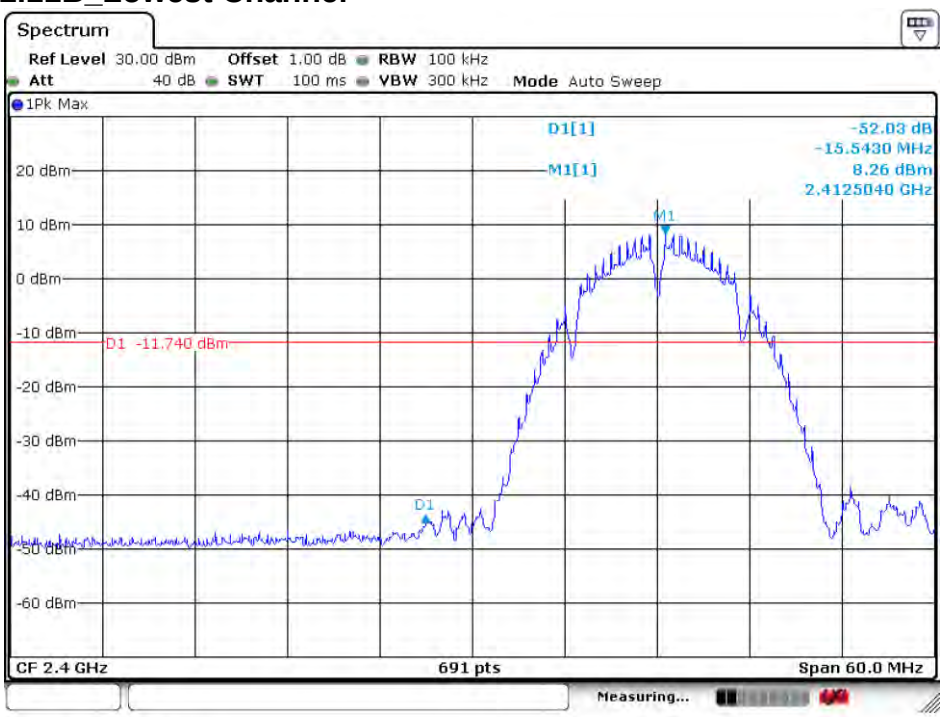
4.7.1 Test plots

4.7.1.1 ANT1

4.7.1.1.1 802.11B_Lowest Channel



Date: 12.JUN.2020 03:54:11

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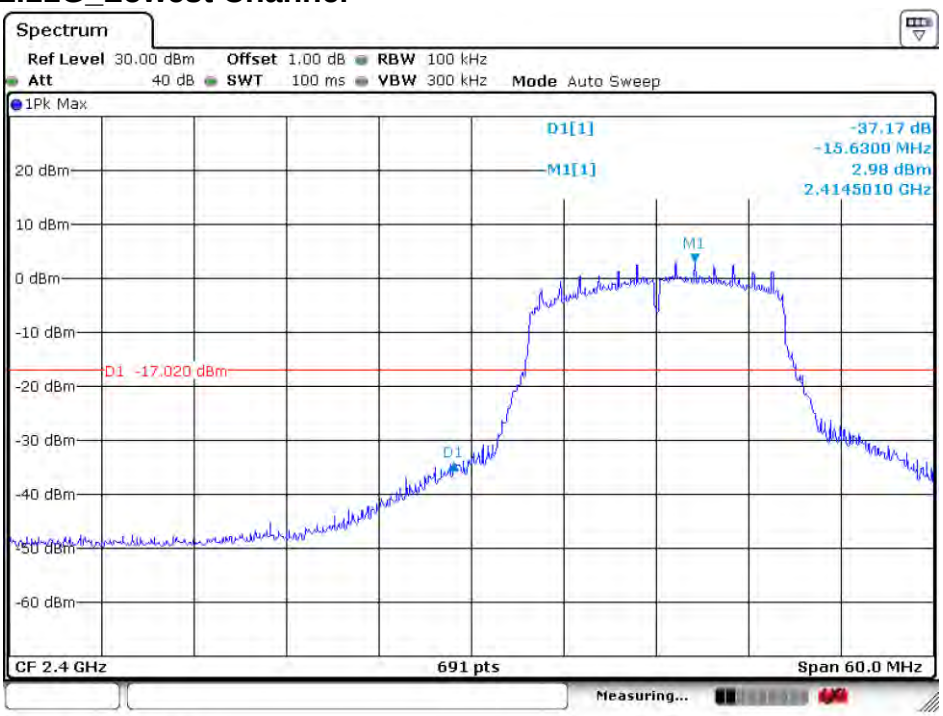
4.7.1.1.2 802.11B_ Highest Channel

Date: 12.JUN.2020 03:53:08

4.7.1.1.3 802.11G_Lowest Channel



Date: 12.JUN.2020 03:55:07

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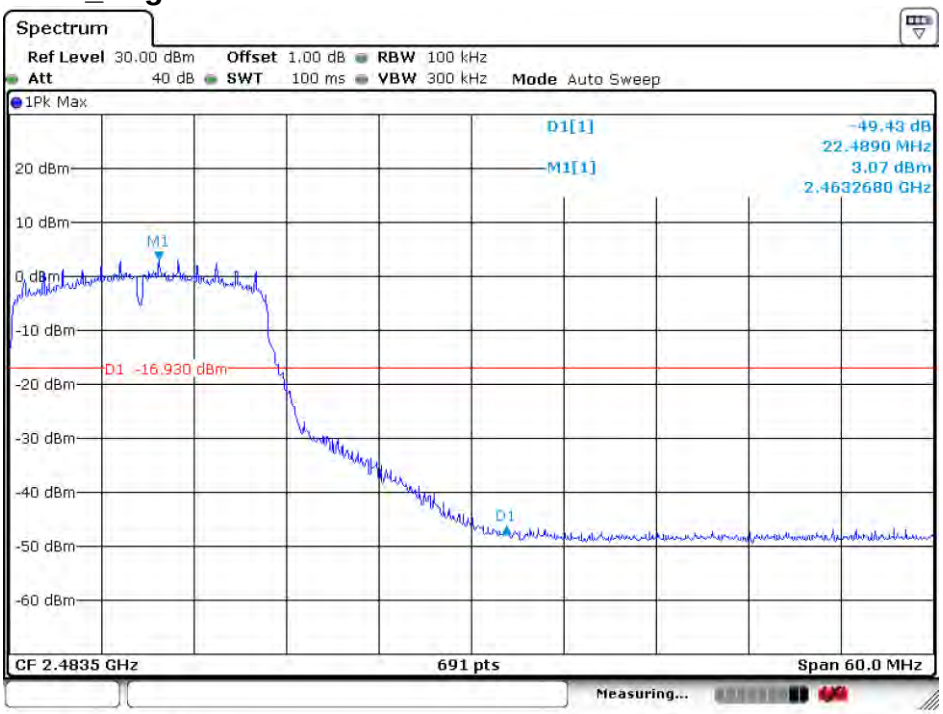
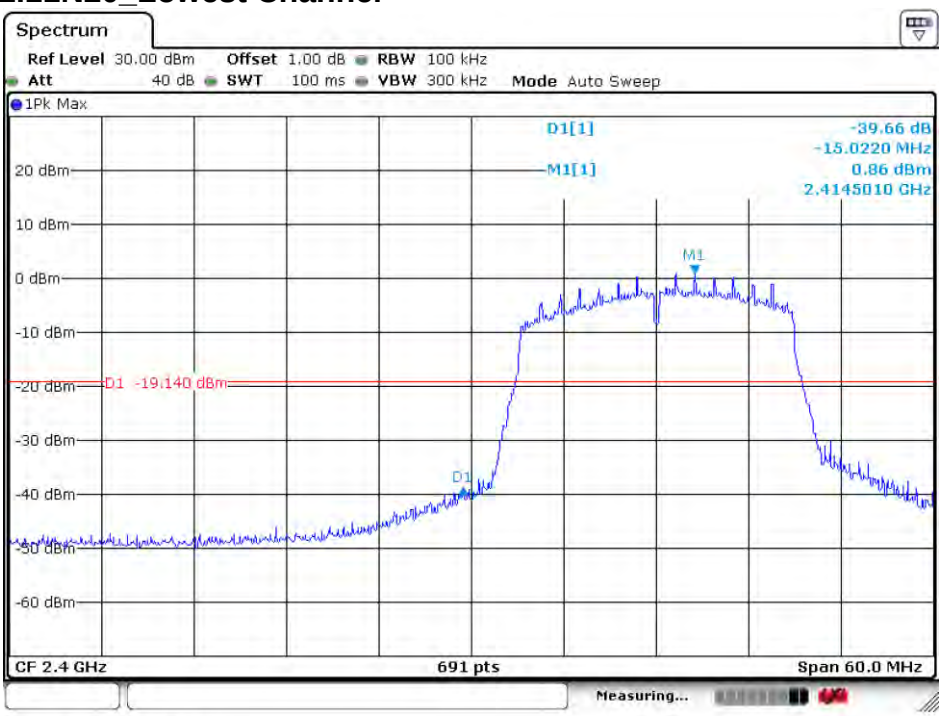
4.7.1.1.4 802.11G_ Highest Channel



Date: 12.JUN.2020 03:59:04

4.7.1.1.5 802.11N20_Lowest Channel



Date: 12.JUN.2020 03:50:18

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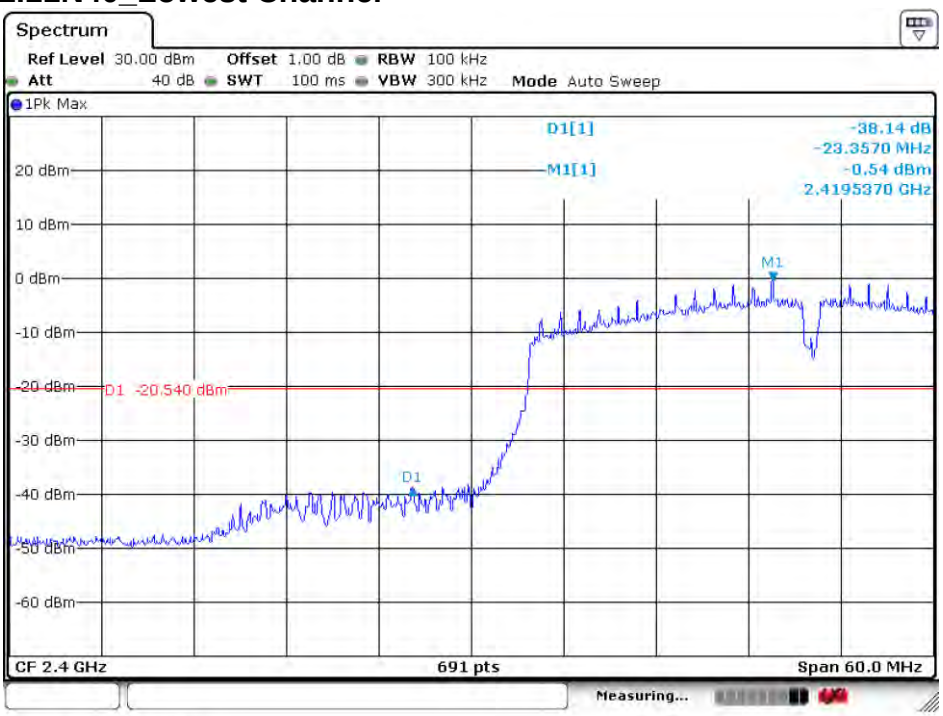
4.7.1.1.6 802.11 N20_ Highest Channel

Date: 12.JUN.2020 03:52:00

4.7.1.1.7 802.11N40_Lowest Channel



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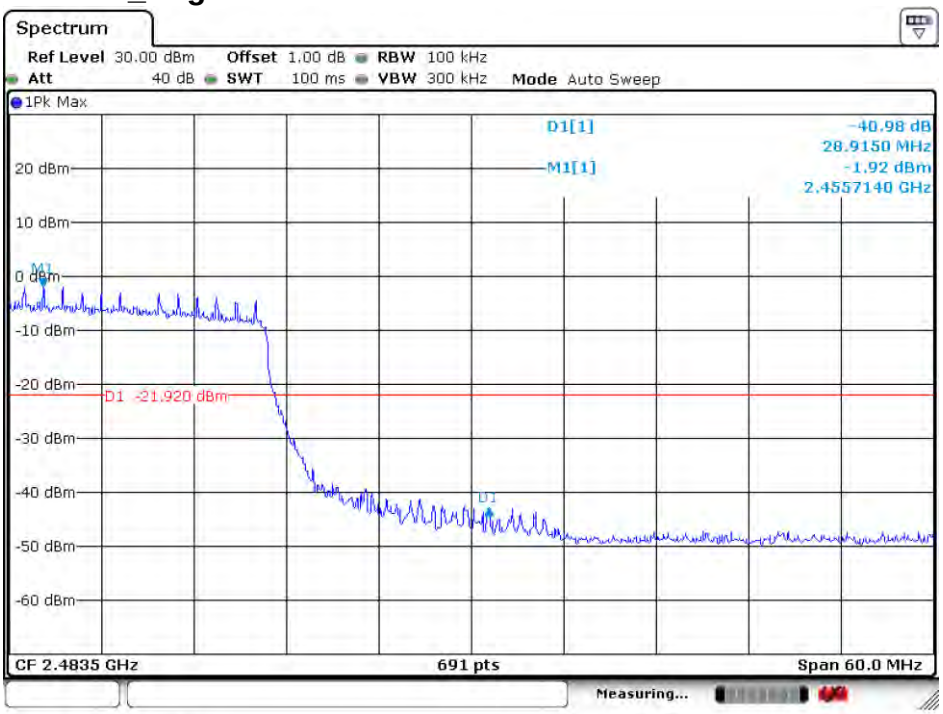
4.7.1.1.8 802.11 N40_ Highest Channel



Date: 12.JUN.2020 03:47:53

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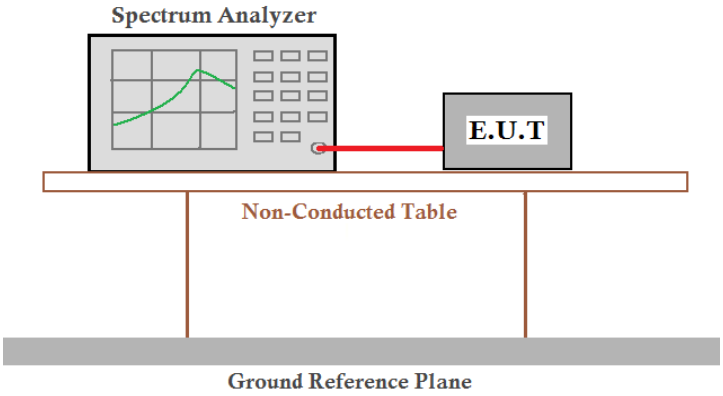
4.8 RF Conducted Spurious Emissions

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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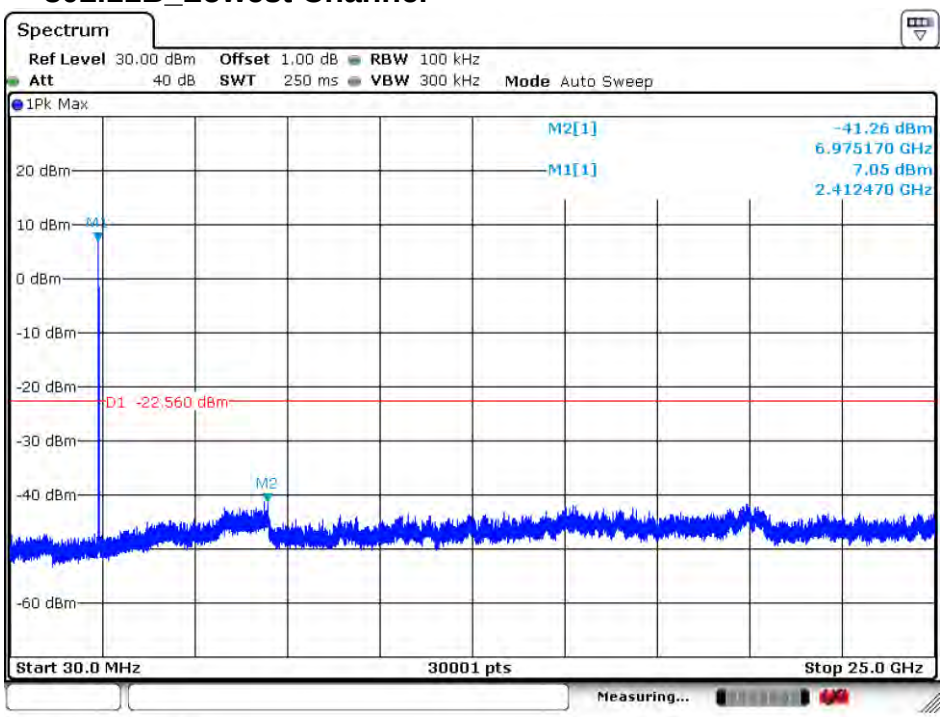
4.8.1 Test plots

4.8.1.1 ANT1

4.8.1.1.1 802.11B_Lowest Channel



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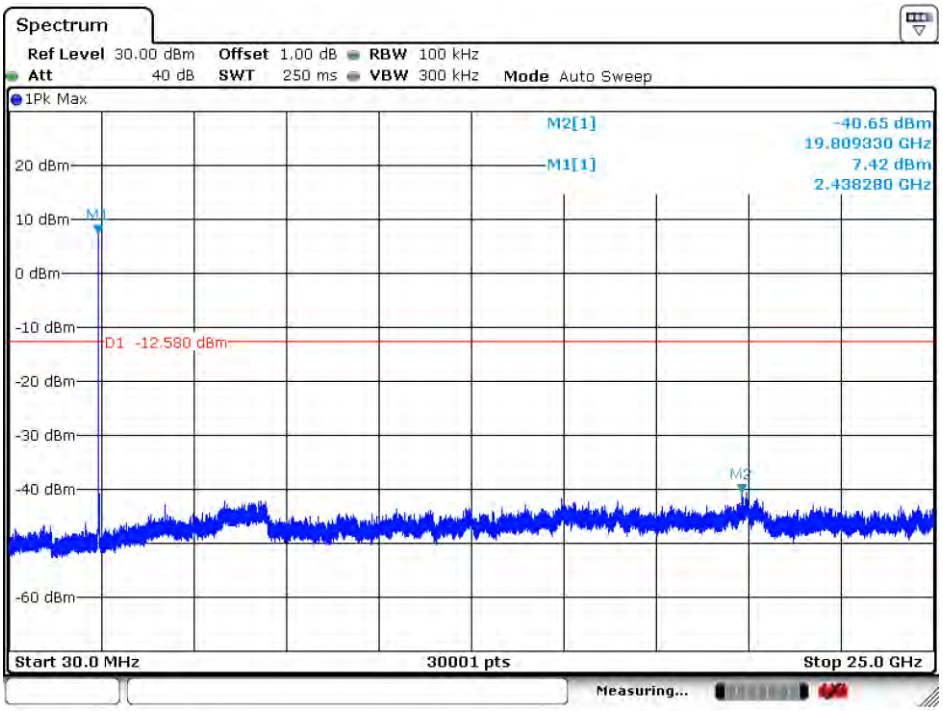
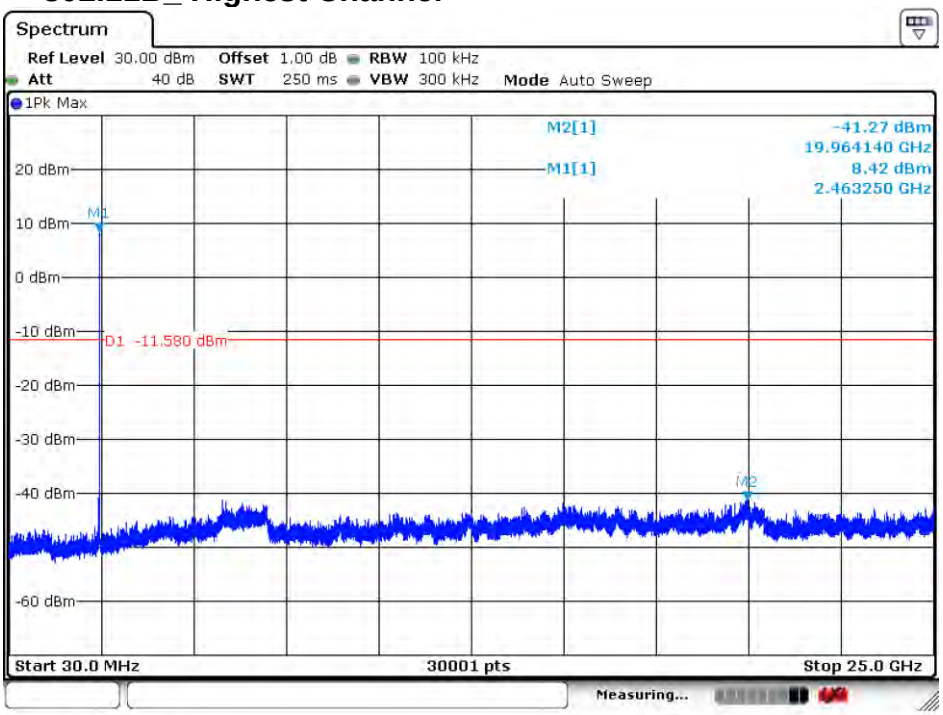
4.8.1.1.2 802.11B_ Middle Channel



Date: 12.JUN.2020 04:24:31

4.8.1.1.3 802.11B_ Highest Channel



Date: 12.JUN.2020 04:25:49

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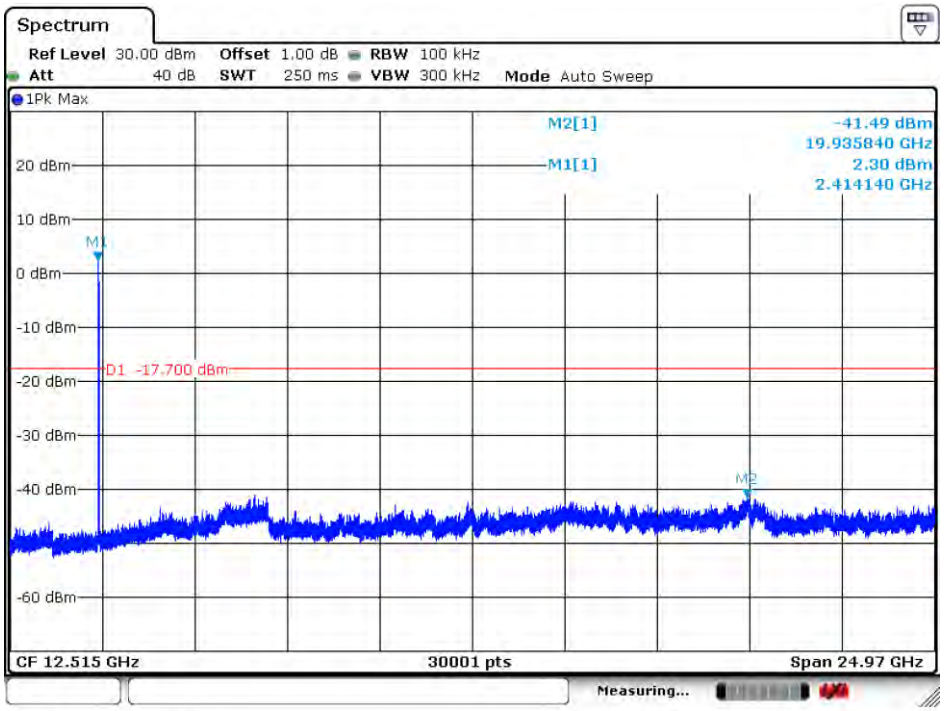
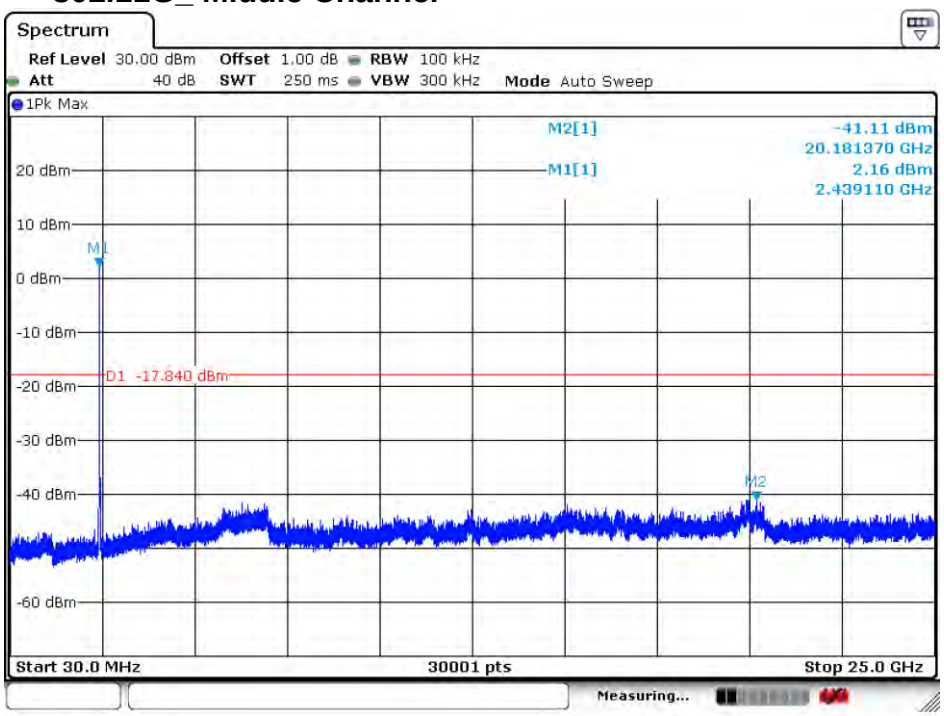
4.8.1.1.4 802.11G_Lowest Channel



Date: 12.JUN.2020 04:08:00

4.8.1.1.5 802.11G_ Middle Channel



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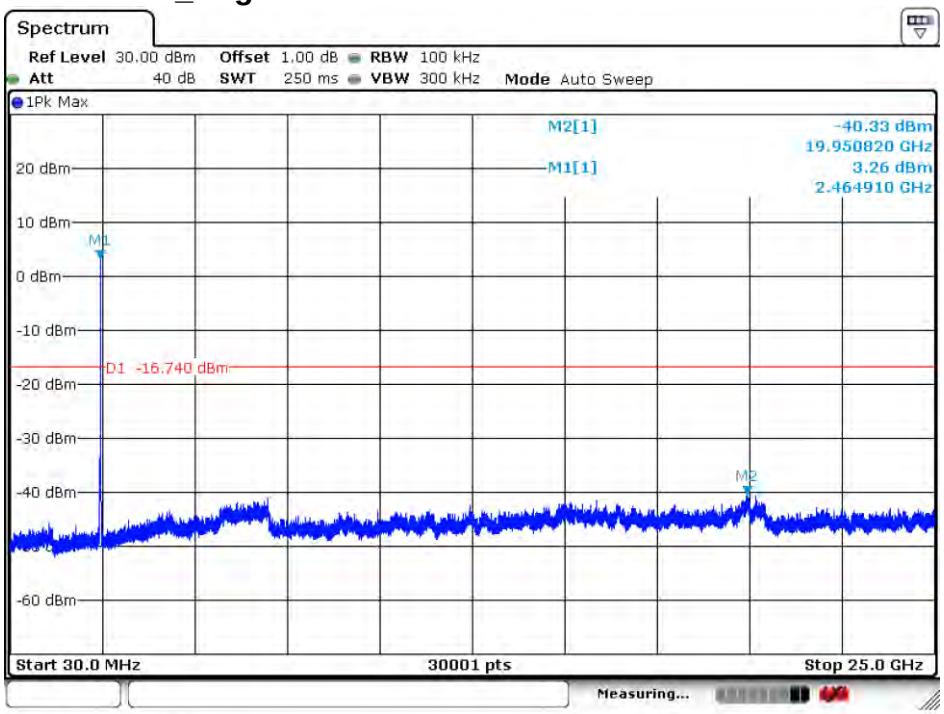
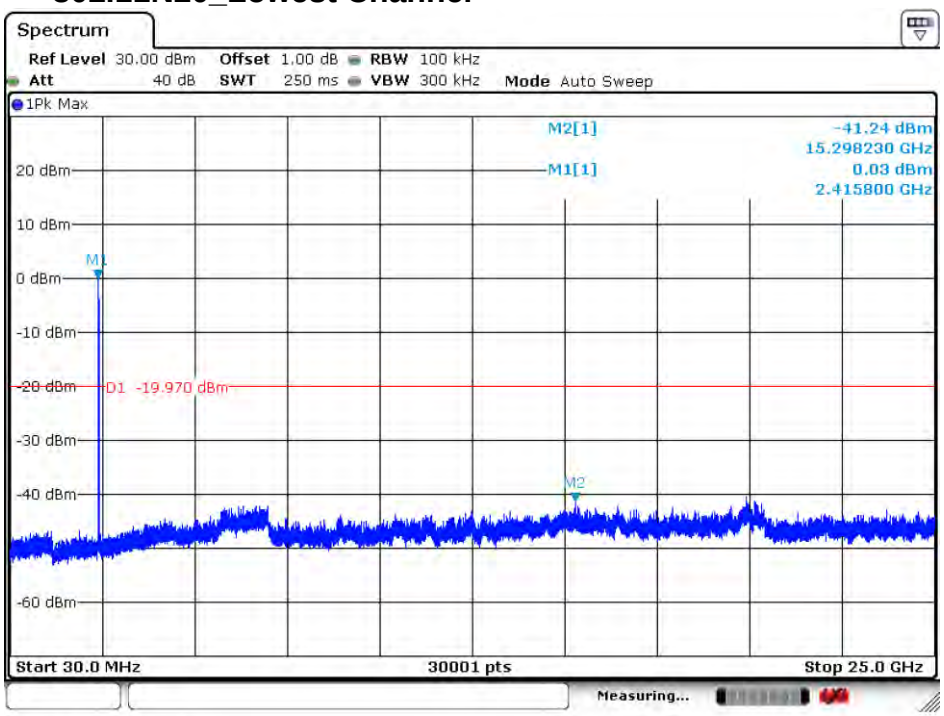
4.8.1.1.6 802.11G_ Highest Channel



Date: 12.JUN.2020 04:02:43

4.8.1.1.7 802.11N20_Lowest Channel



Date: 12.JUN.2020 04:19:49

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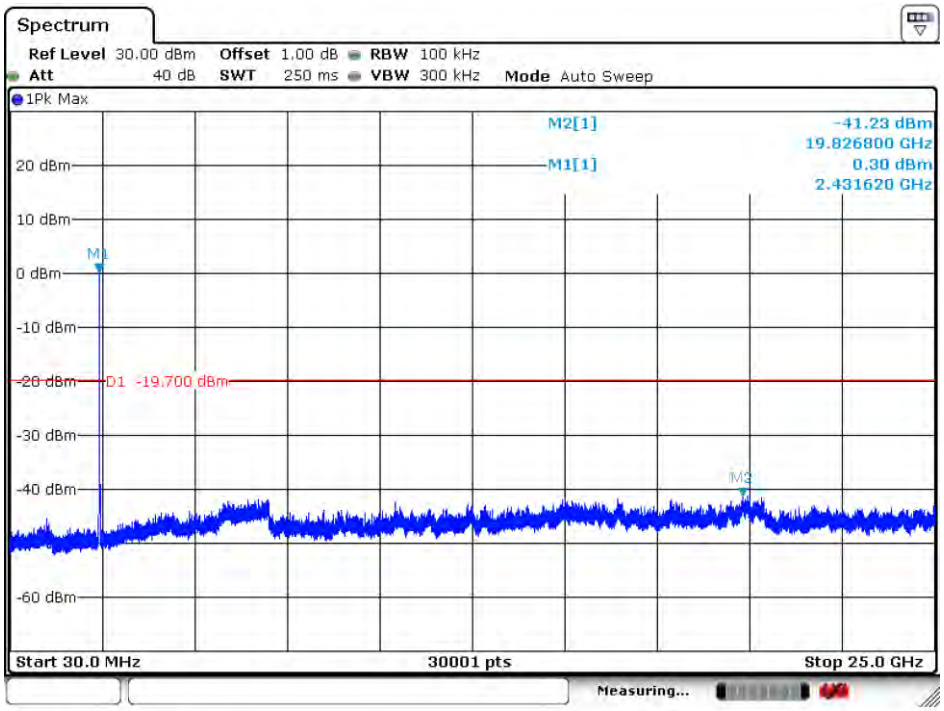
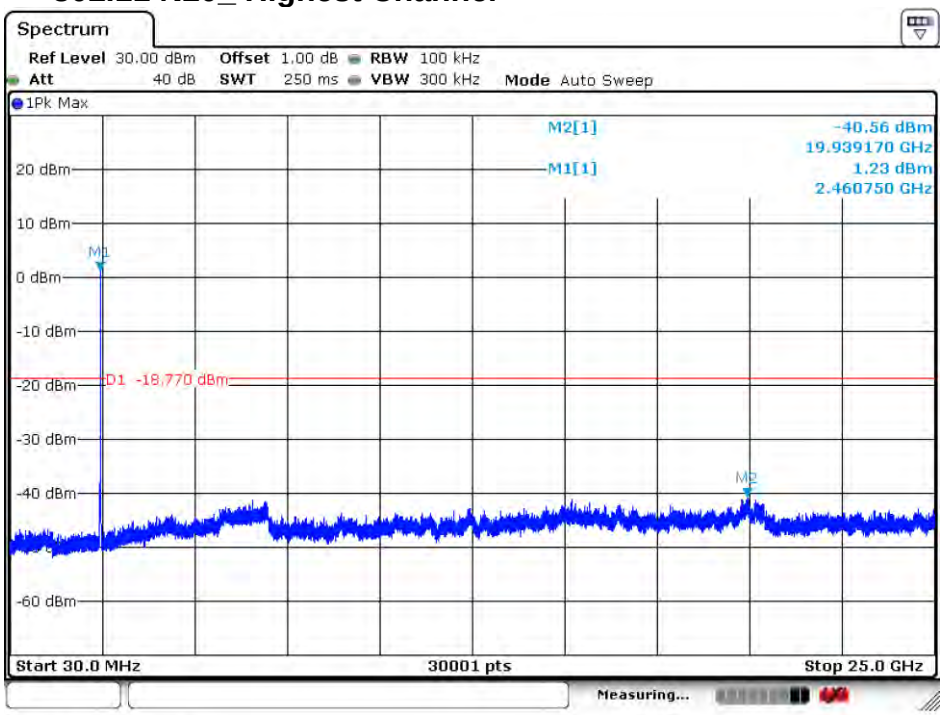
4.8.1.1.8 802.11 N20_ Middle Channel



Date: 12.JUN.2020 04:18:51

4.8.1.1.9 802.11 N20_ Highest Channel



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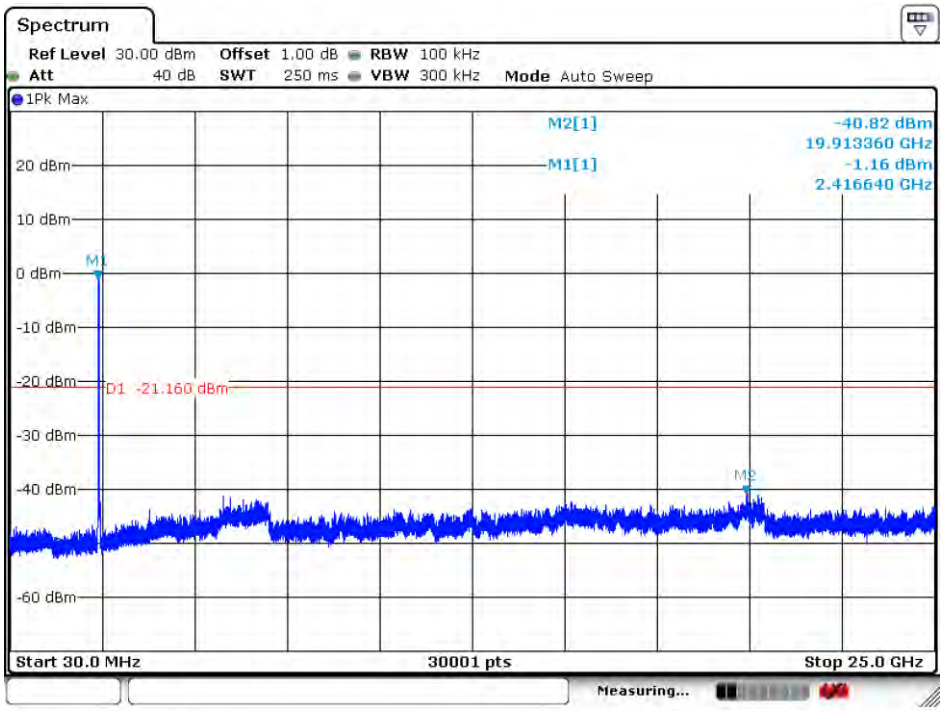
4.8.1.1.10 802.11N40_Lowest Channel



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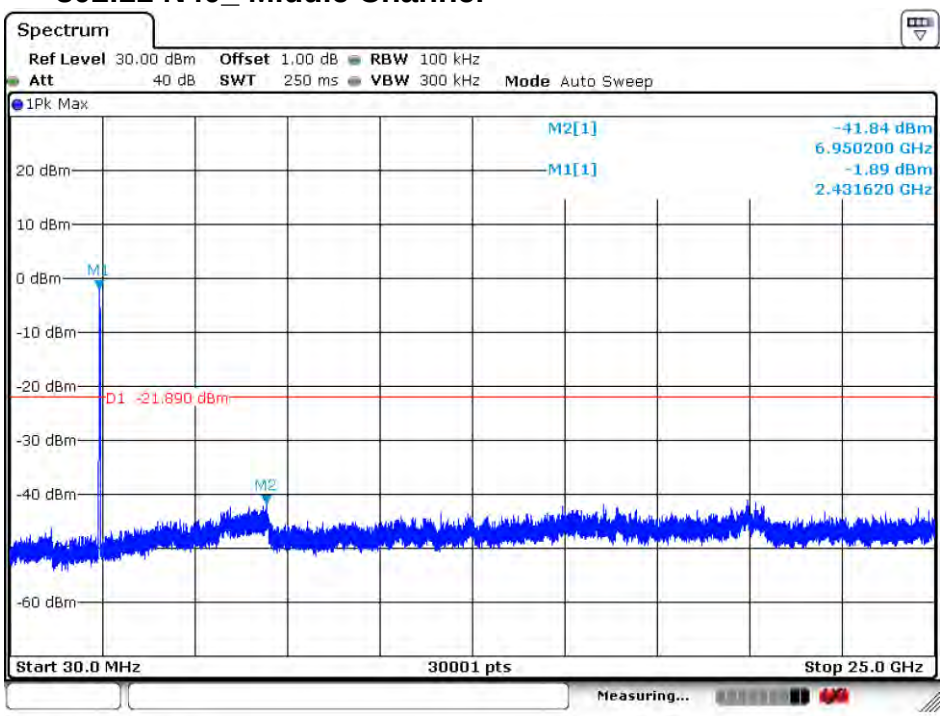
4.8.1.1.11 802.11 N40_ Middle Channel



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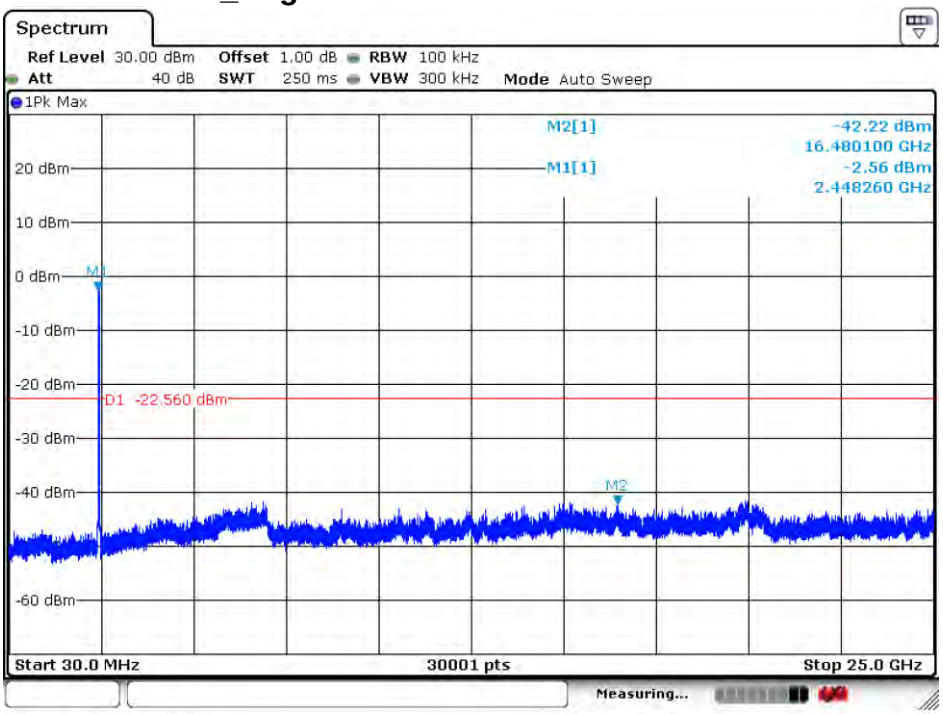
4.8.1.1.12 802.11 N40_ Highest Channel



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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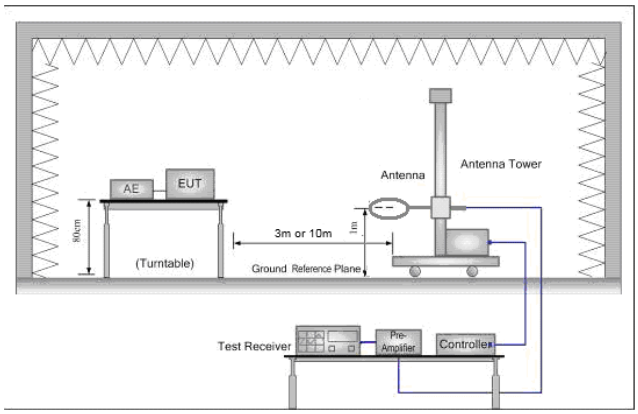

Figure 1. Below 30MHz

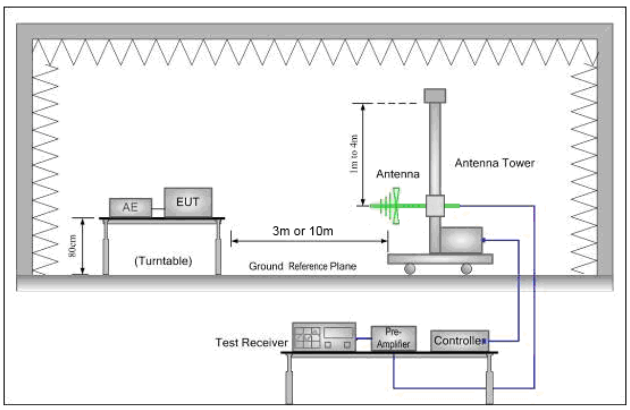

Figure 2. 30MHz to 1GHz

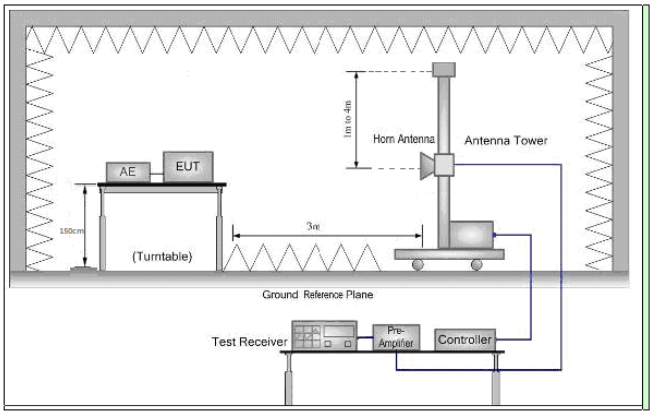

Figure 3. Above 1 GHz

Test Procedure:	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. Use the following spectrum analyzer settings: (1) Span shall wide enough to fully capture the emission being measured; (2) Set RBW=100 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW ⩾ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak (3) For average measurement: use duty cycle correction factor method per 15.35(c). Duty cycle = On time/100 milliseconds

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	On time = N 1 *L 1 +N 2 *L 2 +...+N n-1 *LN 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(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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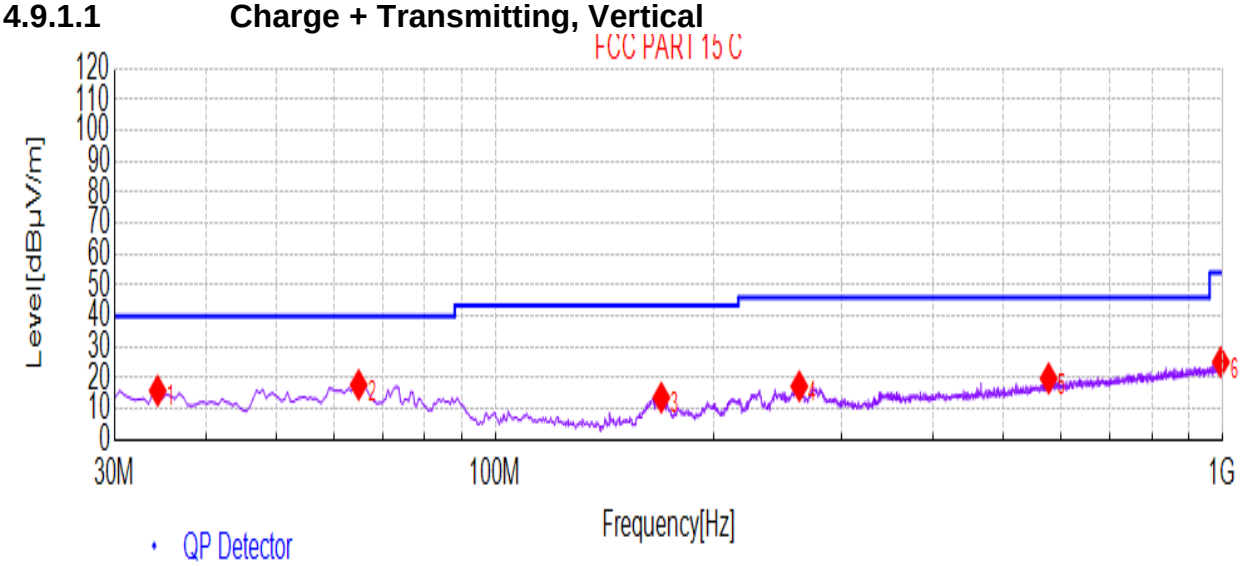
4.9.1 Radiated emission below 1GHz

4.9.1.1 Charge + Transmitting, Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	34.3672	15.88	-32.77	40.00	24.12	166	257	Vertical
2	64.9375	17.81	-32.91	40.00	22.19	210	335	Vertical
3	169.264	13.68	-33.66	43.50	29.82	249	170	Vertical
4	261.946	17.34	-28.90	46.00	28.66	261	0	Vertical
5	576.868	19.90	-20.71	46.00	26.10	164	91	Vertical
6	995.147	25.16	-13.93	54.00	28.84	191	57	Vertical

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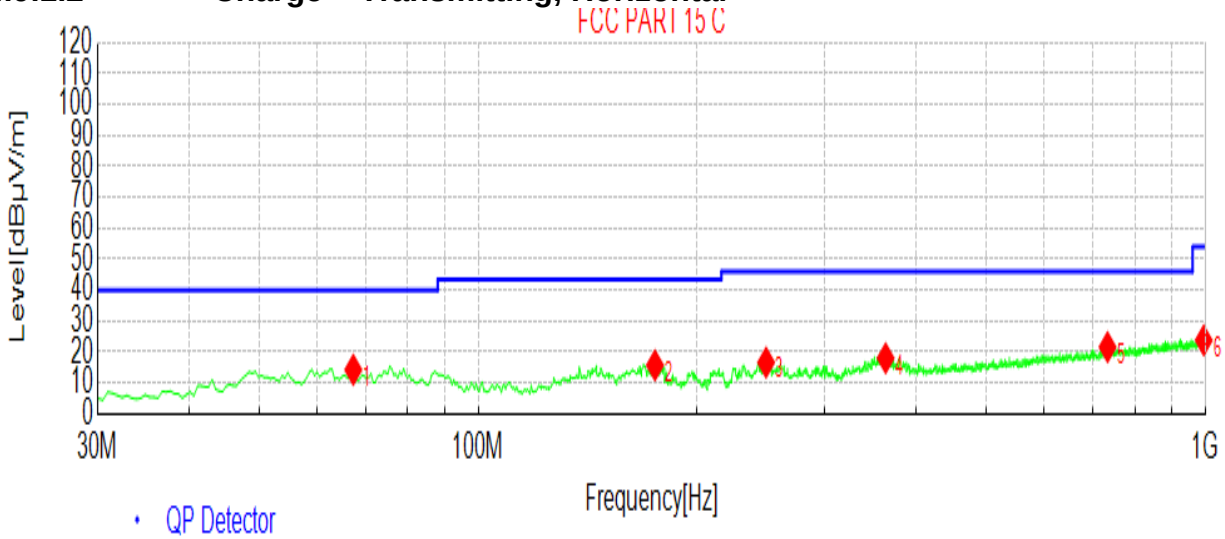
4.9.1.2 Charge + Transmitting, Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	67.3637	14.29	-33.51	40.00	25.71	156	275	Horizontal
2	175.087	15.73	-33.25	43.50	27.77	121	97	Horizontal
3	248.844	16.62	-29.30	46.00	29.38	197	241	Horizontal
4	363.361	18.02	-25.92	46.00	27.98	229	250	Horizontal
5	733.601	21.60	-17.88	46.00	24.40	188	228	Horizontal
6	994.662	23.79	-13.93	54.00	30.21	200	316	Horizontal

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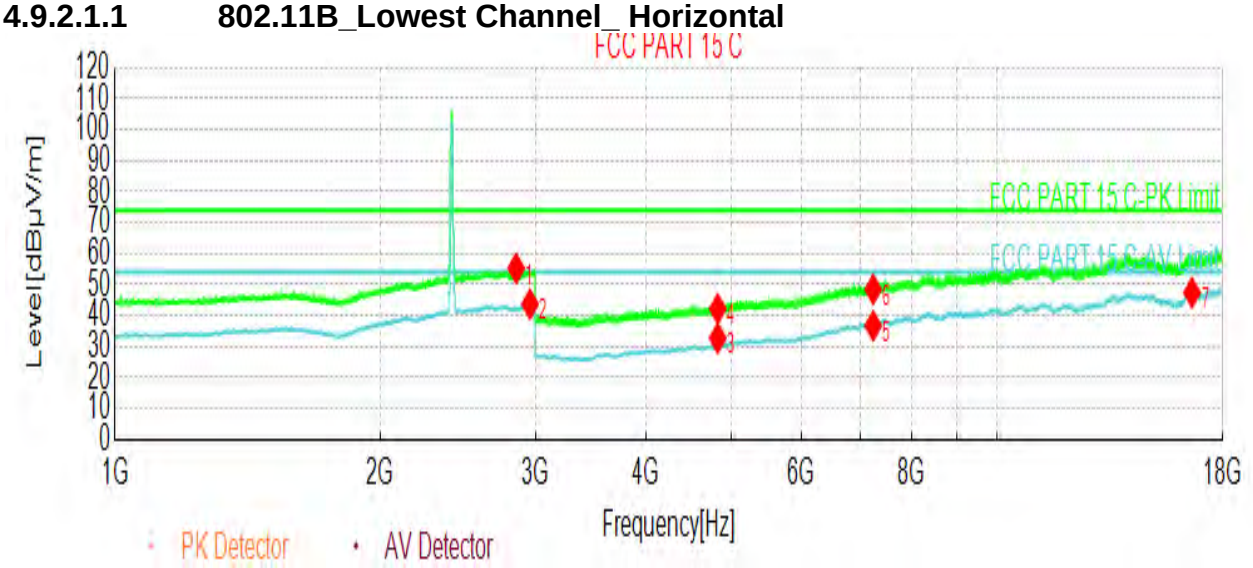
4.9.2 Transmitter emission above 1GHz

4.9.2.1 ANT1

4.9.2.1.1 802.11B_Lowest Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2850.46	55.30	9.24	74.00	18.70	229	264	Horizontal
2	2954.98	43.74	9.66	54.00	10.26	123	46	Horizontal
3	4824.00	32.79	-18.21	54.00	21.21	116	343	Horizontal
4	4824.00	42.26	-18.21	74.00	31.74	127	316	Horizontal
5	7236.00	36.78	-9.99	54.00	17.22	156	142	Horizontal
6	7236.00	48.49	-9.99	74.00	25.51	133	292	Horizontal
7	16626.0	47.46	0.30	54.00	6.54	117	342	Horizontal

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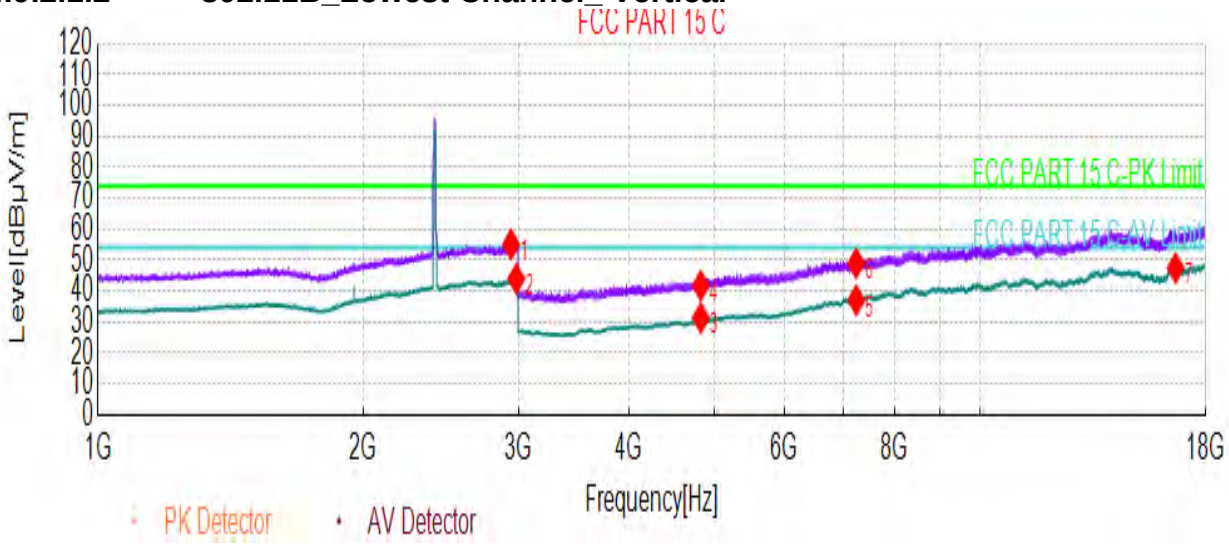
4.9.2.1.2 802.11B_Lowest Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2939.98	55.18	9.57	74.00	18.82	177	315	Vertical
2	2980.49	44.04	9.54	54.00	9.96	242	342	Vertical
3	4824.00	31.40	-18.21	54.00	22.60	224	263	Vertical
4	4824.00	41.81	-18.21	74.00	32.19	253	99	Vertical
5	7236.00	37.08	-9.99	54.00	16.92	243	192	Vertical
6	7236.00	49.02	-9.99	74.00	24.98	240	94	Vertical
7	16647.4	47.50	0.38	54.00	6.50	200	44	Vertical

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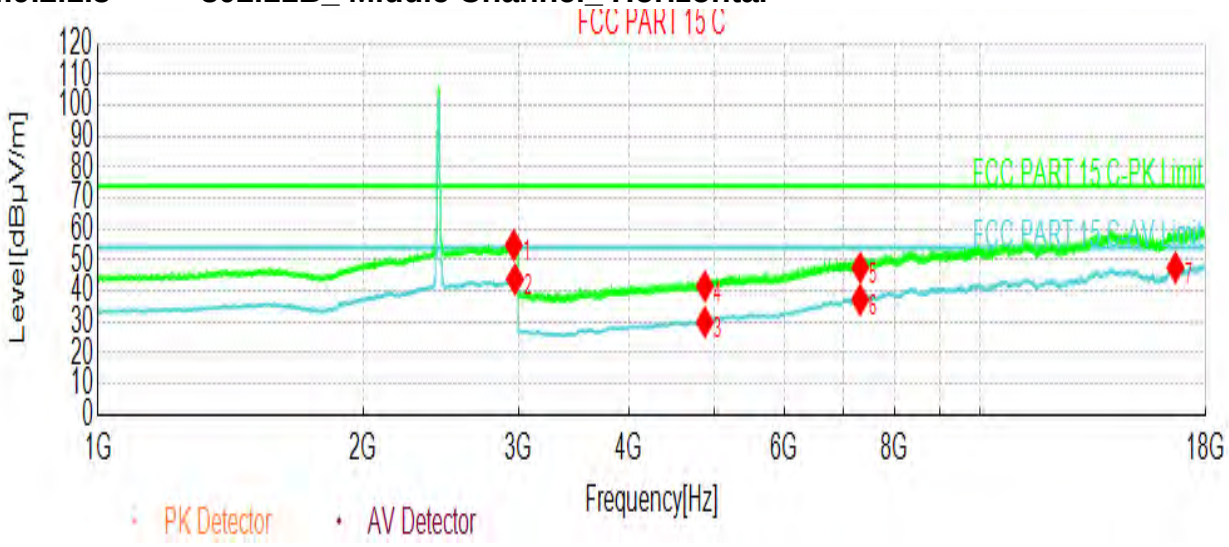
4.9.2.1.3 802.11B_ Middle Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2960.99	54.89	9.63	74.00	19.11	188	140	Horizontal
2	2970.99	43.86	9.58	54.00	10.14	216	167	Horizontal
3	4874.00	29.99	-17.99	54.00	24.01	213	316	Horizontal
4	4874.00	41.64	-17.99	74.00	32.36	190	45	Horizontal
5	7311.00	47.59	-9.74	74.00	26.41	164	143	Horizontal
6	7311.00	37.22	-9.74	54.00	16.78	208	43	Horizontal
7	16642.5	47.65	0.36	54.00	6.35	118	193	Horizontal

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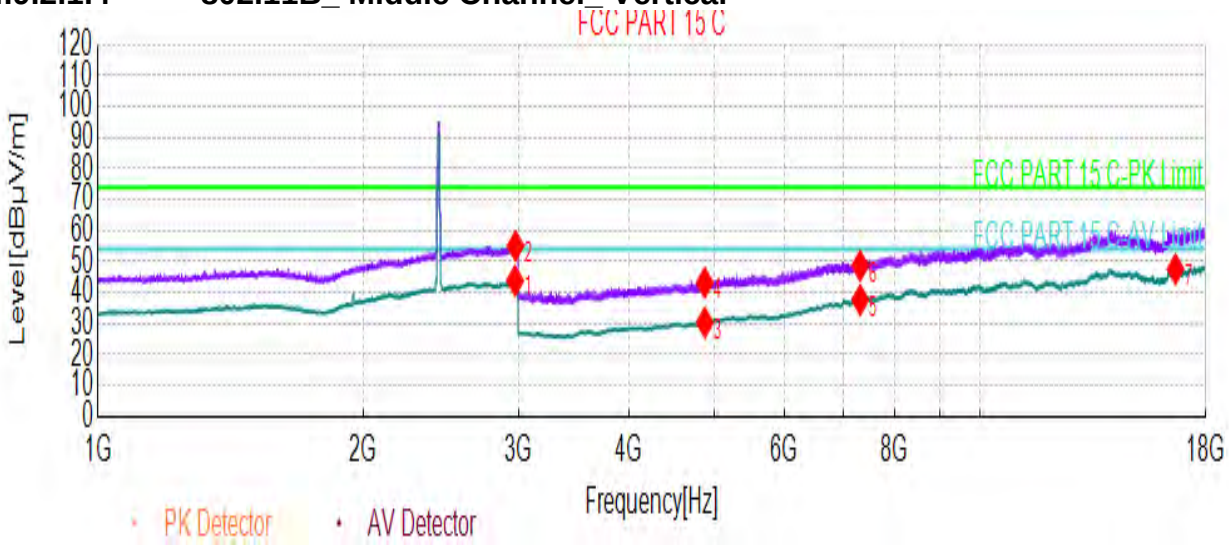
4.9.2.1.4 802.11B_ Middle Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2970.99	43.90	9.58	54.00	10.10	200	56	Vertical
2	2974.49	55.18	9.57	74.00	18.82	161	97	Vertical
3	4874.00	30.36	-17.99	54.00	23.64	154	263	Vertical
4	4874.00	43.28	-17.99	74.00	30.72	214	208	Vertical
5	7311.00	37.69	-9.74	54.00	16.31	247	342	Vertical
6	7311.00	48.71	-9.74	74.00	25.29	211	0	Vertical
7	16645.8	47.65	0.38	54.00	6.35	262	292	Vertical

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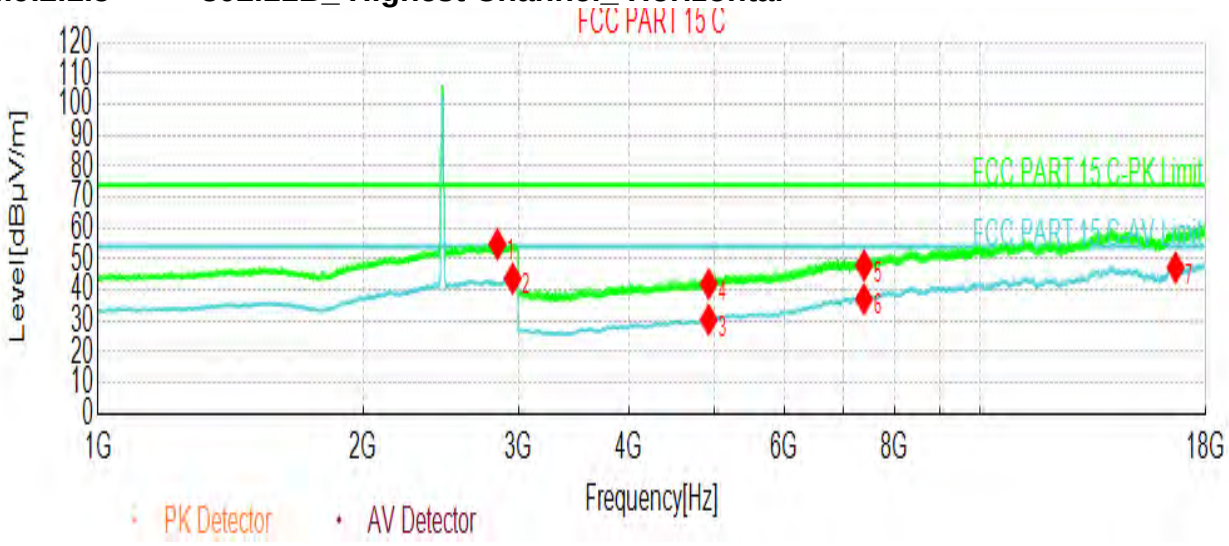
4.9.2.1.5 802.11B_ Highest Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2837.45	54.90	9.17	74.00	19.10	192	290	Horizontal
2	2952.48	43.76	9.67	54.00	10.24	144	343	Horizontal
3	4924.00	30.44	-17.72	54.00	23.56	195	44	Horizontal
4	4924.00	42.02	-17.72	74.00	31.98	208	360	Horizontal
5	7386.00	48.03	-9.55	74.00	25.97	142	93	Horizontal
6	7386.00	37.12	-9.55	54.00	16.88	208	93	Horizontal
7	16650.2	47.33	0.40	54.00	6.67	159	192	Horizontal

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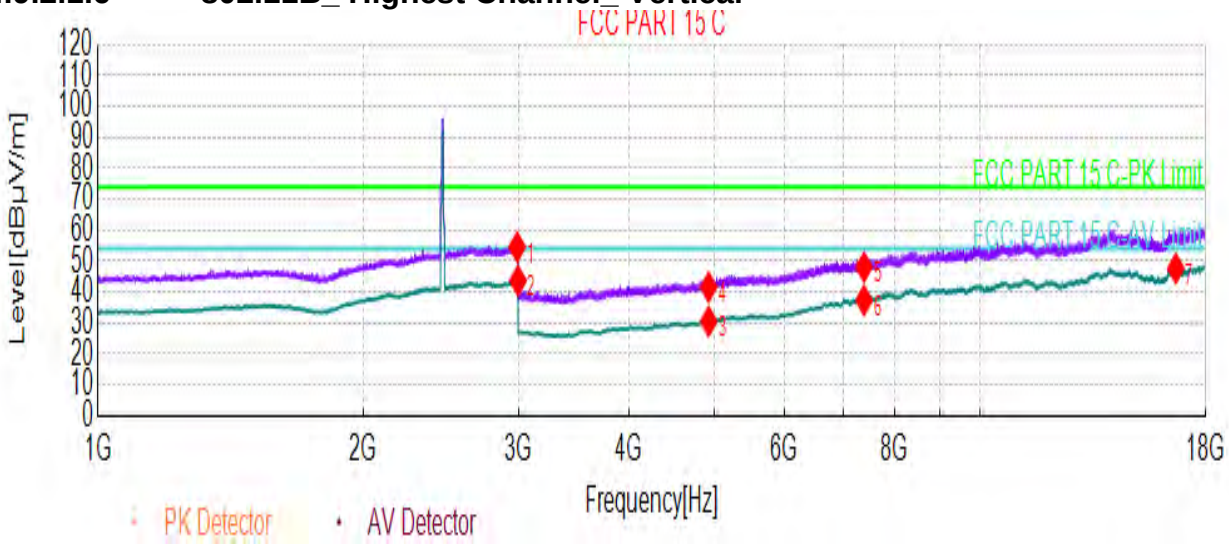
4.9.2.1.6 802.11B_ Highest Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2987.49	54.64	9.51	74.00	19.36	225	29	Vertical
2	2993.99	43.77	9.48	54.00	10.23	224	42	Vertical
3	4924.00	30.57	-17.72	54.00	23.43	261	180	Vertical
4	4924.00	41.65	-17.72	74.00	32.35	175	71	Vertical
5	7386.00	48.13	-9.55	74.00	25.87	219	1	Vertical
6	7386.00	37.40	-9.55	54.00	16.60	216	193	Vertical
7	16659.0	47.67	0.43	54.00	6.33	152	143	Vertical

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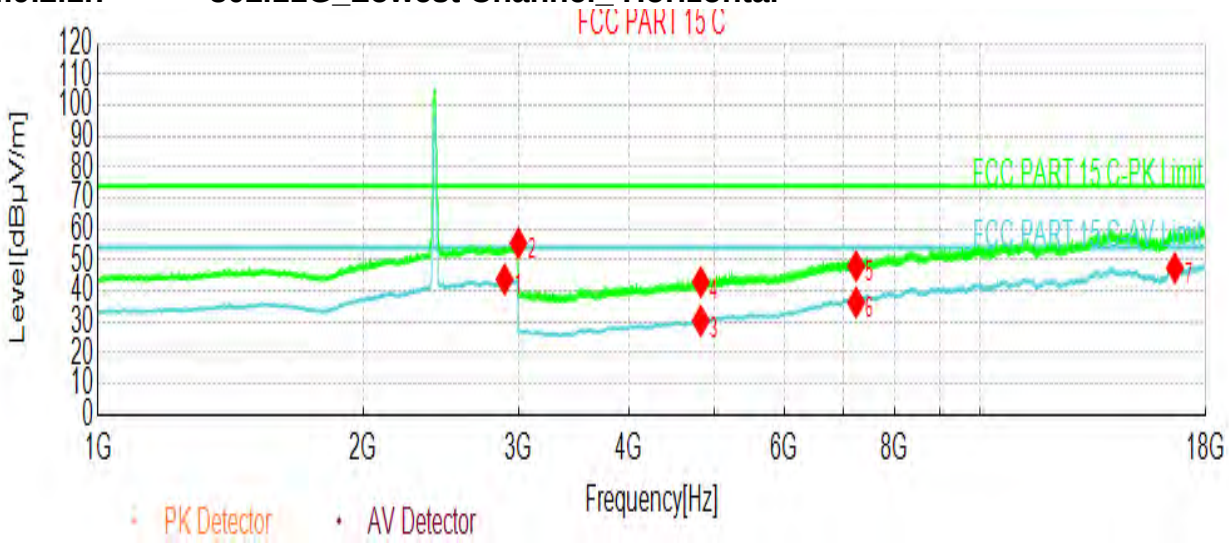
4.9.2.1.7 802.11G_Lowest Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2890.97	43.83	9.16	54.00	10.17	126	261	Horizontal
2	2996.99	55.54	9.46	74.00	18.46	235	235	Horizontal
3	4824.00	30.42	-18.21	54.00	23.58	193	343	Horizontal
4	4824.00	42.93	-18.21	74.00	31.07	221	288	Horizontal
5	7236.00	48.10	-9.99	74.00	25.90	150	292	Horizontal
6	7236.00	36.38	-9.99	54.00	17.62	170	142	Horizontal
7	16619.9	47.50	0.27	54.00	6.50	175	192	Horizontal

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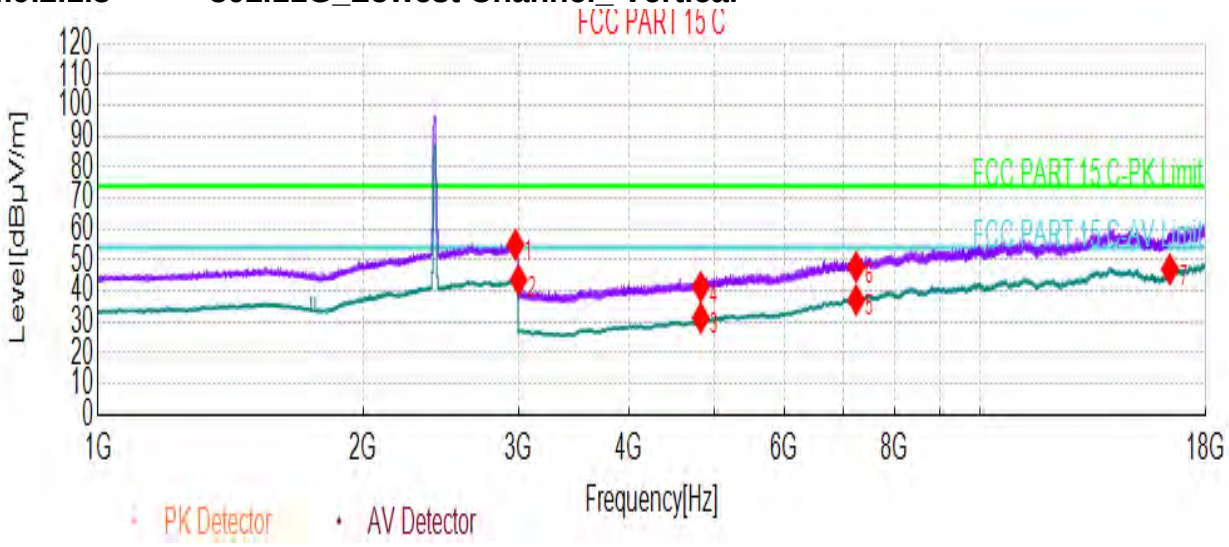
4.9.2.1.8 802.11G_Lowest Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2974.49	55.02	9.57	74.00	18.98	220	192	Vertical
2	2998.49	43.64	9.46	54.00	10.36	272	124	Vertical
3	4824.00	31.38	-18.21	54.00	22.62	268	262	Vertical
4	4824.00	41.45	-18.21	74.00	32.55	249	343	Vertical
5	7236.00	37.12	-9.99	54.00	16.88	177	143	Vertical
6	7236.00	47.83	-9.99	74.00	26.17	235	143	Vertical
7	16404.9	47.11	-0.10	54.00	6.89	160	242	Vertical

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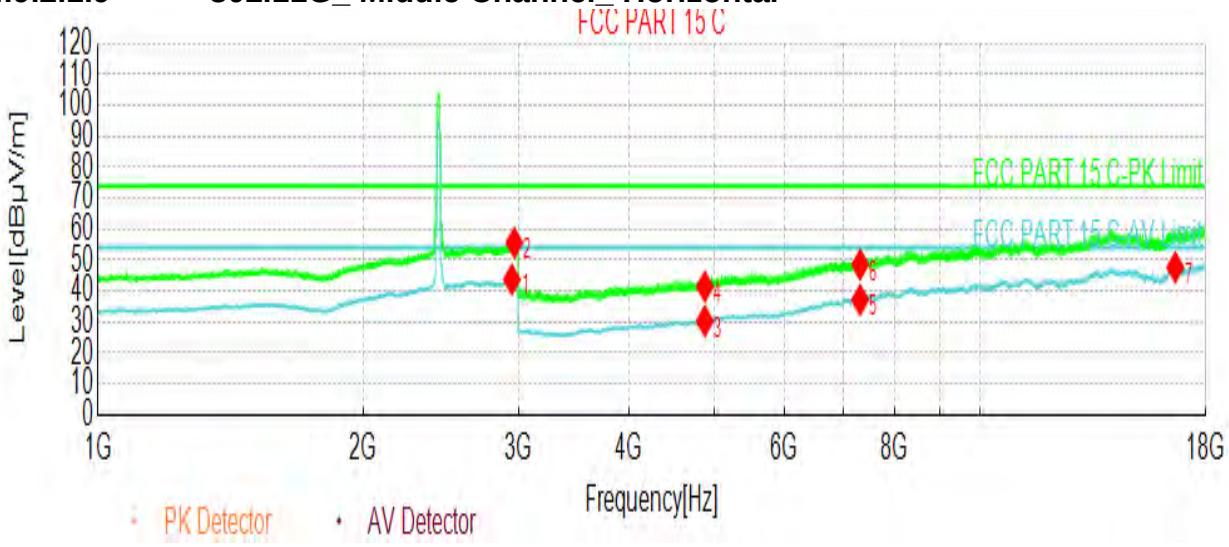
4.9.2.1.9 802.11G_ Middle Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2946.48	43.77	9.64	54.00	10.23	118	18	Horizontal
2	2965.49	55.70	9.61	74.00	18.30	238	169	Horizontal
3	4874.00	30.39	-17.99	54.00	23.61	148	209	Horizontal
4	4874.00	41.54	-17.99	74.00	32.46	197	235	Horizontal
5	7311.00	37.18	-9.74	54.00	16.82	207	193	Horizontal
6	7311.00	48.61	-9.74	74.00	25.39	240	242	Horizontal
7	16637.0	47.70	0.34	54.00	6.30	228	193	Horizontal

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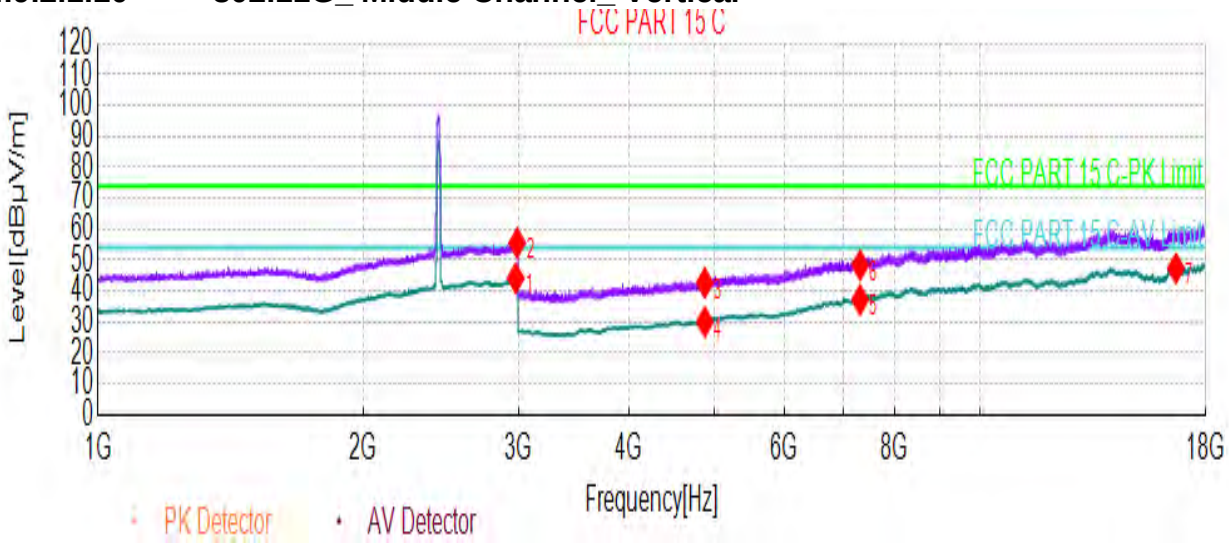
4.9.2.1.10 802.11G_ Middle Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2975.99	44.17	9.56	54.00	9.83	153	262	Vertical
2	2987.49	55.61	9.51	74.00	18.39	234	18	Vertical
3	4874.00	42.74	-17.99	74.00	31.26	184	360	Vertical
4	4874.00	30.11	-17.99	54.00	23.89	252	18	Vertical
5	7311.00	37.17	-9.74	54.00	16.83	281	140	Vertical
6	7311.00	48.37	-9.74	74.00	25.63	154	37	Vertical
7	16665.0	47.42	0.46	54.00	6.58	174	90	Vertical

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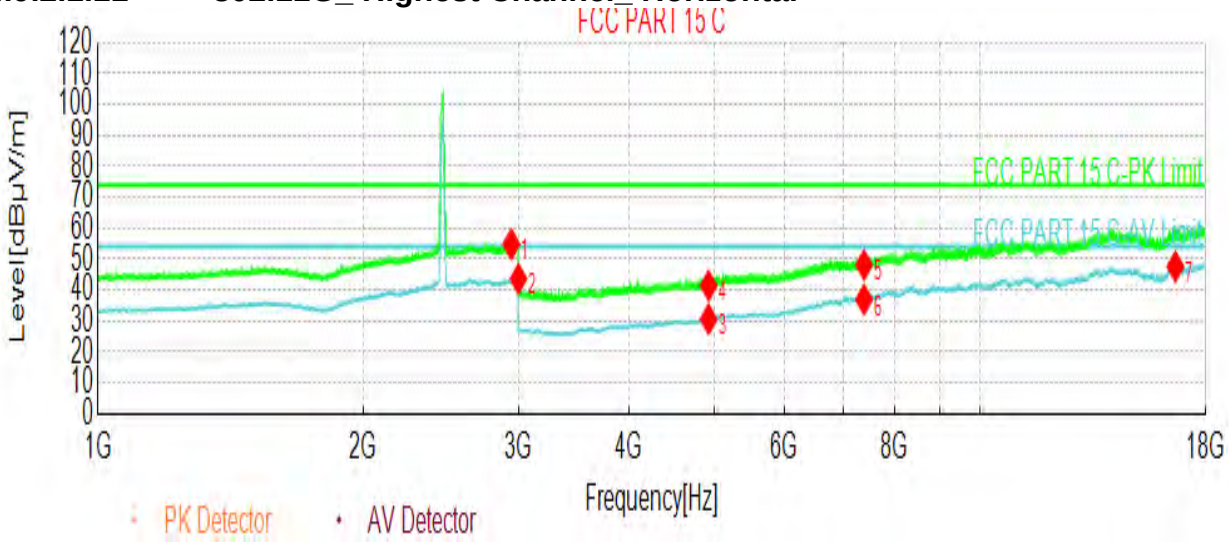
4.9.2.1.11 802.11G_ Highest Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2941.98	54.88	9.59	74.00	19.12	243	32	Horizontal
2	2997.49	43.73	9.46	54.00	10.27	171	18	Horizontal
3	4924.00	30.63	-17.72	54.00	23.37	168	18	Horizontal
4	4924.00	41.51	-17.72	74.00	32.49	212	208	Horizontal
5	7386.00	48.20	-9.55	74.00	25.80	192	43	Horizontal
6	7386.00	36.99	-9.55	54.00	17.01	115	0	Horizontal
7	16642.5	47.65	0.36	54.00	6.35	122	192	Horizontal

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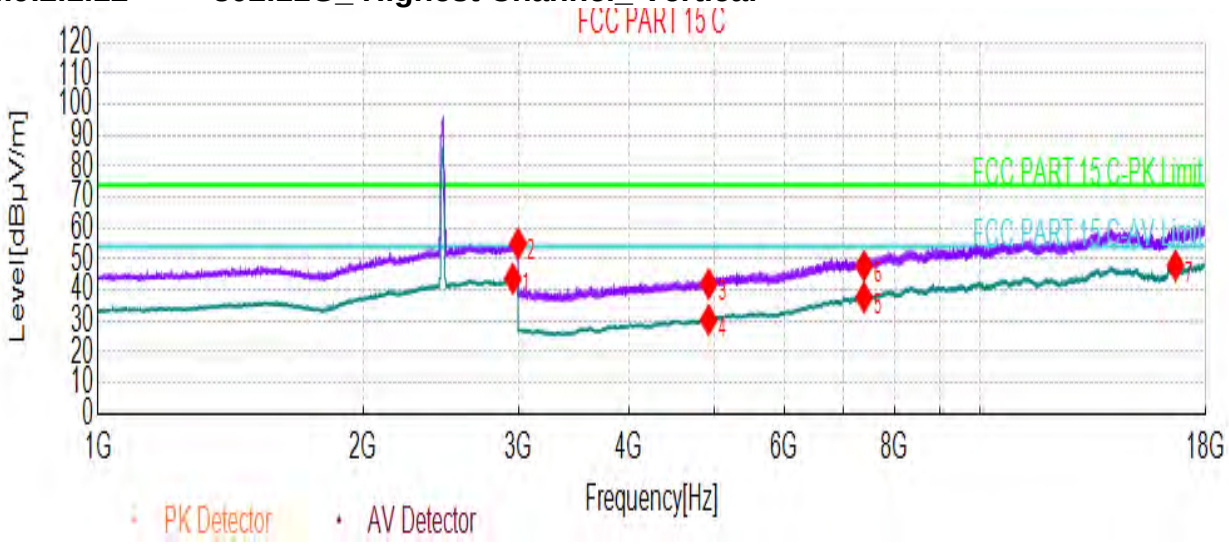
4.9.2.1.12 802.11G_ Highest Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2953.98	43.70	9.66	54.00	10.30	167	233	Vertical
2	2994.49	55.06	9.48	74.00	18.94	231	137	Vertical
3	4924.00	42.01	-17.72	74.00	31.99	182	211	Vertical
4	4924.00	30.38	-17.72	54.00	23.62	166	18	Vertical
5	7386.00	37.66	-9.55	54.00	16.34	273	94	Vertical
6	7386.00	47.85	-9.55	74.00	26.15	170	143	Vertical
7	16644.7	47.97	0.37	54.00	6.03	171	143	Vertical

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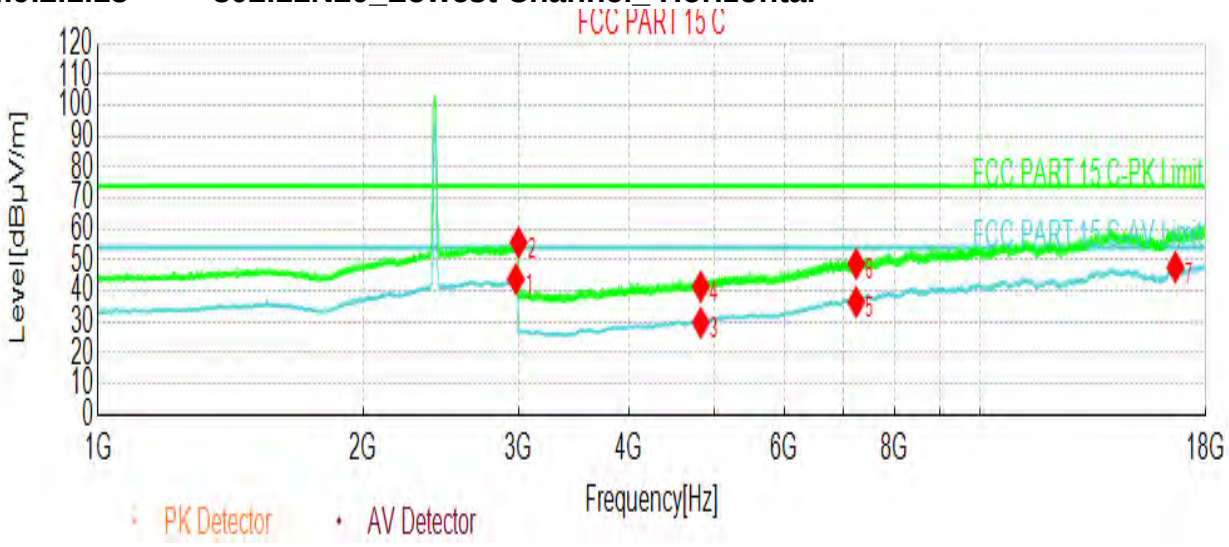
4.9.2.1.13 802.11N20_Lowest Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2976.99	43.87	9.56	54.00	10.13	167	303	Horizontal
2	2998.49	55.74	9.46	74.00	18.26	119	235	Horizontal
3	4824.00	29.84	-18.21	54.00	24.16	118	153	Horizontal
4	4824.00	41.50	-18.21	74.00	32.50	242	45	Horizontal
5	7236.00	36.49	-9.99	54.00	17.51	244	143	Horizontal
6	7236.00	48.83	-9.99	74.00	25.17	150	44	Horizontal
7	16638.1	47.77	0.35	54.00	6.23	222	0	Horizontal

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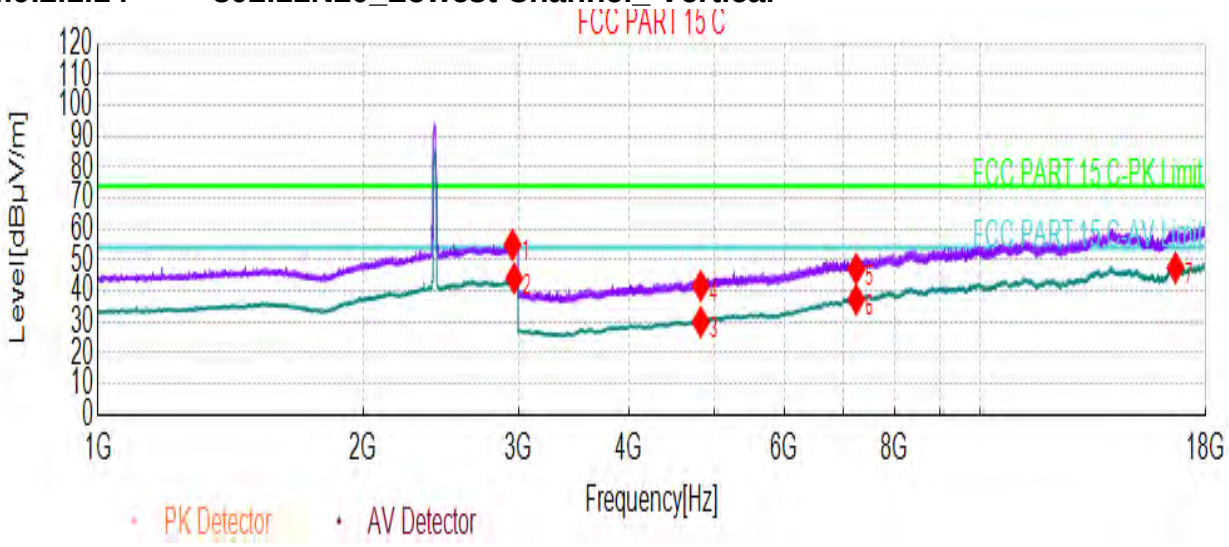
4.9.2.1.14 802.11N20_Lowest Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2951.48	55.00	9.67	74.00	19.00	197	0	Vertical
2	2964.49	44.16	9.61	54.00	9.84	250	219	Vertical
3	4824.00	30.07	-18.21	54.00	23.93	212	99	Vertical
4	4824.00	41.74	-18.21	74.00	32.26	183	235	Vertical
5	7236.00	47.17	-9.99	74.00	26.83	278	242	Vertical
6	7236.00	37.30	-9.99	54.00	16.70	168	94	Vertical
7	16645.2	47.60	0.38	54.00	6.40	269	192	Vertical

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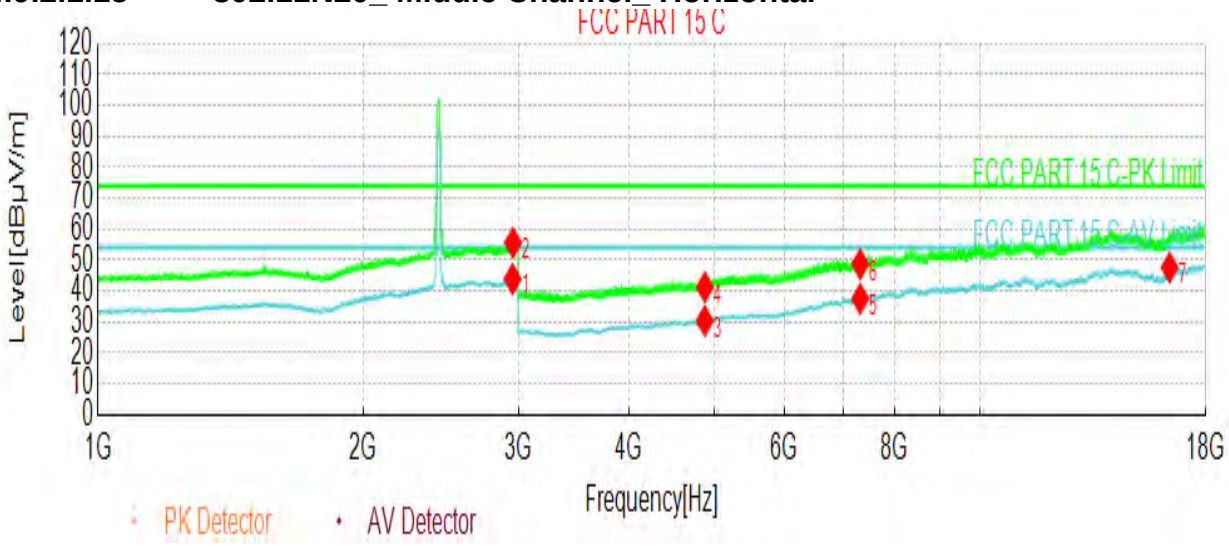
4.9.2.1.15 802.11N20_ Middle Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2951.48	43.95	9.67	54.00	10.05	141	99	Horizontal
2	2955.48	55.66	9.65	74.00	18.34	109	303	Horizontal
3	4874.00	30.41	-17.99	54.00	23.59	219	72	Horizontal
4	4874.00	41.28	-17.99	74.00	32.72	185	209	Horizontal
5	7311.00	37.54	-9.74	54.00	16.46	158	243	Horizontal
6	7311.00	48.73	-9.74	74.00	25.27	193	0	Horizontal
7	16392.8	47.68	-0.12	54.00	6.32	201	292	Horizontal

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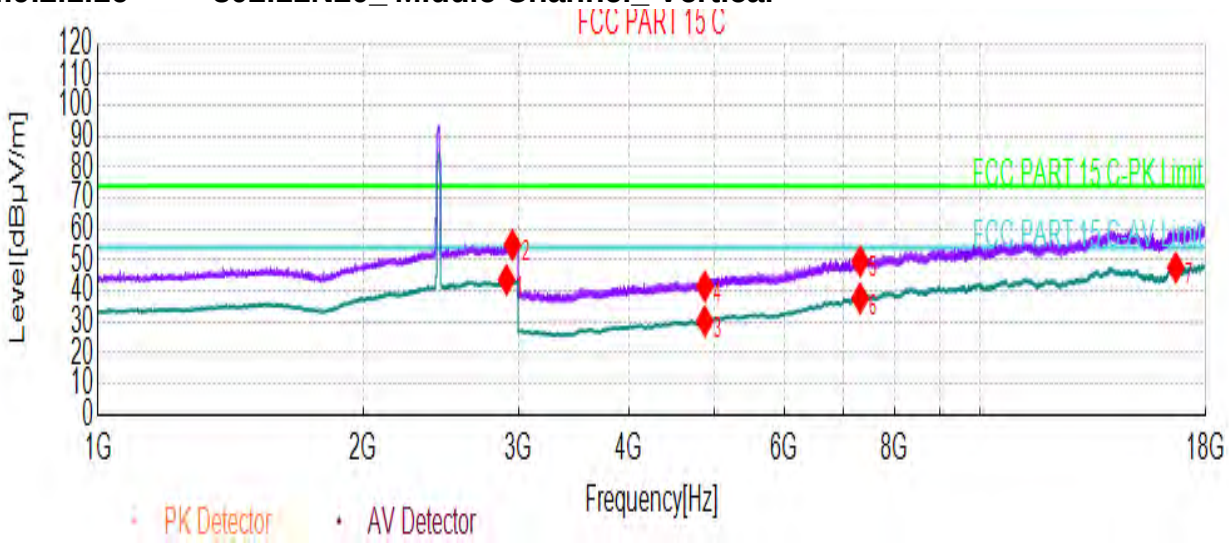
4.9.2.1.16 802.11N20_ Middle Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2905.97	43.67	9.20	54.00	10.33	244	42	Vertical
2	2950.98	54.99	9.68	74.00	19.01	276	3	Vertical
3	4874.00	30.37	-17.99	54.00	23.63	223	236	Vertical
4	4874.00	41.57	-17.99	74.00	32.43	168	182	Vertical
5	7311.00	49.67	-9.74	74.00	24.33	251	192	Vertical
6	7311.00	37.73	-9.74	54.00	16.27	157	292	Vertical
7	16657.9	47.66	0.43	54.00	6.34	183	142	Vertical

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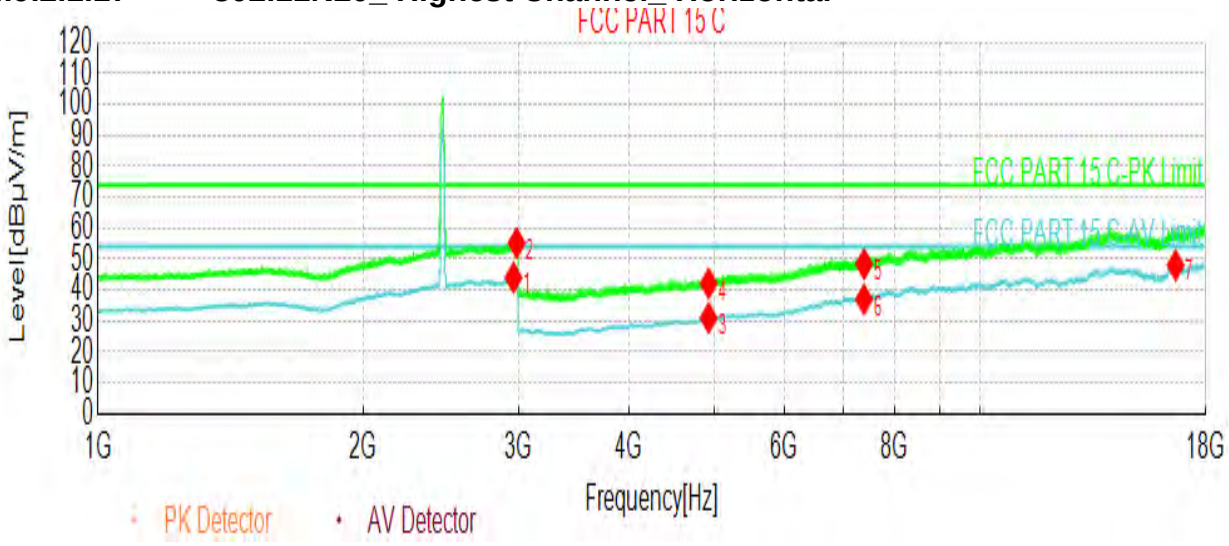
4.9.2.1.17 802.11N20_ Highest Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2958.98	44.11	9.64	54.00	9.89	110	194	Horizontal
2	2983.49	55.25	9.53	74.00	18.75	167	153	Horizontal
3	4924.00	31.03	-17.72	54.00	22.97	117	316	Horizontal
4	4924.00	42.18	-17.72	74.00	31.82	104	18	Horizontal
5	7386.00	48.48	-9.55	74.00	25.52	122	92	Horizontal
6	7386.00	37.07	-9.55	54.00	16.93	194	42	Horizontal
7	16650.7	48.08	0.40	54.00	5.92	206	342	Horizontal

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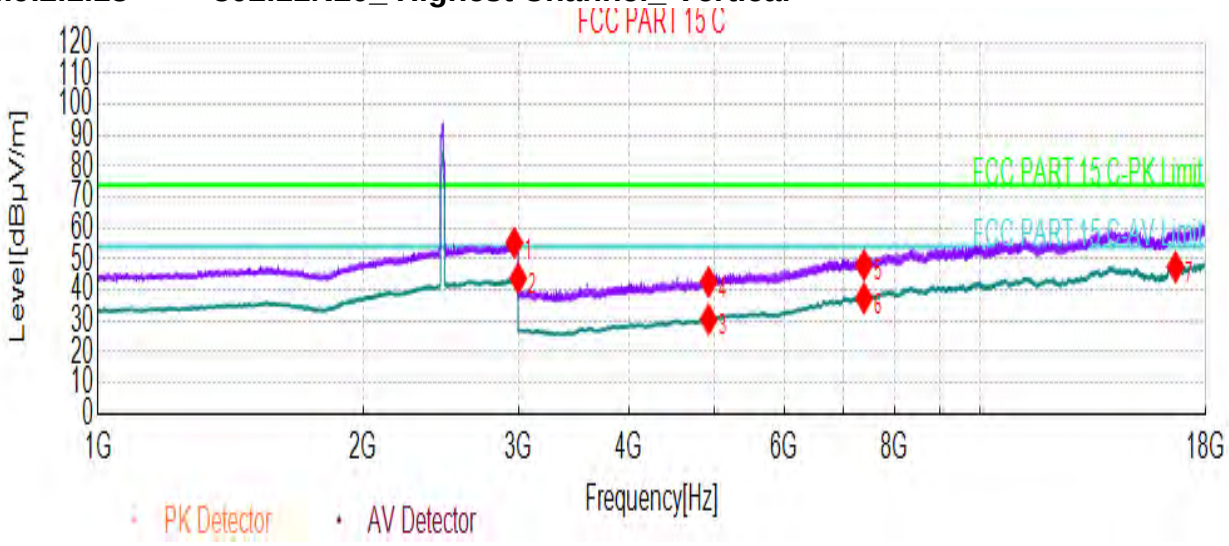
4.9.2.1.18 802.11N20_ Highest Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2965.99	55.35	9.61	74.00	18.65	292	56	Vertical
2	2994.99	43.88	9.47	54.00	10.12	189	124	Vertical
3	4924.00	30.54	-17.72	54.00	23.46	254	180	Vertical
4	4924.00	42.67	-17.72	74.00	31.33	192	73	Vertical
5	7386.00	48.13	-9.55	74.00	25.87	244	292	Vertical
6	7386.00	37.42	-9.55	54.00	16.58	298	242	Vertical
7	16644.7	47.56	0.37	54.00	6.44	289	42	Vertical

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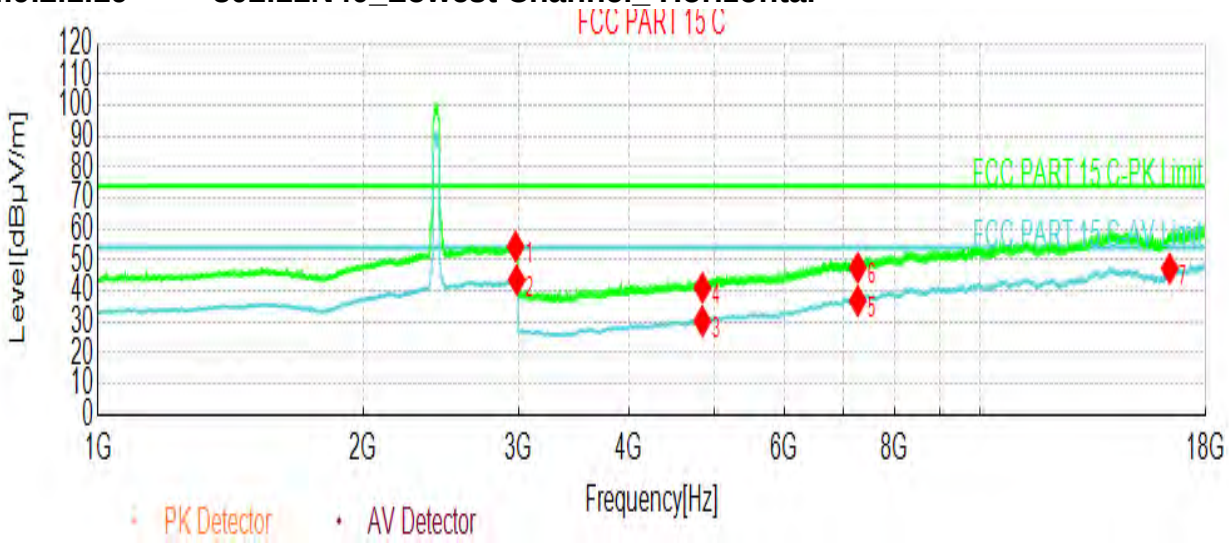
4.9.2.1.19 802.11N40_Lowest Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2975.49	54.45	9.56	74.00	19.55	150	166	Horizontal
2	2983.99	43.65	9.52	54.00	10.35	167	287	Horizontal
3	4844.00	30.34	-18.13	54.00	23.66	124	345	Horizontal
4	4844.00	41.14	-18.13	74.00	32.86	128	236	Horizontal
5	7266.00	36.90	-9.88	54.00	17.10	249	292	Horizontal
6	7266.00	47.58	-9.88	74.00	26.42	155	94	Horizontal
7	16397.7	47.34	-0.12	54.00	6.66	201	94	Horizontal

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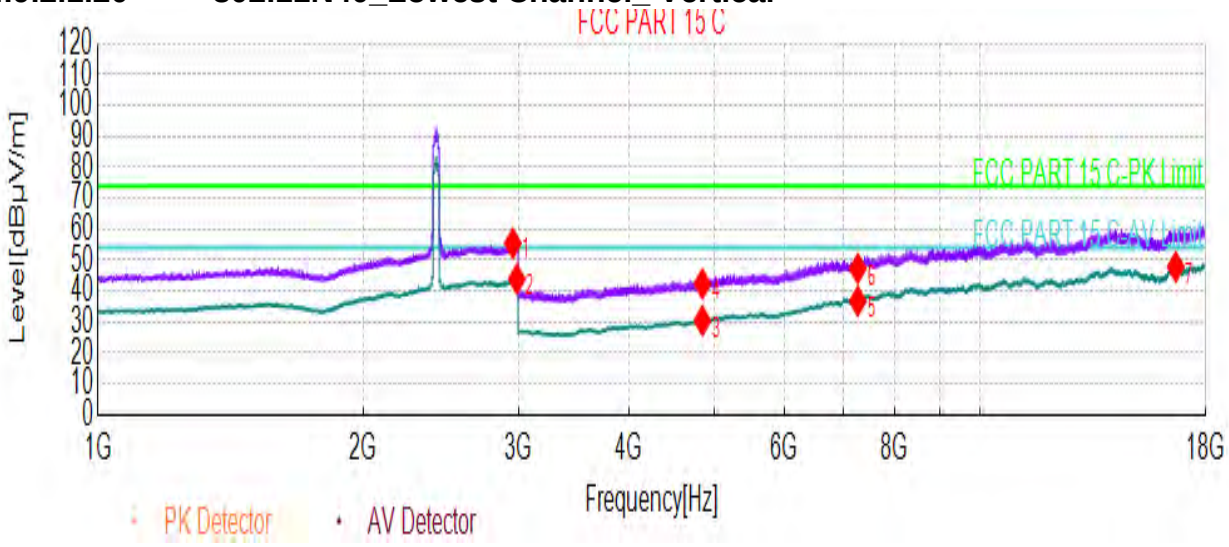
4.9.2.1.20 802.11N40_Lowest Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2953.98	55.50	9.66	74.00	18.50	221	314	Vertical
2	2984.99	43.92	9.52	54.00	10.08	290	221	Vertical
3	4844.00	30.48	-18.13	54.00	23.52	283	235	Vertical
4	4844.00	42.38	-18.13	74.00	31.62	258	45	Vertical
5	7266.00	36.80	-9.88	54.00	17.20	162	42	Vertical
6	7266.00	47.30	-9.88	74.00	26.70	221	292	Vertical
7	16660.1	47.89	0.44	54.00	6.11	258	142	Vertical

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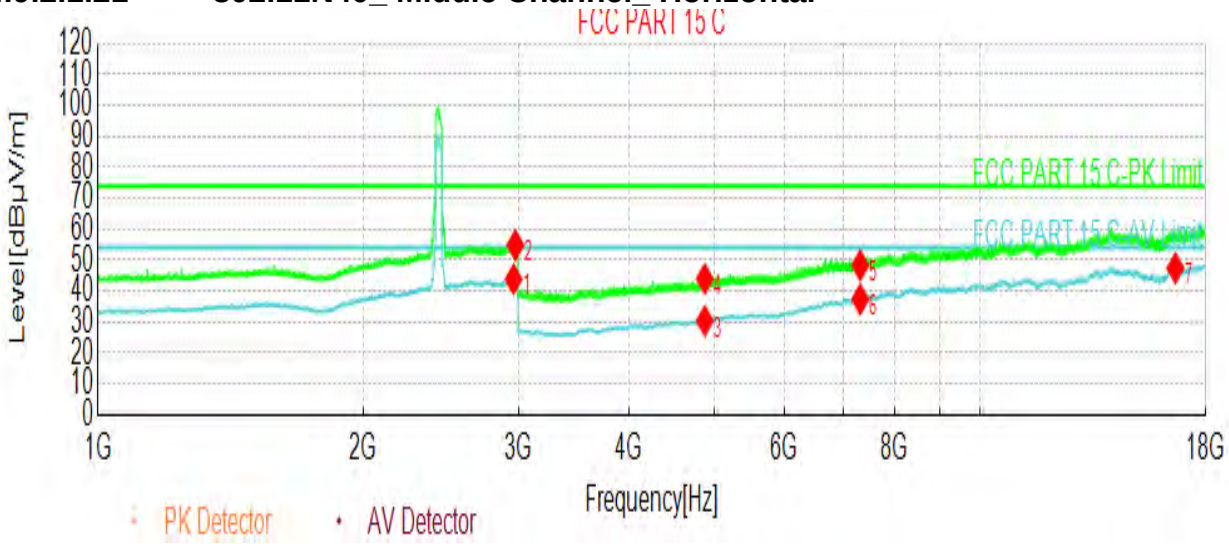
4.9.2.1.21 802.11N40_ Middle Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2959.48	43.89	9.64	54.00	10.11	165	183	Horizontal
2	2972.99	54.92	9.57	74.00	19.08	143	72	Horizontal
3	4874.00	30.43	-17.99	54.00	23.57	140	344	Horizontal
4	4874.00	43.96	-17.99	74.00	30.04	189	235	Horizontal
5	7311.00	48.39	-9.74	74.00	25.61	136	93	Horizontal
6	7311.00	37.43	-9.74	54.00	16.57	183	292	Horizontal
7	16639.2	47.47	0.35	54.00	6.53	177	143	Horizontal

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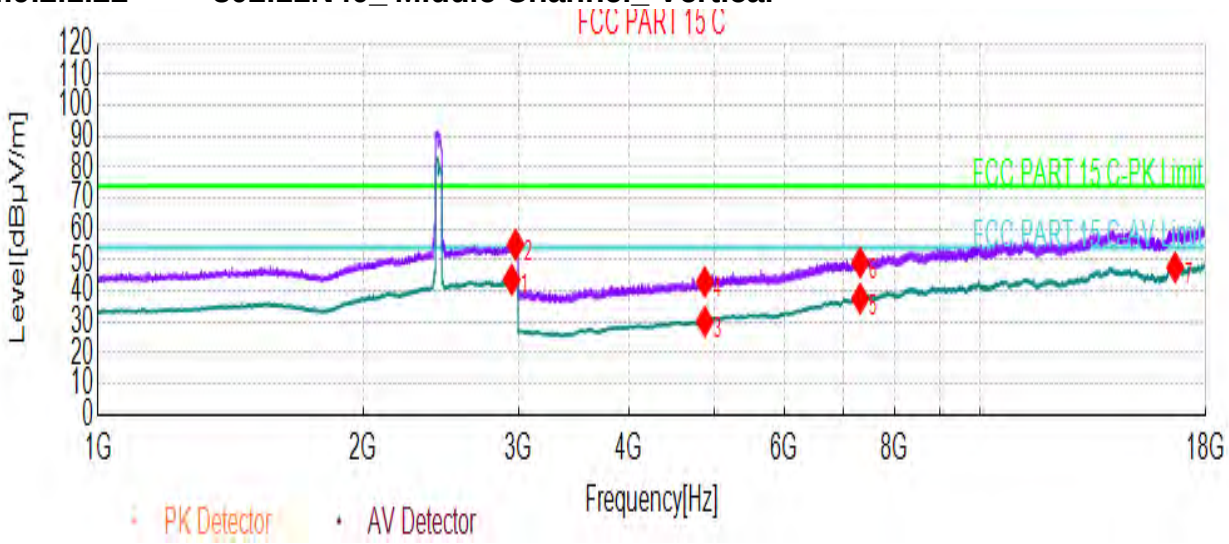
4.9.2.1.22 802.11N40_ Middle Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2944.98	43.77	9.63	54.00	10.23	293	15	Vertical
2	2974.99	55.09	9.57	74.00	18.91	152	138	Vertical
3	4874.00	30.22	-17.99	54.00	23.78	167	45	Vertical
4	4874.00	43.01	-17.99	74.00	30.99	152	100	Vertical
5	7311.00	37.61	-9.74	54.00	16.39	237	193	Vertical
6	7311.00	49.27	-9.74	74.00	24.73	255	292	Vertical
7	16629.8	47.73	0.31	54.00	6.27	158	342	Vertical

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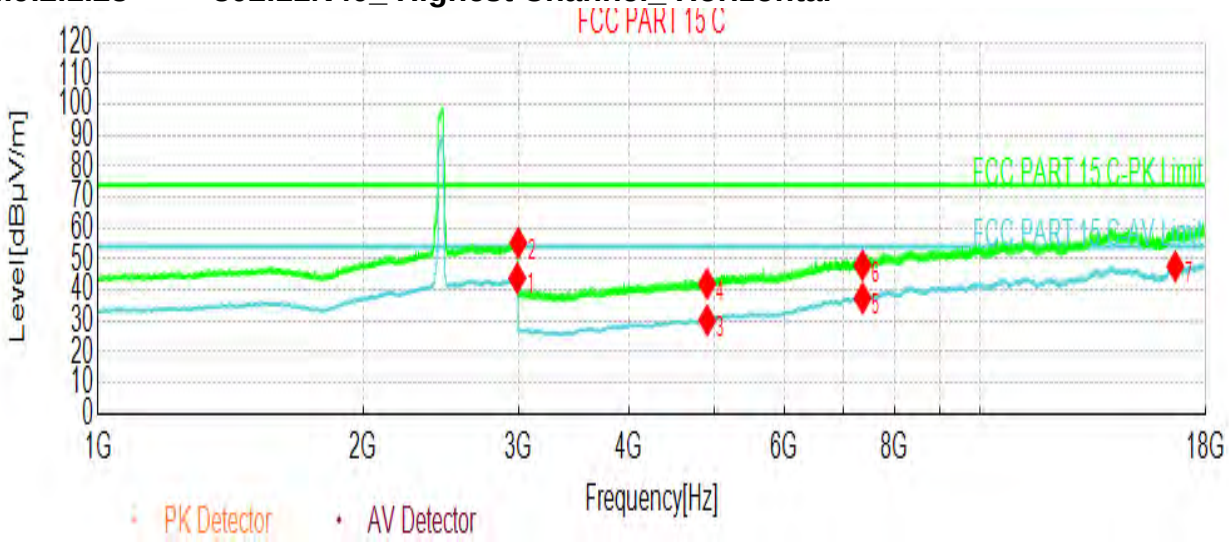
4.9.2.1.23 802.11N40_ Highest Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2987.99	43.92	9.51	54.00	10.08	166	58	Horizontal
2	2995.99	55.27	9.47	74.00	18.73	101	209	Horizontal
3	4904.00	30.28	-17.85	54.00	23.72	195	45	Horizontal
4	4904.00	42.03	-17.85	74.00	31.97	150	126	Horizontal
5	7356.00	37.43	-9.62	54.00	16.57	194	342	Horizontal
6	7356.00	48.06	-9.62	74.00	25.94	231	94	Horizontal
7	16637.5	47.77	0.34	54.00	6.23	189	242	Horizontal

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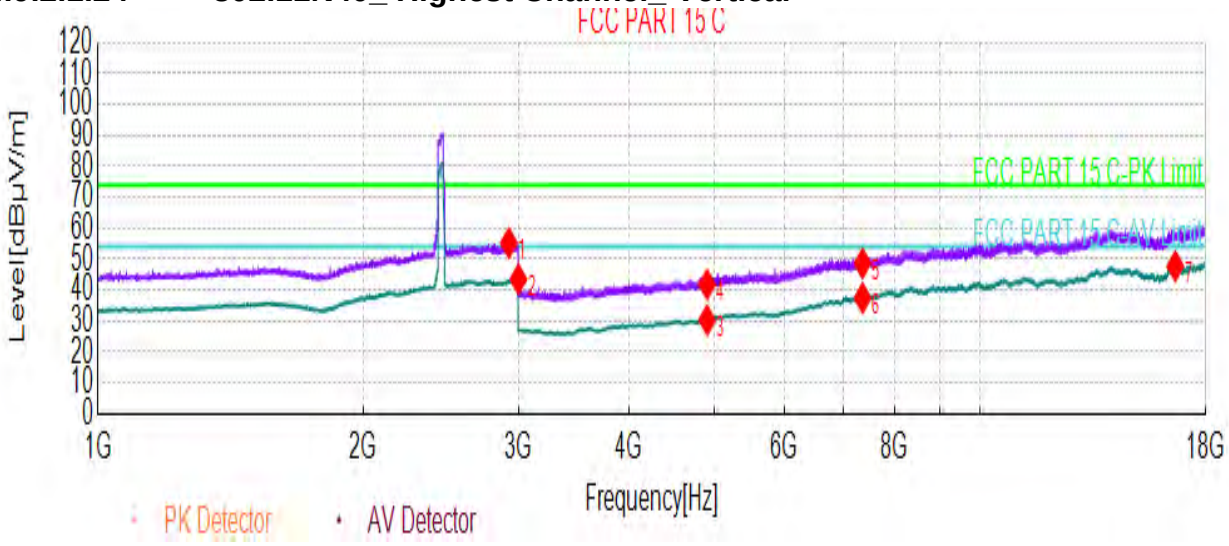
4.9.2.1.24 802.11N40_ Highest Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2923.98	55.30	9.40	74.00	18.70	155	150	Vertical
2	2996.99	43.56	9.46	54.00	10.44	196	233	Vertical
3	4904.00	30.34	-17.85	54.00	23.66	181	154	Vertical
4	4904.00	41.87	-17.85	74.00	32.13	200	154	Vertical
5	7356.00	48.70	-9.62	74.00	25.30	187	94	Vertical
6	7356.00	37.49	-9.62	54.00	16.51	158	44	Vertical
7	16635.9	47.78	0.34	54.00	6.22	162	44	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:			

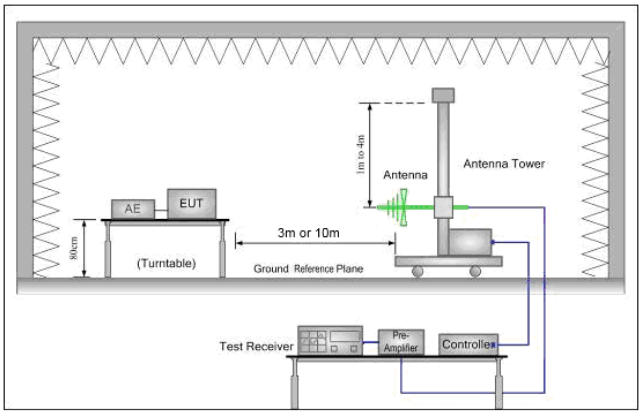

Figure 1. 30MHz to 1GHz

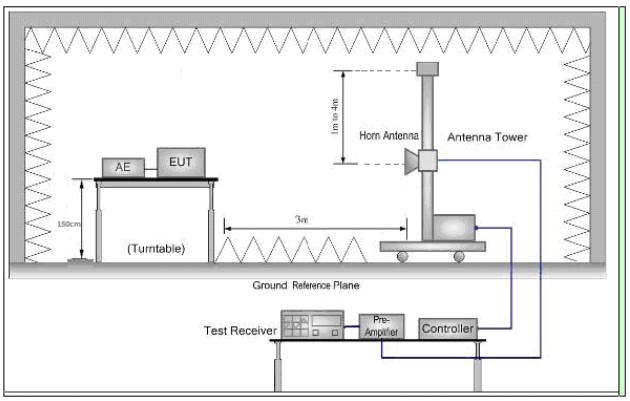

Figure 2. Above 1 GHz

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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

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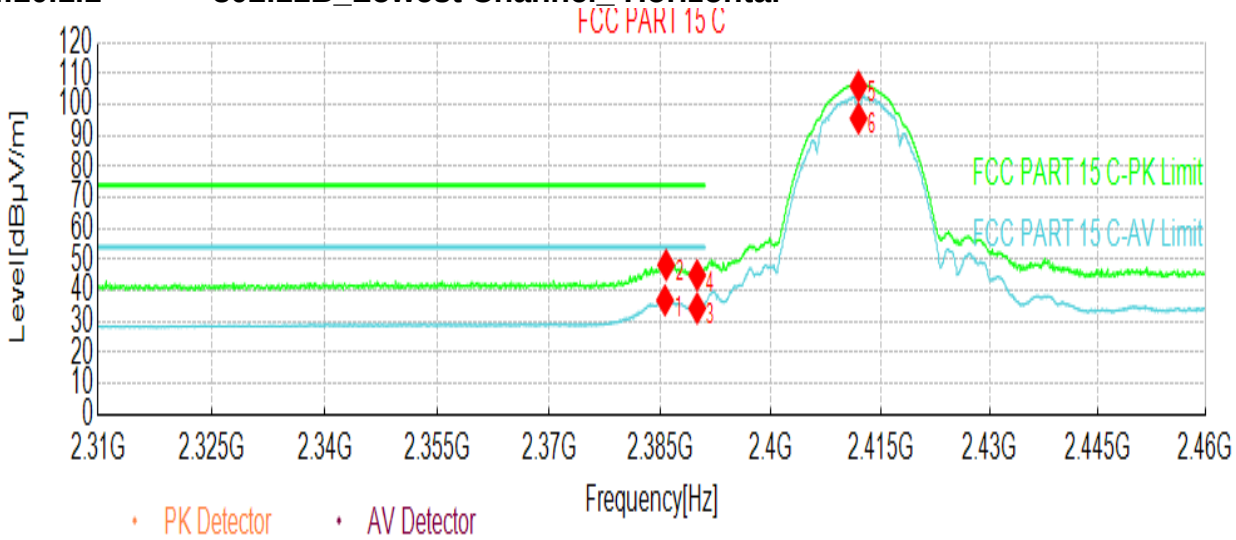
Test plot as follows:

4.10.1 ANT1

4.10.1.1 802.11B_Lowest Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2385.63	36.90	7.77	54.00	17.10	173	194	Horizontal
2	2385.78	48.31	7.77	74.00	25.69	227	200	Horizontal
3	2390.00	34.35	7.77	54.00	19.65	228	194	Horizontal
4	2390.00	45.02	7.77	74.00	28.98	209	205	Horizontal
5	2412.00	106.03	7.81	0.00	-106.03	203	200	Horizontal
6	2412.00	95.65	7.81	0.00	-95.65	230	194	Horizontal

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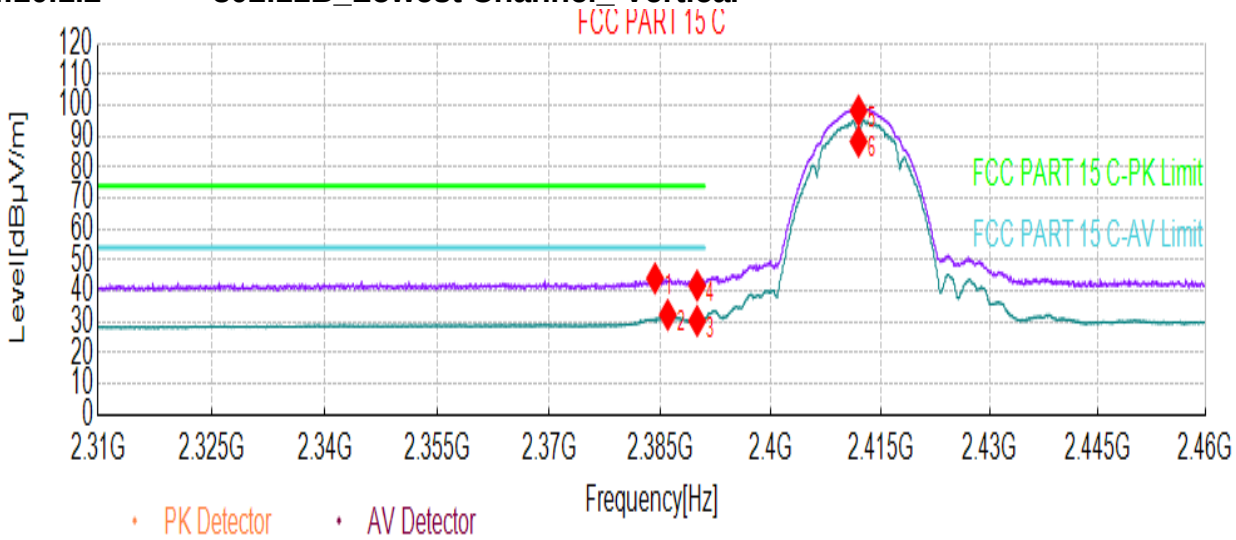
4.10.1.2 802.11B_Lowest Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2384.28	44.16	7.78	74.00	29.84	244	239	Vertical
2	2386.01	32.37	7.77	54.00	21.63	219	239	Vertical
3	2390.00	30.39	7.77	54.00	23.61	236	239	Vertical
4	2390.00	41.81	7.77	74.00	32.19	271	266	Vertical
5	2412.00	98.40	7.81	0.00	-98.40	220	124	Vertical
6	2412.00	88.43	7.81	0.00	-88.43	159	124	Vertical

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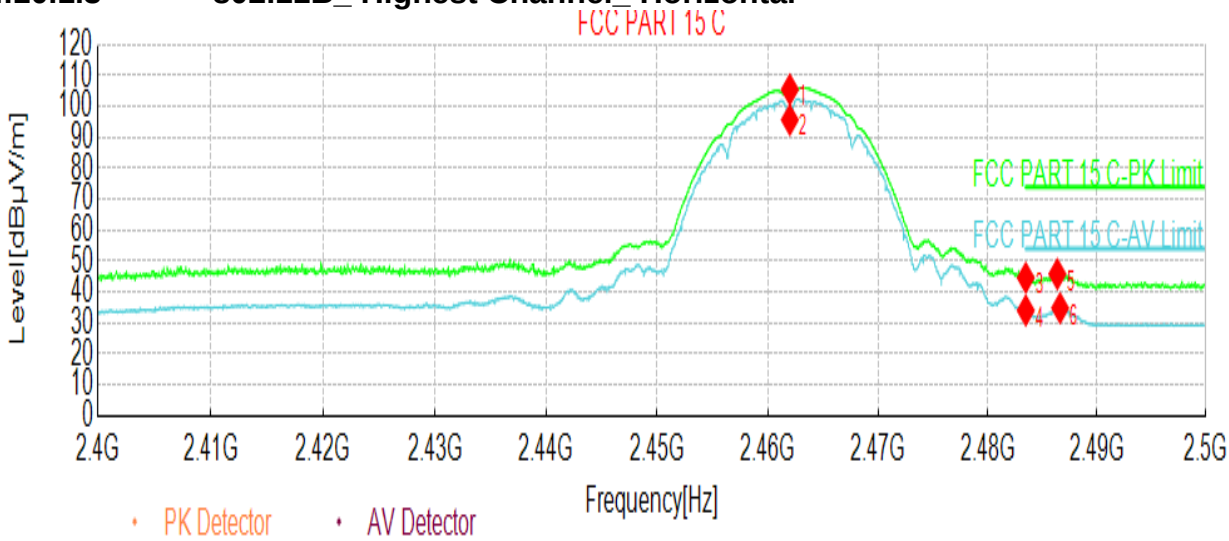
4.10.1.3 802.11B_ Highest Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	105.54	7.98	0.00	-105.54	214	214	Horizontal
2	2462.00	95.75	7.98	0.00	-95.75	122	209	Horizontal
3	2483.50	44.68	8.01	74.00	29.32	109	214	Horizontal
4	2483.50	34.11	8.01	54.00	19.89	167	209	Horizontal
5	2486.39	45.87	8.01	74.00	28.13	197	209	Horizontal
6	2486.64	34.88	8.01	54.00	19.12	103	209	Horizontal

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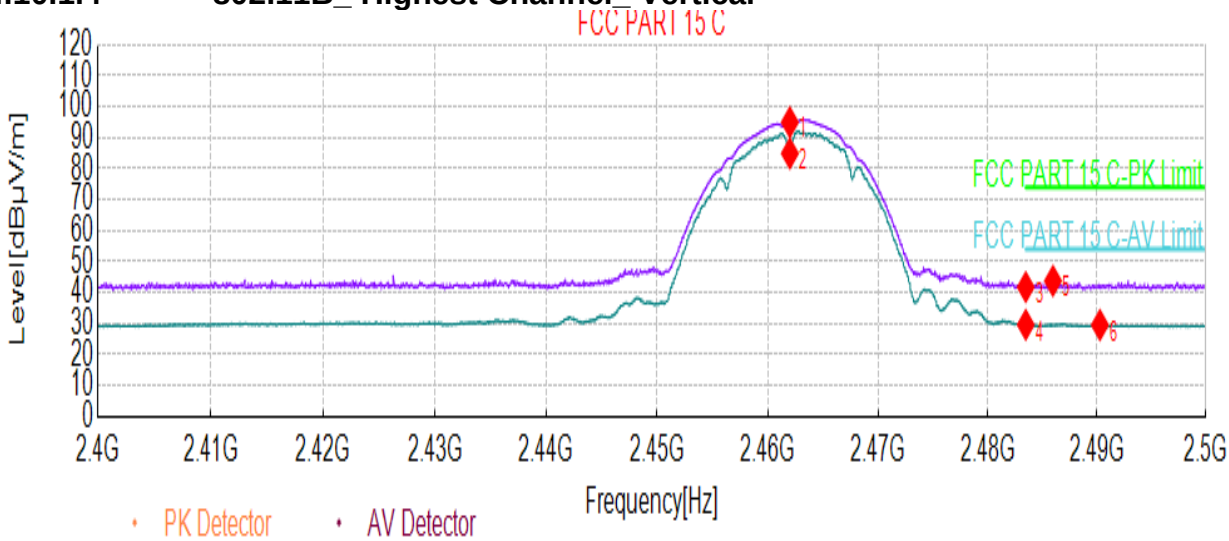
4.10.1.4 802.11B_ Highest Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	95.03	7.98	0.00	-95.03	283	346	Vertical
2	2462.00	84.97	7.98	0.00	-84.97	176	346	Vertical
3	2483.50	41.85	8.01	74.00	32.15	255	249	Vertical
4	2483.50	29.69	8.01	54.00	24.31	206	303	Vertical
5	2485.99	43.85	8.01	74.00	30.15	264	32	Vertical
6	2490.29	29.59	8.02	54.00	24.41	246	16	Vertical

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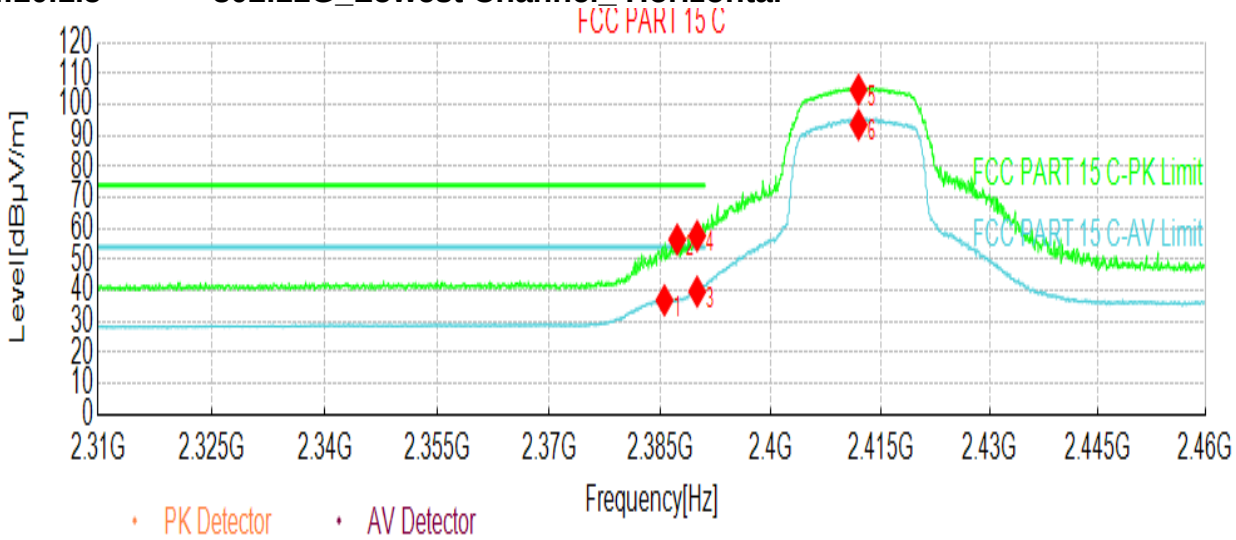
4.10.1.5 802.11G_Lowest Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2385.56	36.93	7.77	54.00	17.07	234	206	Horizontal
2	2387.28	56.52	7.77	74.00	17.48	240	228	Horizontal
3	2390.00	39.72	7.77	54.00	14.28	183	206	Horizontal
4	2390.00	57.71	7.77	74.00	16.29	136	212	Horizontal
5	2412.00	104.91	7.81	0.00	-104.91	131	206	Horizontal
6	2412.00	93.63	7.81	0.00	-93.63	202	201	Horizontal

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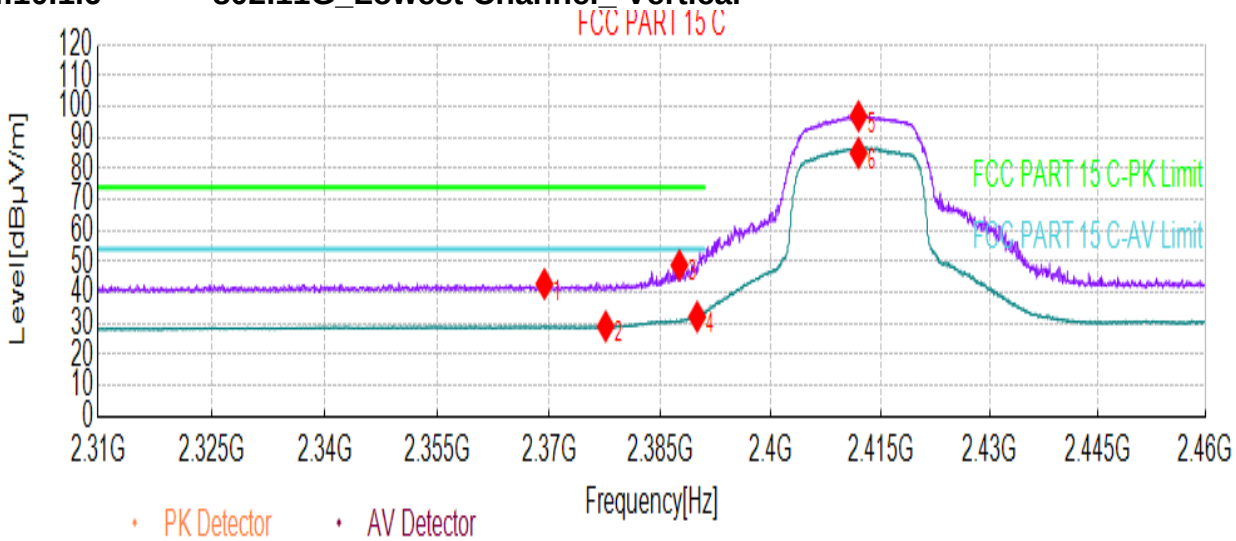
4.10.1.6 802.11G_Lowest Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2369.35	42.82	7.79	74.00	31.18	262	282	Vertical
2	2377.60	29.17	7.78	54.00	24.83	214	238	Vertical
3	2387.58	48.91	7.77	74.00	25.09	195	238	Vertical
4	2390.00	32.24	7.77	54.00	21.76	168	319	Vertical
5	2412.00	96.97	7.81	0.00	-96.97	162	238	Vertical
6	2412.00	85.11	7.81	0.00	-85.11	174	238	Vertical

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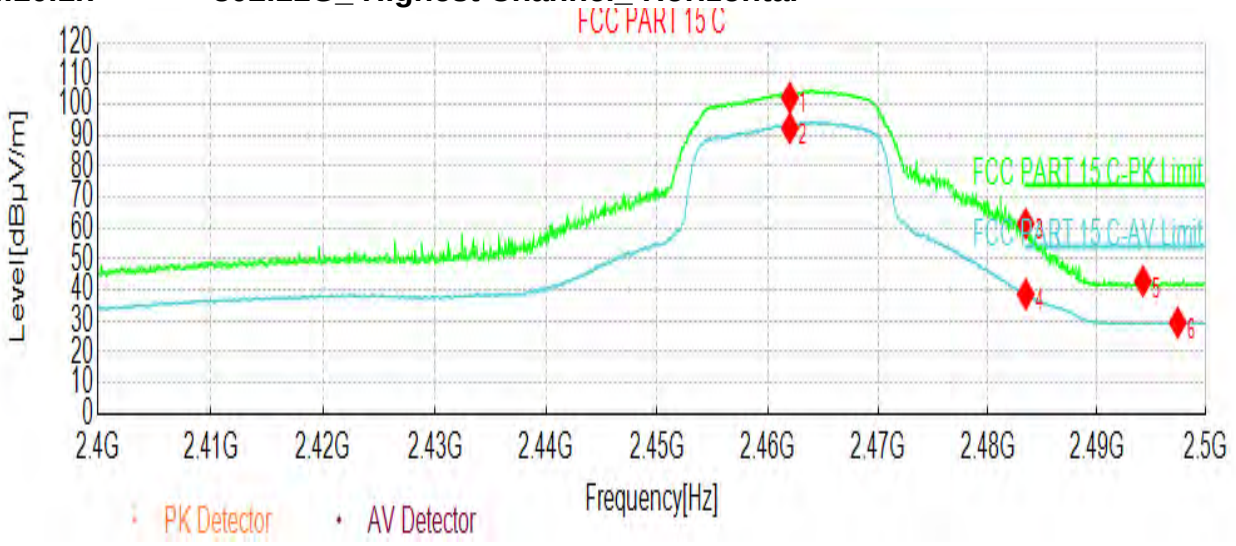
4.10.1.7 802.11G_ Highest Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	102.28	7.98	0.00	-102.28	199	204	Horizontal
2	2462.00	92.41	7.98	0.00	-92.41	127	204	Horizontal
3	2483.50	61.51	8.01	74.00	12.49	221	209	Horizontal
4	2483.50	38.71	8.01	54.00	15.29	171	204	Horizontal
5	2494.24	42.93	8.02	74.00	31.07	210	193	Horizontal
6	2497.44	29.53	8.03	54.00	24.47	180	221	Horizontal

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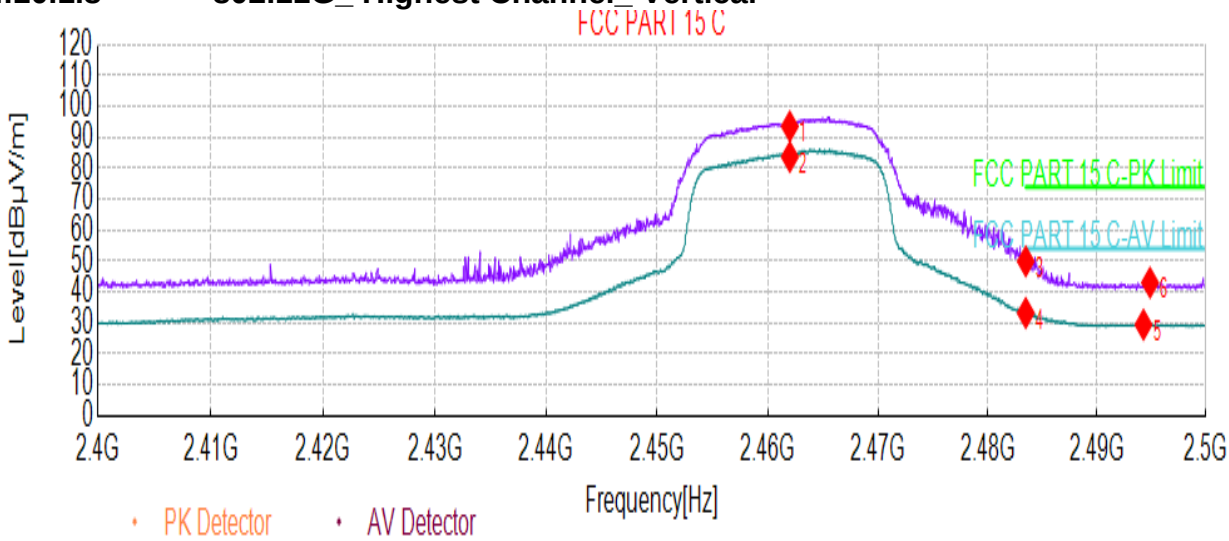
4.10.1.8 802.11G_ Highest Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	93.64	7.98	0.00	-93.64	176	320	Vertical
2	2462.00	83.78	7.98	0.00	-83.78	158	107	Vertical
3	2483.50	49.97	8.01	74.00	24.03	176	320	Vertical
4	2483.50	33.30	8.01	54.00	20.70	195	107	Vertical
5	2494.29	29.50	8.02	54.00	24.50	258	157	Vertical
6	2494.89	43.10	8.02	74.00	30.90	277	331	Vertical

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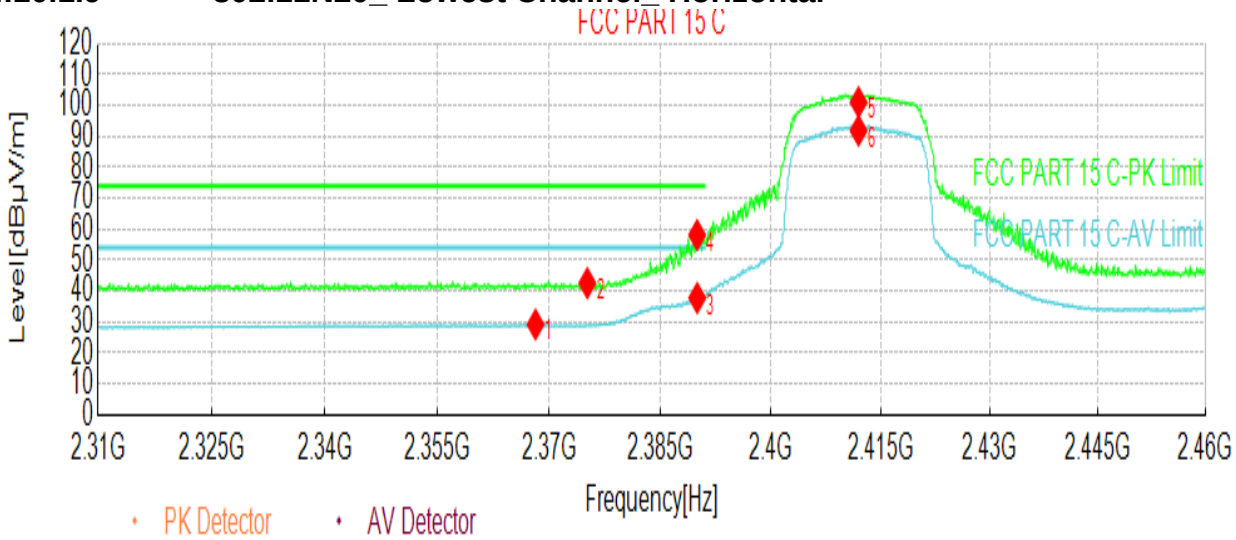
4.10.1.9 802.11N20_ Lowest Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2368.15	29.25	7.79	54.00	24.75	196	360	Horizontal
2	2375.13	42.61	7.78	74.00	31.39	159	78	Horizontal
3	2390.00	37.81	7.77	54.00	16.19	128	150	Horizontal
4	2390.00	58.18	7.77	74.00	15.82	110	150	Horizontal
5	2412.00	101.13	7.81	0.00	-101.13	230	156	Horizontal
6	2412.00	91.97	7.81	0.00	-91.97	153	150	Horizontal

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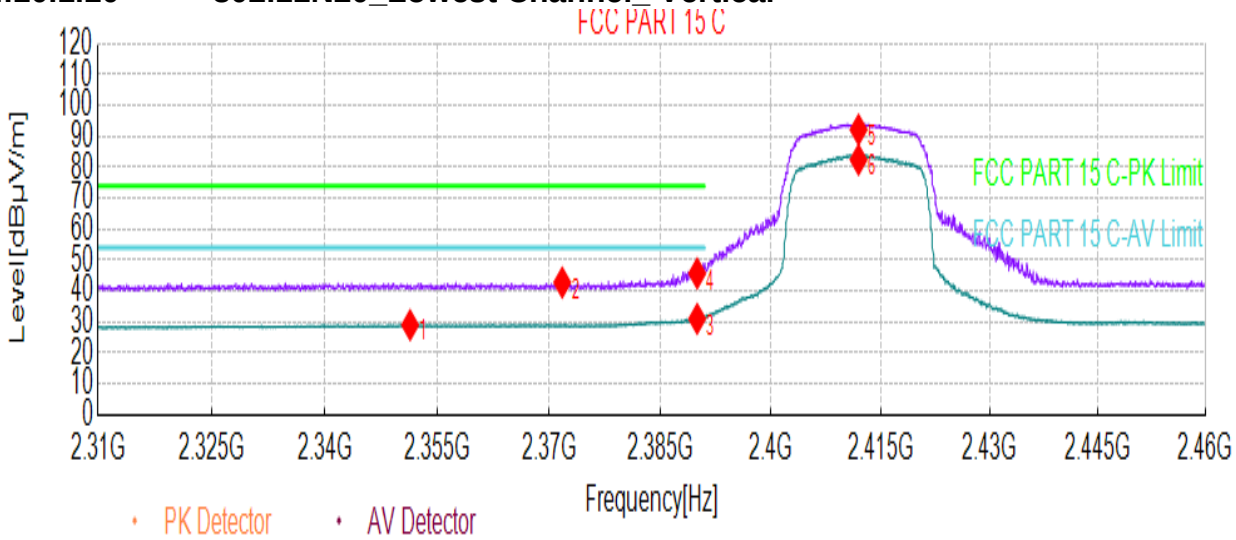
4.10.1.10 802.11N20_Lowest Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2351.34	29.05	7.81	54.00	24.95	231	270	Vertical
2	2371.75	42.82	7.79	74.00	31.18	228	57	Vertical
3	2390.00	31.09	7.77	54.00	22.91	298	101	Vertical
4	2390.00	45.80	7.77	74.00	28.20	289	101	Vertical
5	2412.00	92.25	7.81	0.00	-92.25	267	57	Vertical
6	2412.00	82.53	7.81	0.00	-82.53	293	112	Vertical

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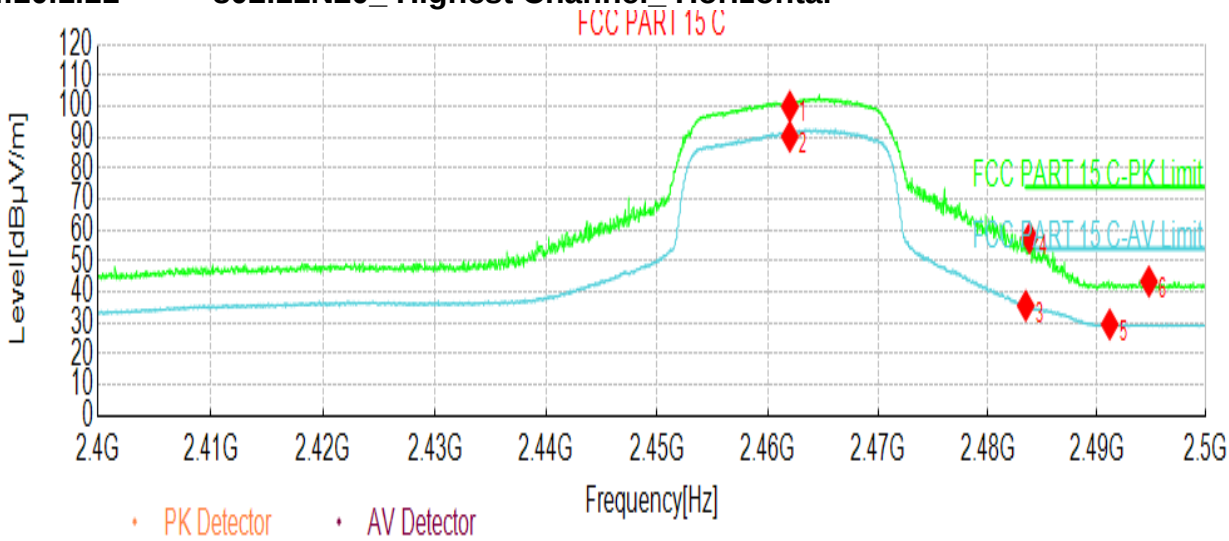
4.10.1.11 802.11N20_ Highest Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	100.06	7.98	0.00	-100.06	120	221	Horizontal
2	2462.00	90.35	7.98	0.00	-90.35	199	221	Horizontal
3	2483.50	35.62	8.01	54.00	18.38	161	221	Horizontal
4	2483.84	57.53	8.01	74.00	16.47	167	227	Horizontal
5	2491.19	29.60	8.02	54.00	24.40	200	210	Horizontal
6	2494.79	43.49	8.02	74.00	30.51	184	298	Horizontal

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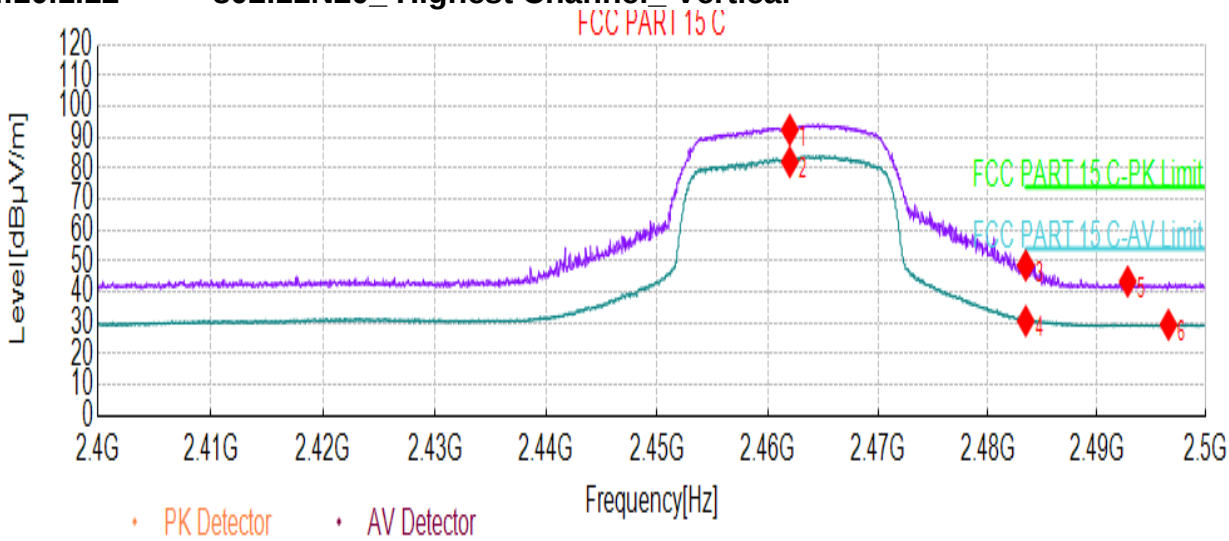
4.10.1.12 802.11N20_ Highest Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	92.51	7.98	0.00	-92.51	174	326	Vertical
2	2462.00	82.11	7.98	0.00	-82.11	233	331	Vertical
3	2483.50	48.68	8.01	74.00	25.32	191	341	Vertical
4	2483.50	30.68	8.01	54.00	23.32	198	303	Vertical
5	2492.84	43.46	8.02	74.00	30.54	175	276	Vertical
6	2496.59	29.48	8.03	54.00	24.52	212	298	Vertical

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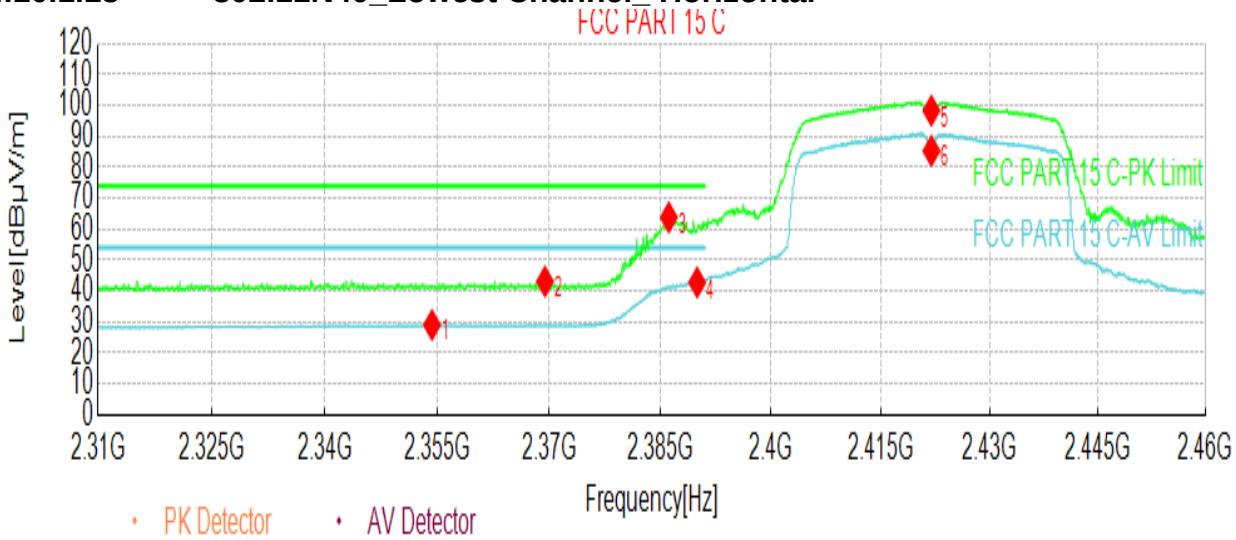
4.10.1.13 802.11N40_Lowest Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2354.27	29.08	7.81	54.00	24.92	229	199	Horizontal
2	2369.42	43.14	7.79	74.00	30.86	204	149	Horizontal
3	2386.16	63.89	7.77	74.00	10.11	157	210	Horizontal
4	2390.00	42.83	7.77	54.00	11.17	247	144	Horizontal
5	2422.00	98.41	7.85	0.00	-98.41	127	210	Horizontal
6	2422.00	85.40	7.85	0.00	-85.40	127	210	Horizontal

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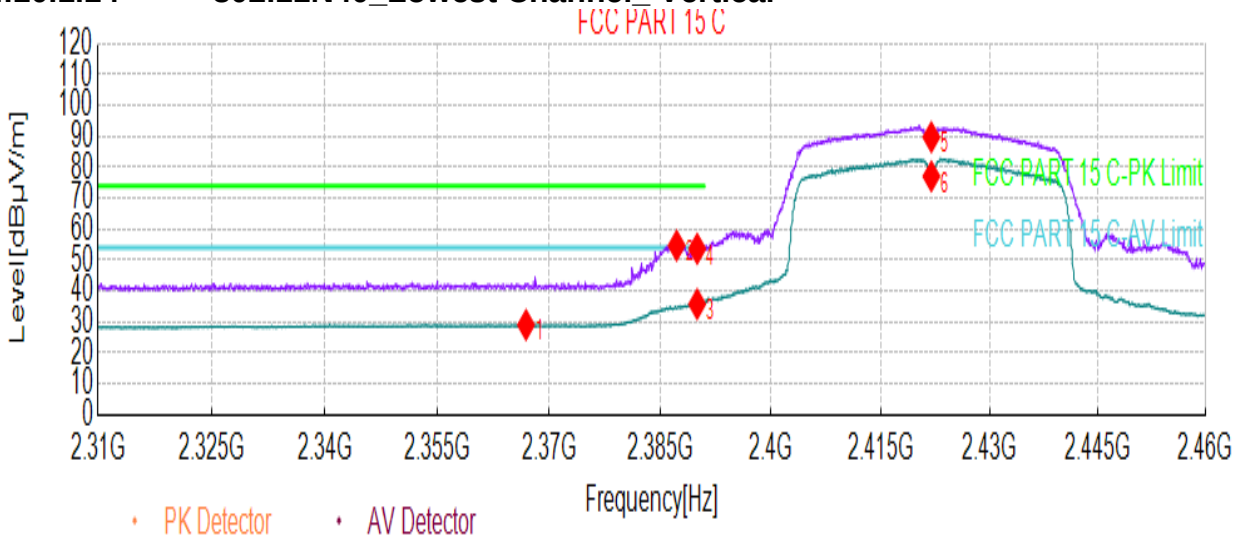
4.10.1.14 802.11N40_Lowest Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2366.87	29.11	7.79	54.00	24.89	270	276	Vertical
2	2387.21	54.76	7.77	74.00	19.24	161	51	Vertical
3	2390.00	35.84	7.77	54.00	18.16	162	325	Vertical
4	2390.00	53.74	7.77	74.00	20.26	186	304	Vertical
5	2422.00	89.84	7.85	0.00	-89.84	155	133	Vertical
6	2422.00	77.19	7.85	0.00	-77.19	227	133	Vertical

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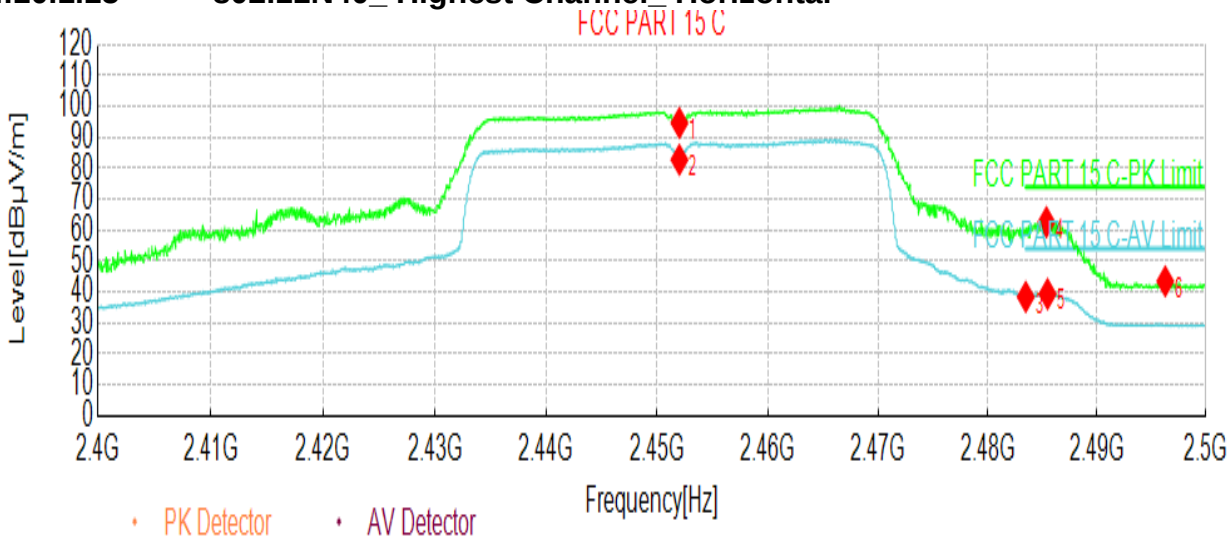
4.10.1.15 802.11N40_ Highest Channel_ Horizontal



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2452.00	94.74	7.97	0.00	-94.74	112	223	Horizontal
2	2452.00	82.85	7.97	0.00	-82.85	192	223	Horizontal
3	2483.50	38.49	8.01	54.00	15.51	248	218	Horizontal
4	2485.39	62.66	8.01	74.00	11.34	192	223	Horizontal
5	2485.49	39.44	8.01	54.00	14.56	104	218	Horizontal
6	2496.29	43.55	8.03	74.00	30.45	237	185	Horizontal

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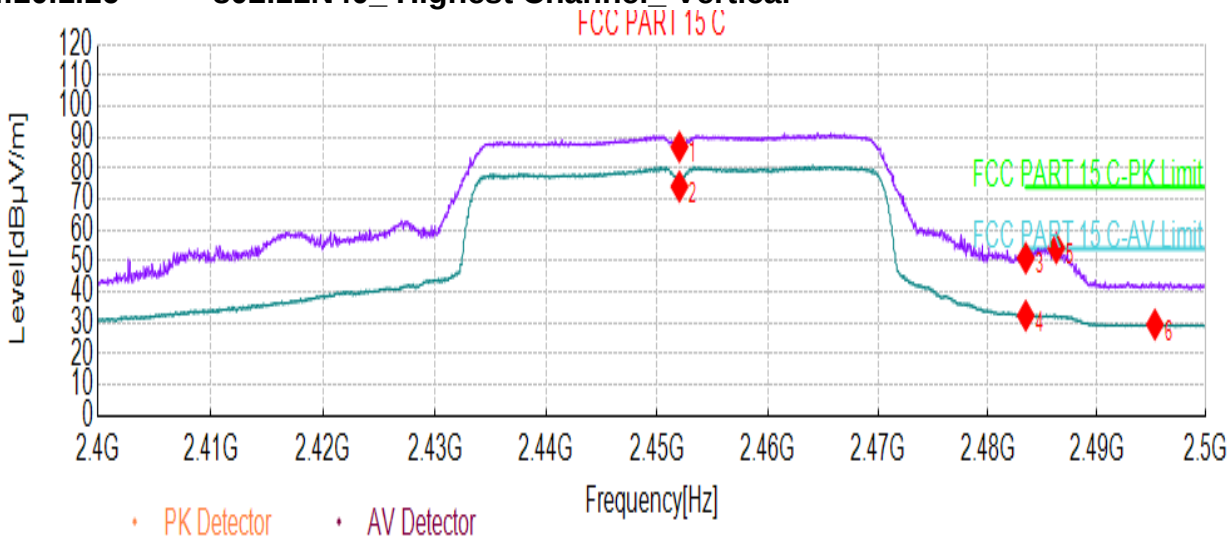
4.10.1.16 802.11N40_ Highest Channel_ Vertical



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2452.00	87.03	7.97	0.00	-87.03	209	331	Vertical
2	2452.00	74.17	7.97	0.00	-74.17	257	331	Vertical
3	2483.50	51.03	8.01	74.00	22.97	162	85	Vertical
4	2483.50	32.42	8.01	54.00	21.58	169	288	Vertical
5	2486.29	54.26	8.01	74.00	19.74	264	304	Vertical
6	2495.34	29.53	8.02	54.00	24.47	277	288	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.

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

Lab A:

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

Lab B:

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

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6 Equipment List

RF conducted test					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Duedate (yyyy-mm-dd)
DC Power Supply	Agilent Technologies Inc	66311B	W009-09	2019/7/15	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	2019/7/14	2020/7/14
Temperature Chamber	GIANT FORCE	ICT-150-40-CP-AR	W027-03	2019/10/27	2020/10/27
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2019/7/14	2020/7/14

CE Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Shielding Room	Brilliant-emc	N/A	XAW03-35-01	2019-09-11	2022-09-10
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2019-09-07	2020-09-06
Artificial network	ROHDE&SCHWARZ	ENV216	XAW01-04-01	2019-07-16	2020-07-15
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

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7 Photographs - EUT Constructional Details

Refer to Appendix A - Photographs of Set-Up for ZR/2020/50042.

The End

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