FCC TEST REPORT

Application No.:	ZR/2020/A0015
Applicant:	HMD global Oy
Address of Applicant	Bertel Jungin aukio 9, 02600 Espoo, Finland
Manufacturer:	HMD global Oy
Address of Manufacturer	Bertel Jungin aukio 9, 02600 Espoo, Finland
EUT Description:	Smart Phone
Model No.:	TA-1322
Trade Mark:	NOKIA
FCC ID:	2AJOTTA-1322
Standards:	47 CFR FCC Part 2, Subpart J 47 CFR Part 15, Subpart C
Date of Receipt:	2020/10/19
Date of Test:	2020/10/23 to 2020/12/10
Date of Issue:	2020/12/11
Test Result :	**PASS ***

* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Sugnature:

Derek Yang
Wireless Laboratory Manager

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1 Version

Revision Record				
Version	***Chapter***	***Date***	***Modifier***	***Remark***
01		2020-12-11		Original

Authorized for issue by:				
Tested By		Mike Hu **(Mike Hu) /Project Engineer**		
Checked By		David Chen **(David Chen) /Reviewer**		

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2 Test Summary

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

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3 General Information

3.1 Details of Client

Applicant:	HMD global Oy
Address of Applicant	Bertel Jungin aukio 9, 02600 Espoo, Finland
Manufacturer:	HMD global Oy
Address of Manufacturer	Bertel Jungin aukio 9, 02600 Espoo, Finland

3.2 Test Location

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

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3.3 Test Facility

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

• CNAS (No. CNAS L2929)

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

• 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.

• Industry Canada (IC)

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.

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3.4 General Description of EUT

EUT Description:	Smart Phone
Model No.:	TA-1322
Trade Mark:	NOKIA
Hardware Version:	V1.0
Software Version:	00WW_0_070
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
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:

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		

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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)
The Lowest channel	2412MHz
The Middle channel	2437MHz
The Highest channel	2462MHz

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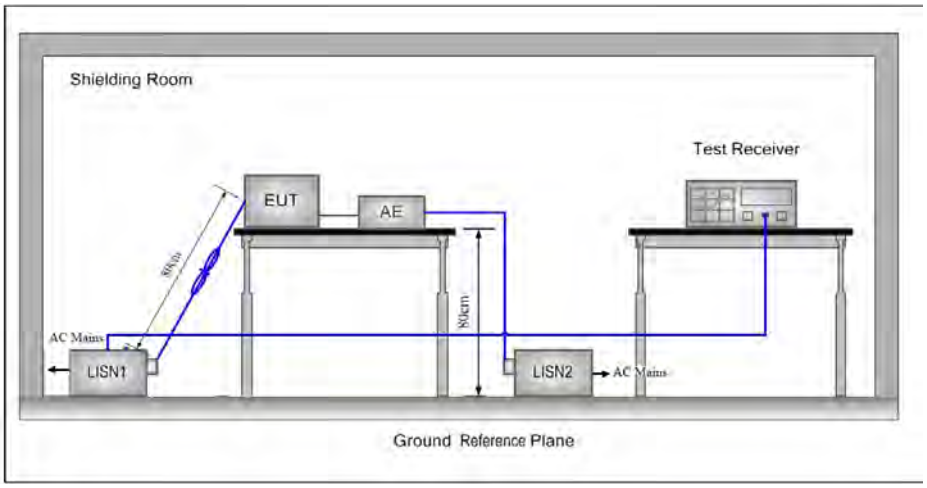
Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates at lowest, middle and highest channel. Charge + Transmitting mode.
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate of 802.11B at lowest channel is the worst case. Charge + Transmitting mode. Only the worst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

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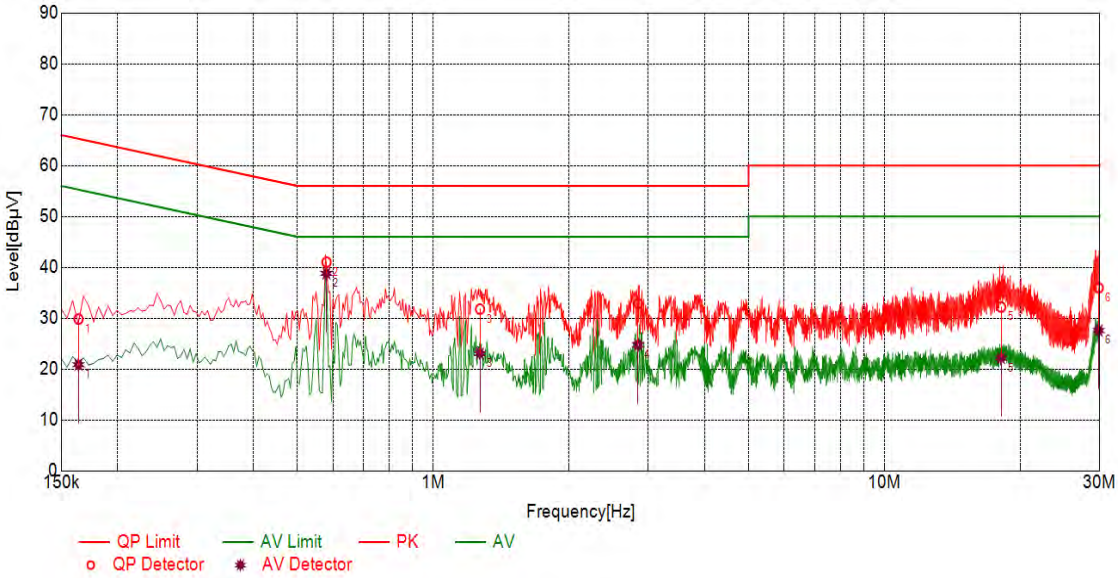
Measurement Data

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.

Firstly Supply:

Live Line:



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	0.1638	10.10	29.83	65.27	35.44	20.86	55.27	34.41	L
2	0.5805	10.10	41.02	56.00	14.98	38.81	46.00	7.19	L
3	1.2704	10.10	31.78	56.00	24.22	23.05	46.00	22.95	L
4	2.8461	10.10	32.89	56.00	23.11	24.78	46.00	21.22	L
5	18.1401	10.11	32.19	60.00	27.81	22.17	50.00	27.83	L
6	29.8459	10.11	35.97	60.00	24.03	27.58	50.00	22.42	L

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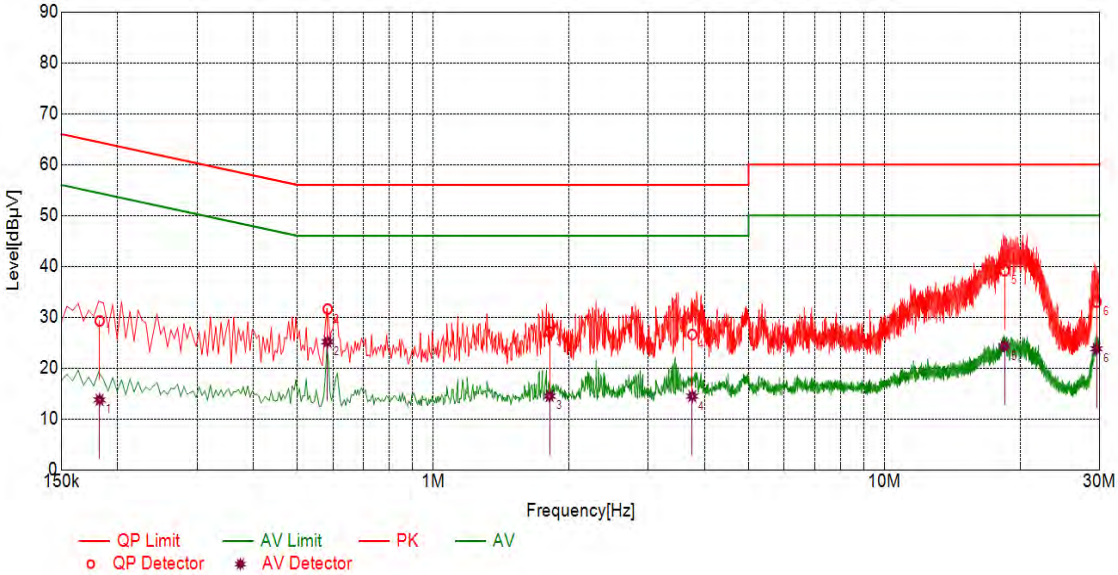
Neutral Line:



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	0.1824	10.10	29.27	64.37	35.10	13.74	54.37	40.63	N
2	0.5838	10.10	31.60	56.00	24.40	25.17	46.00	20.83	N
3	1.8128	10.10	27.09	56.00	28.91	14.50	46.00	31.50	N
4	3.7529	10.10	26.60	56.00	29.40	14.48	46.00	31.52	N
5	18.4710	10.11	39.14	60.00	20.86	24.29	50.00	25.71	N
6	29.5255	10.11	33.00	60.00	27.00	23.79	50.00	26.21	N

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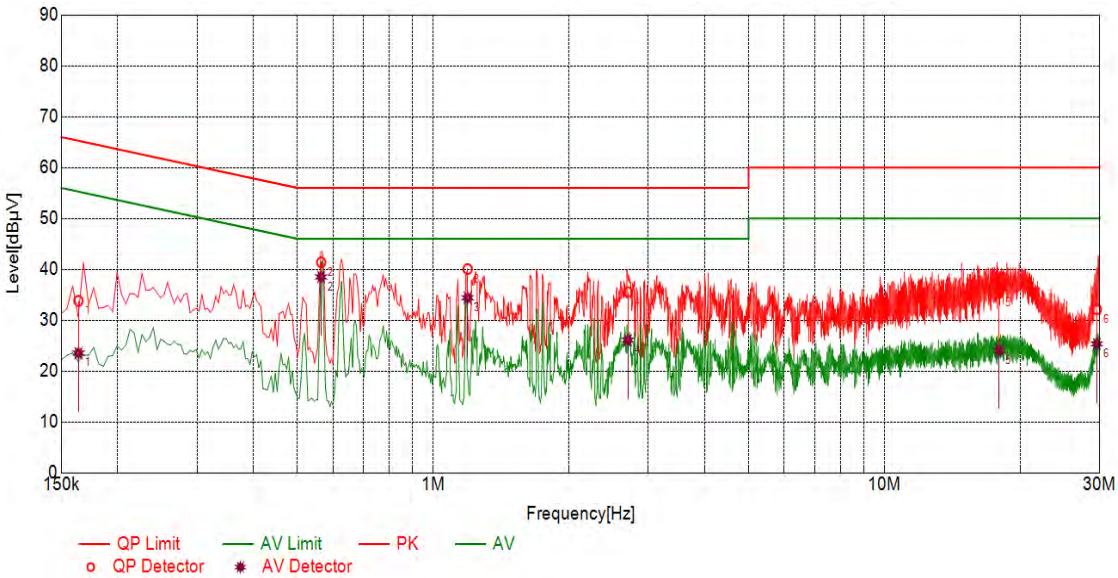
Secondly Supply:

Live Line:



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	0.1638	10.10	33.82	65.27	31.45	23.53	55.27	31.74	L
2	0.5650	10.10	41.38	56.00	14.62	38.50	46.00	7.50	L
3	1.1924	10.10	40.05	56.00	15.95	34.41	46.00	11.59	L
4	2.7019	10.10	35.54	56.00	20.46	26.08	46.00	19.92	L
5	17.9746	10.11	35.35	60.00	24.65	24.08	50.00	25.92	L
6	29.5575	10.11	32.10	60.00	27.90	25.34	50.00	24.66	L

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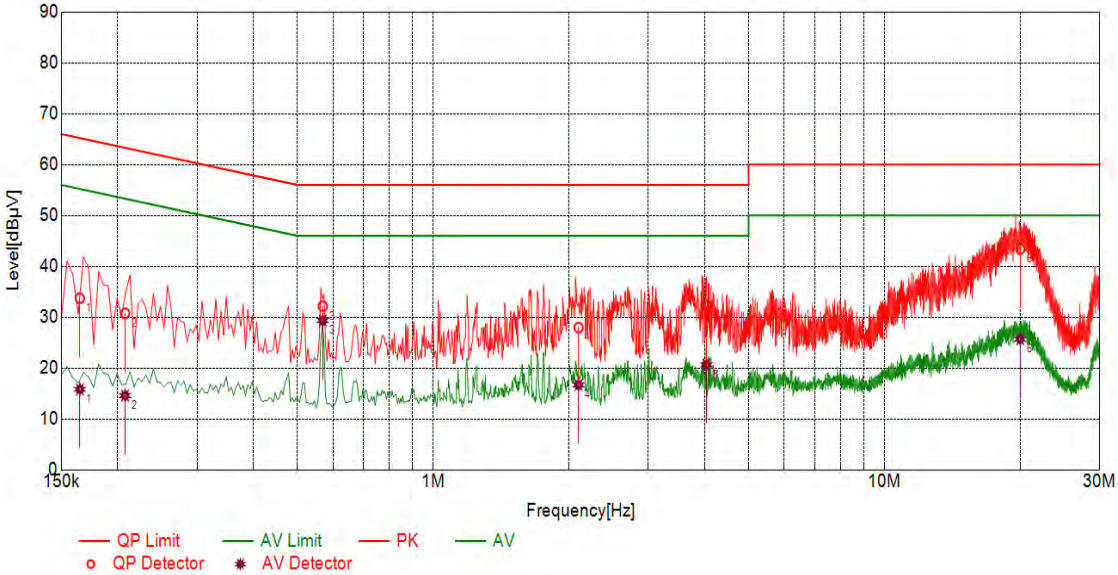
Neutral Line:



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	0.1649	10.10	33.71	65.21	31.50	15.82	55.21	39.39	N
2	0.2077	10.10	30.76	63.30	32.54	14.59	53.30	38.71	N
3	0.5696	10.10	32.16	56.00	23.84	29.35	46.00	16.65	N
4	2.1006	10.10	27.96	56.00	28.04	16.68	46.00	29.32	N
5	4.0374	10.10	32.32	56.00	23.68	20.63	46.00	25.37	N
6	19.9997	10.11	43.40	60.00	16.60	25.66	50.00	24.34	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	97.67
11G	Ant 1: CH1,CH6,CH11	87.04
11N20	Ant 1: CH1,CH6,CH11	86.70

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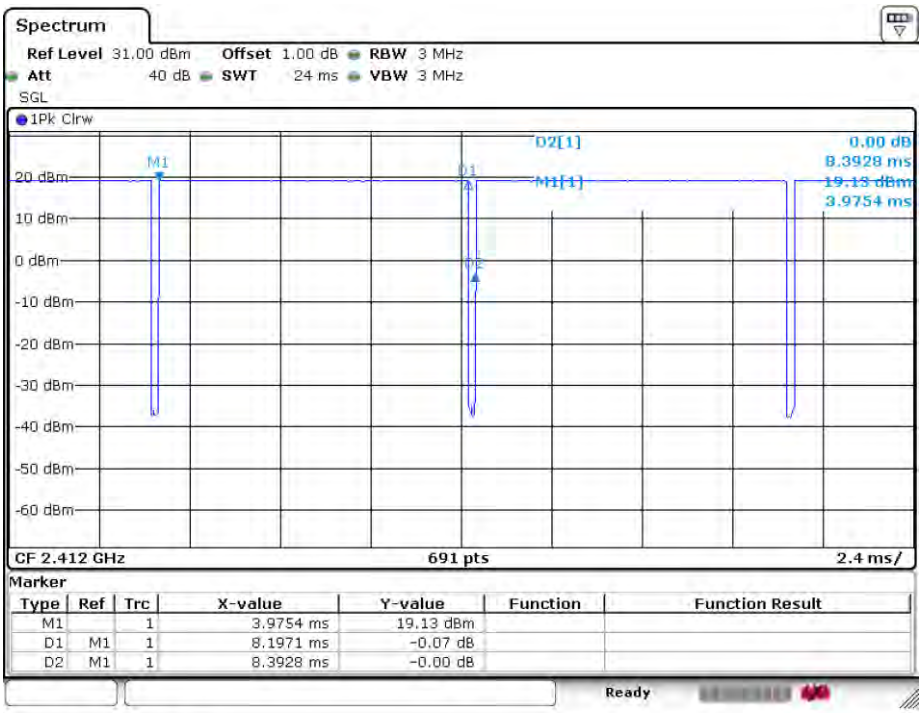
4.3.2 Test Plots

4.3.2.1 ANT1

4.3.2.1.1 11B



Date: 8.NOV.2020 14:58:49

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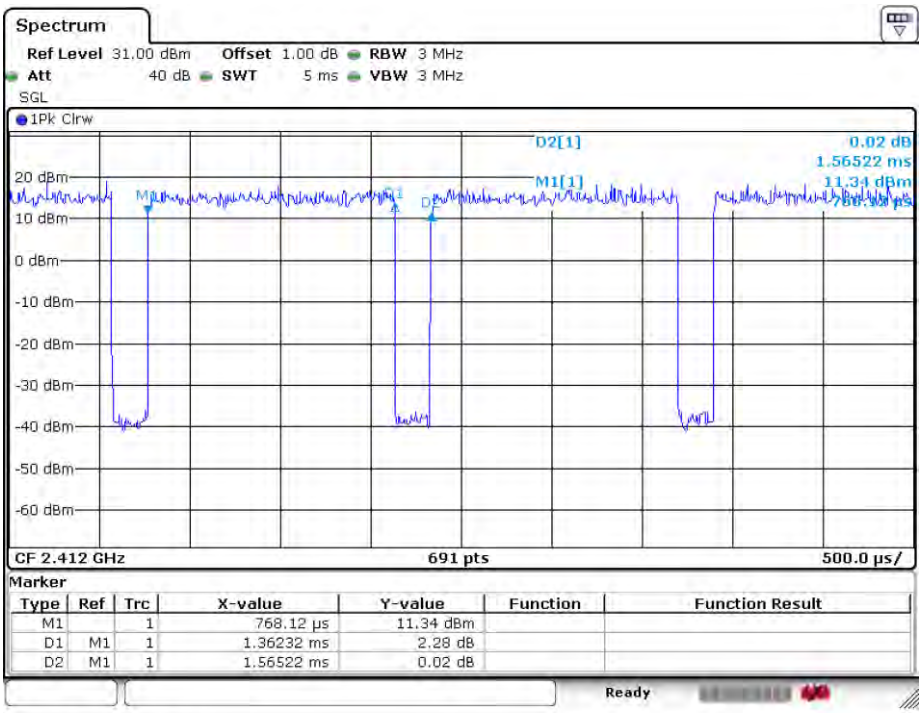
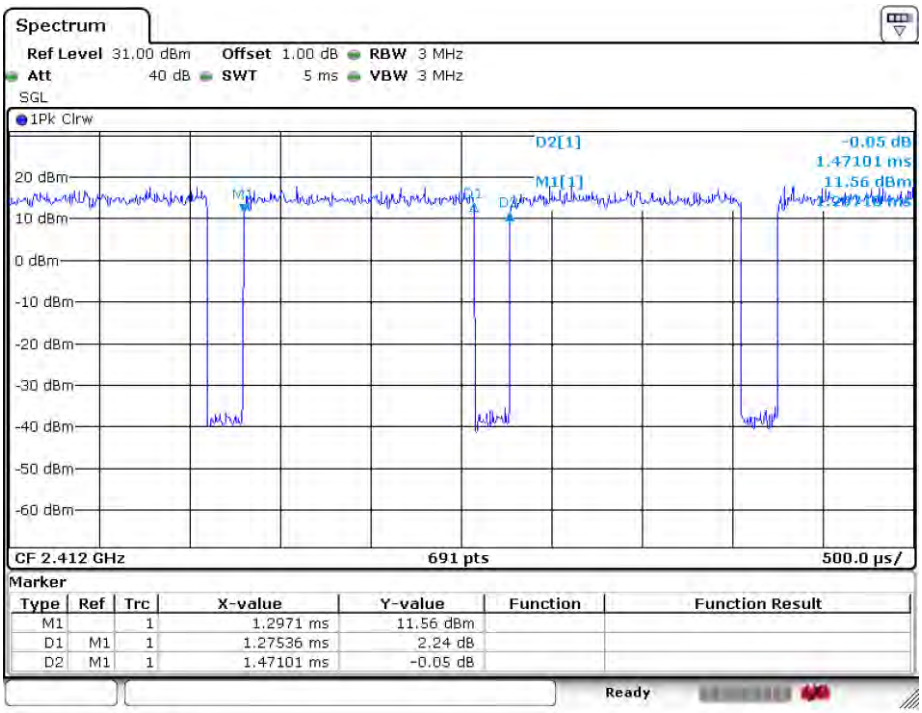
4.3.2.1.2 11G



Date: 8.NOV.2020 14:57:15

4.3.2.1.3 11N20



Date: 8.NOV.2020 14:57:59

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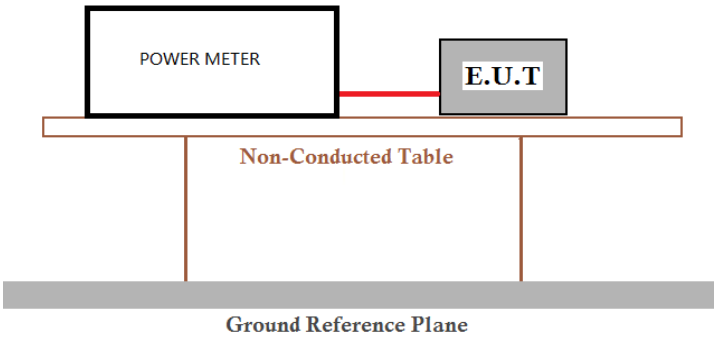
4.4 Conducted Output Power

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

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4.4.1 Test Results

Measurement Data of Peak Power:

Mode	Test Channel	Peak Output Power (dBm)	Limit (dBm)	Result
802.11B	Lowest	19.69	30.00	Pass
	Middle	19.47	30.00	Pass
	Highest	19.21	30.00	Pass
802.11G	Lowest	16.61	30.00	Pass
	Middle	16.37	30.00	Pass
	Highest	16.37	30.00	Pass
802.11N20	Lowest	15.64	30.00	Pass
	Middle	15.25	30.00	Pass
	Highest	15.55	30.00	Pass

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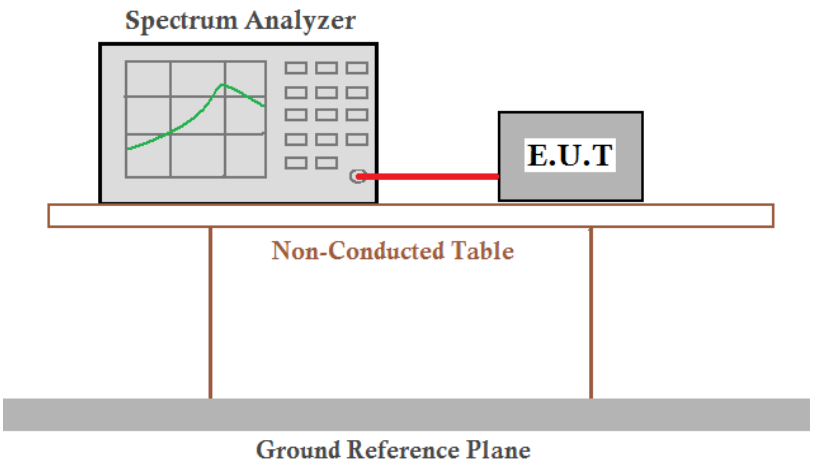
4.5 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth

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);
Limit:	≥ 500 kHz
Test Results:	Pass

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4.5.1 Test Results

Mode	Test Channel	Occupied Bandwidth (MHz)	6dB Emission Bandwidth (MHz)	Limit (kHz)	Result
802.11B	Lowest	13.24	8.55	≥500	Pass
	Middle	13.15	9.03	≥500	Pass
	Highest	13.24	9.07	≥500	Pass
802.11G	Lowest	17.15	16.41	≥500	Pass
	Middle	17.28	16.46	≥500	Pass
	Highest	17.50	16.46	≥500	Pass
802.11N20	Lowest	18.10	17.54	≥500	Pass
	Middle	18.19	17.58	≥500	Pass
	Highest	18.32	17.58	≥500	Pass

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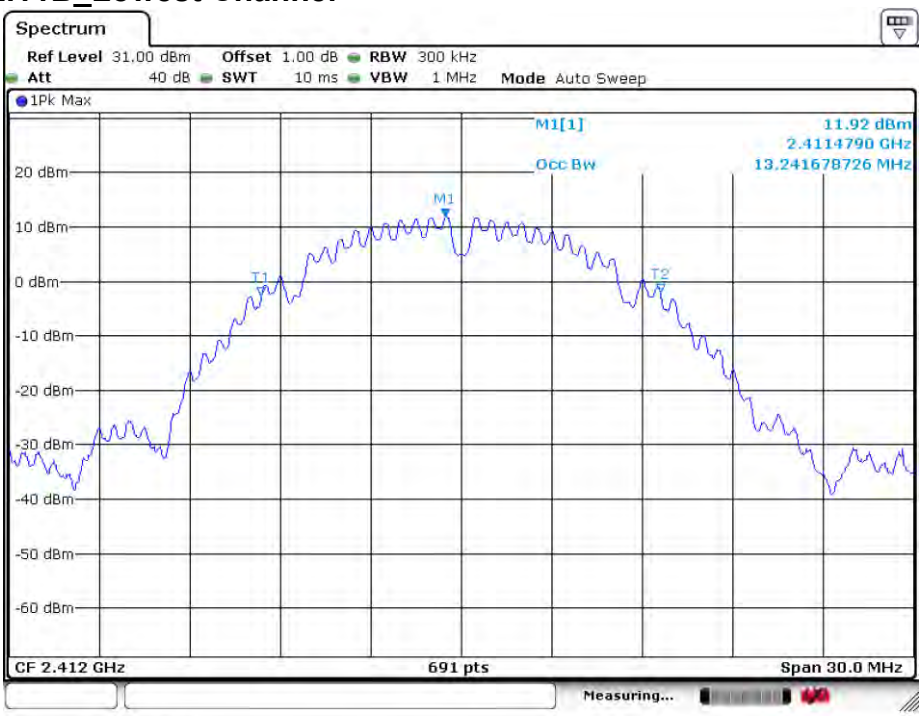
4.5.2 Test Plots

4.5.2.1 ANT1

4.5.2.1.1 802.11B_Lowest Channel



Date: 8.NOV.2020 14:43:42

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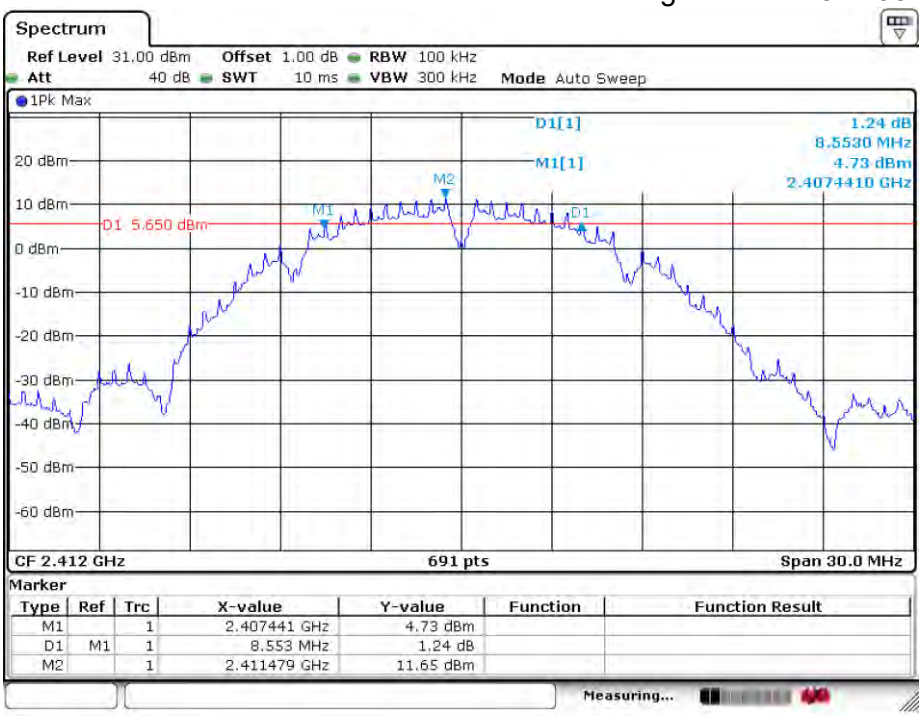

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.407441 GHz	4.73 dBm		
D1	M1	1	8.553 MHz	1.24 dB		
M2		1	2.411479 GHz	11.65 dBm		

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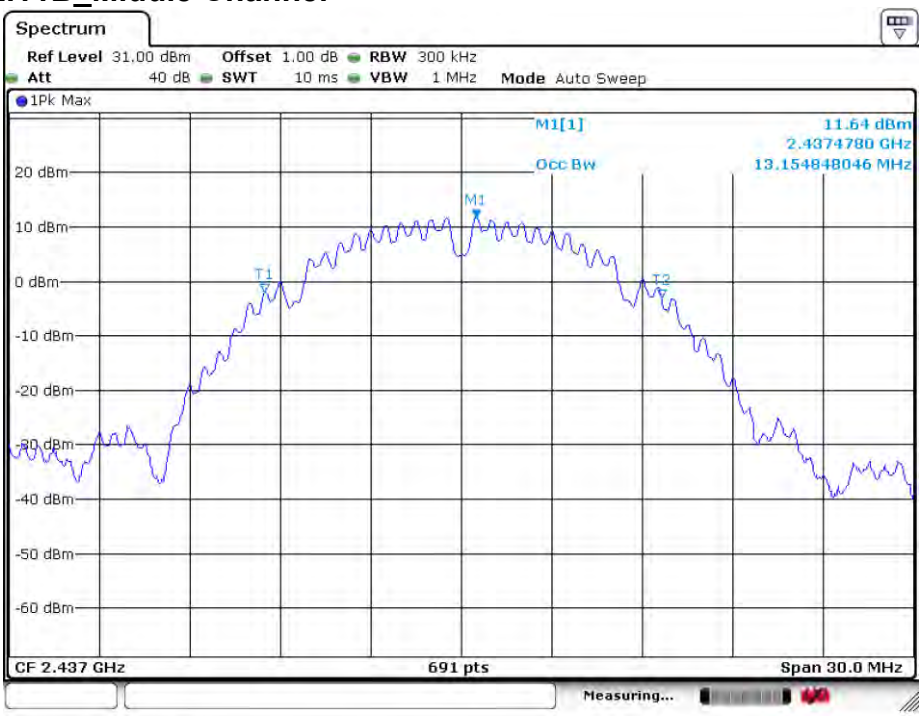
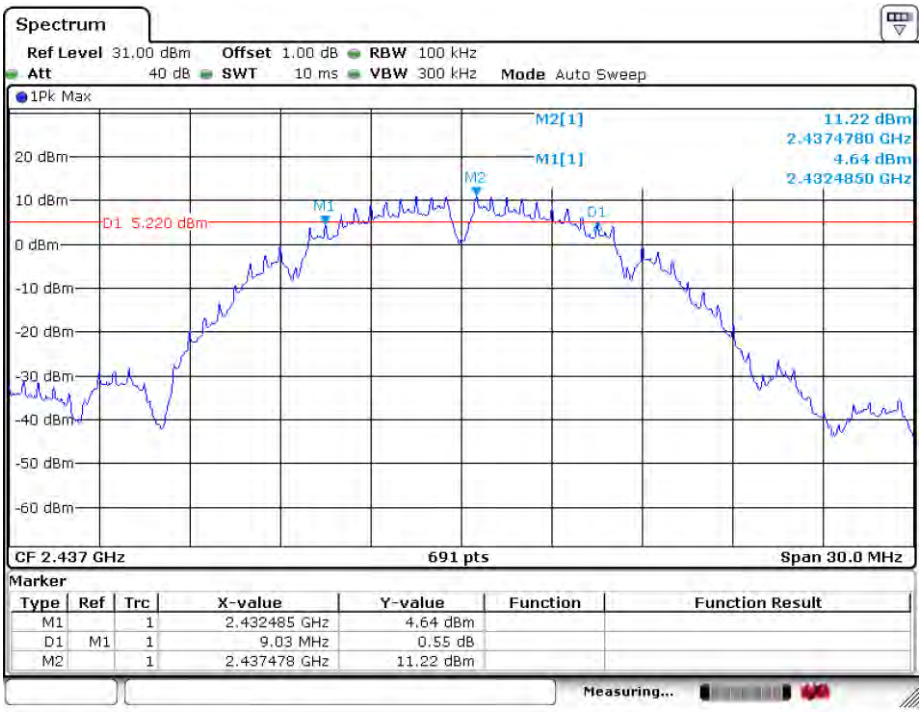
4.5.2.1.2 802.11B_Middle Channel



Date: 8.NOV.2020 14:44:03



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.432485 GHz	4.64 dBm		
D1	M1	1	9.03 MHz	0.55 dB		
M2		1	2.437478 GHz	11.22 dBm		

Date: 8.NOV.2020 14:31:12

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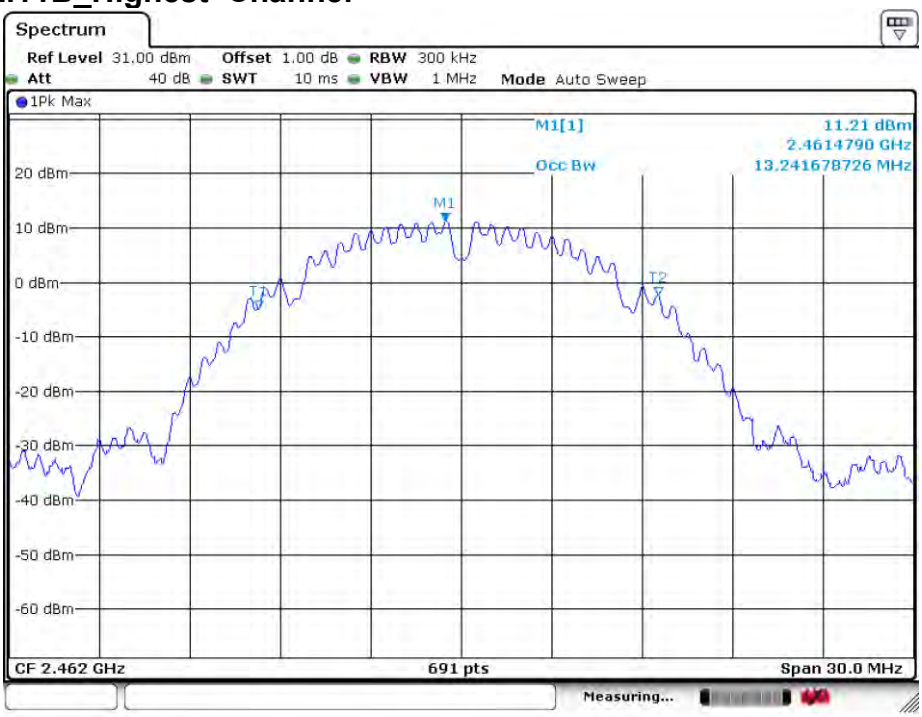
4.5.2.1.3 802.11B_Highest Channel



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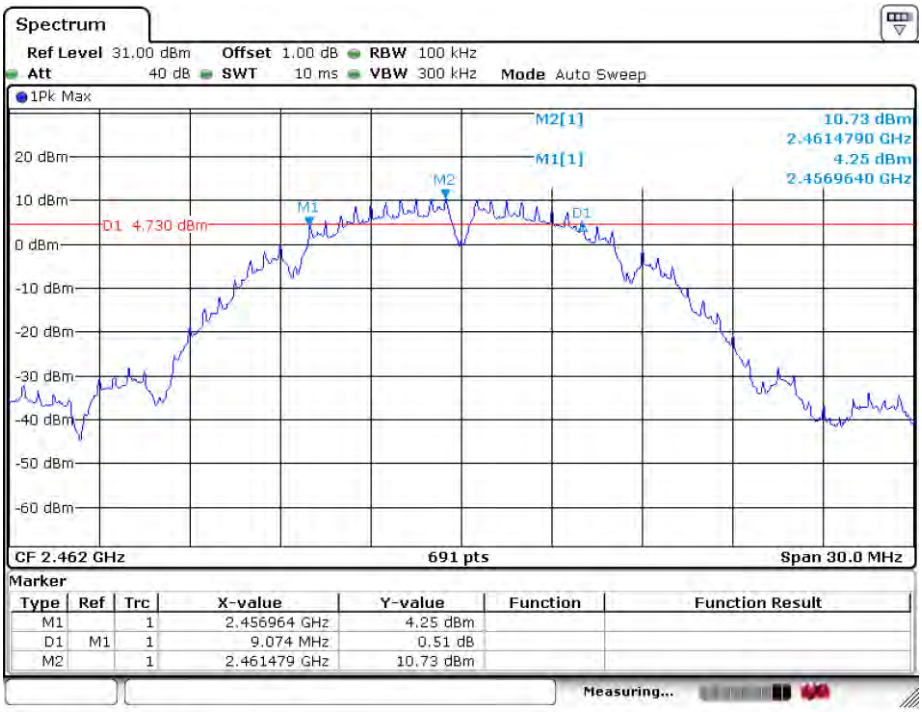

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.456964 GHz	4.25 dBm		
D1	M1	1	9.074 MHz	0.51 dB		
M2		1	2.461479 GHz	10.73 dBm		

Date: 8.NOV.2020 14:31:50

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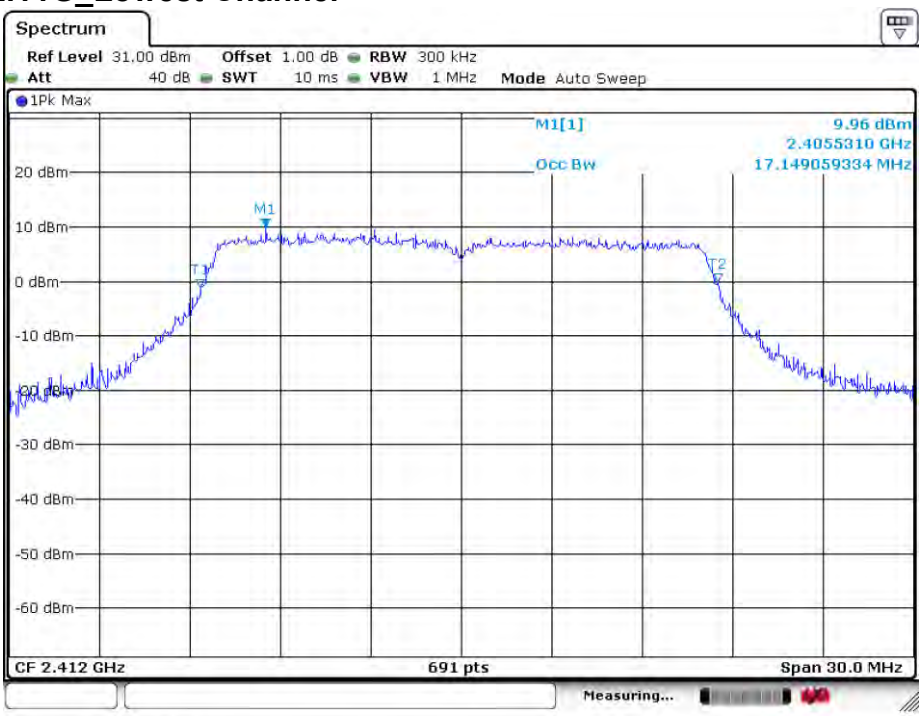
4.5.2.1.4 802.11G_Lowest Channel



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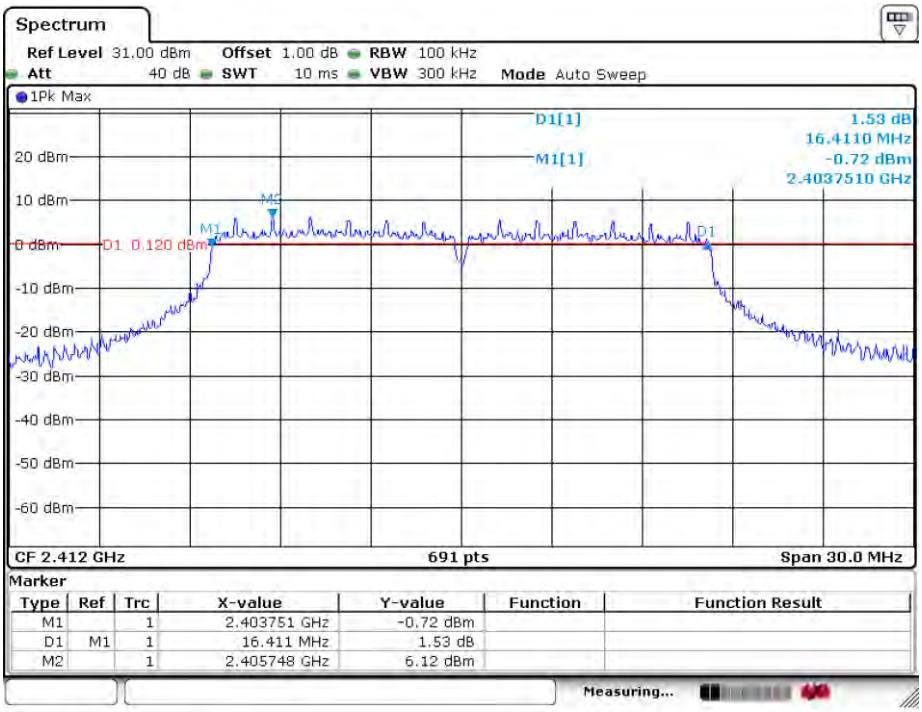

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.403751 GHz	-0.72 dBm		
D1	M1	1	16.411 MHz	1.53 dB		
M2		1	2.405748 GHz	6.12 dBm		

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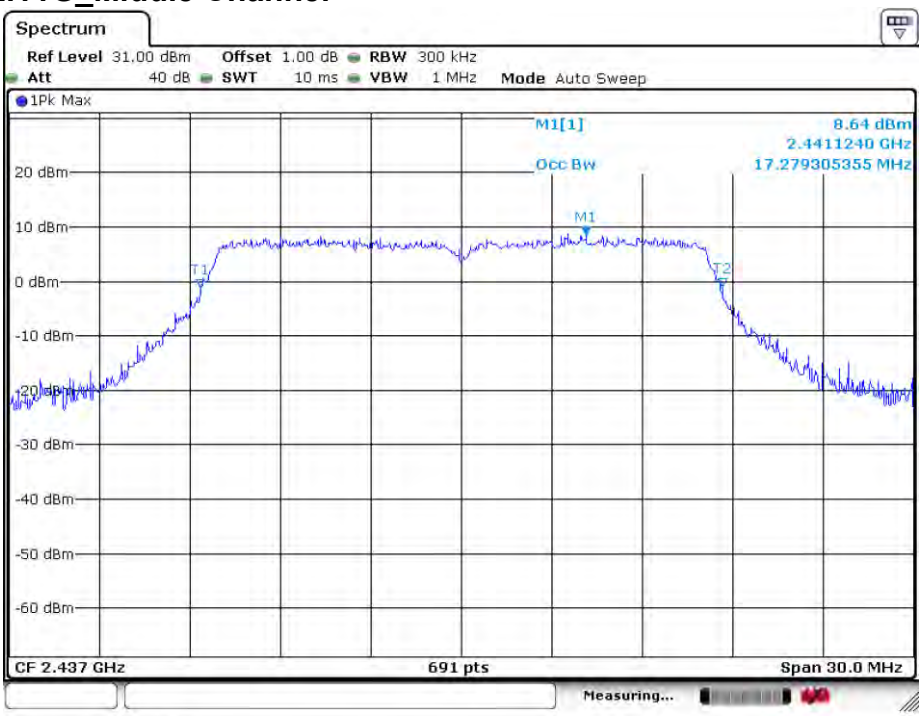
4.5.2.1.5 802.11G_Middle Channel



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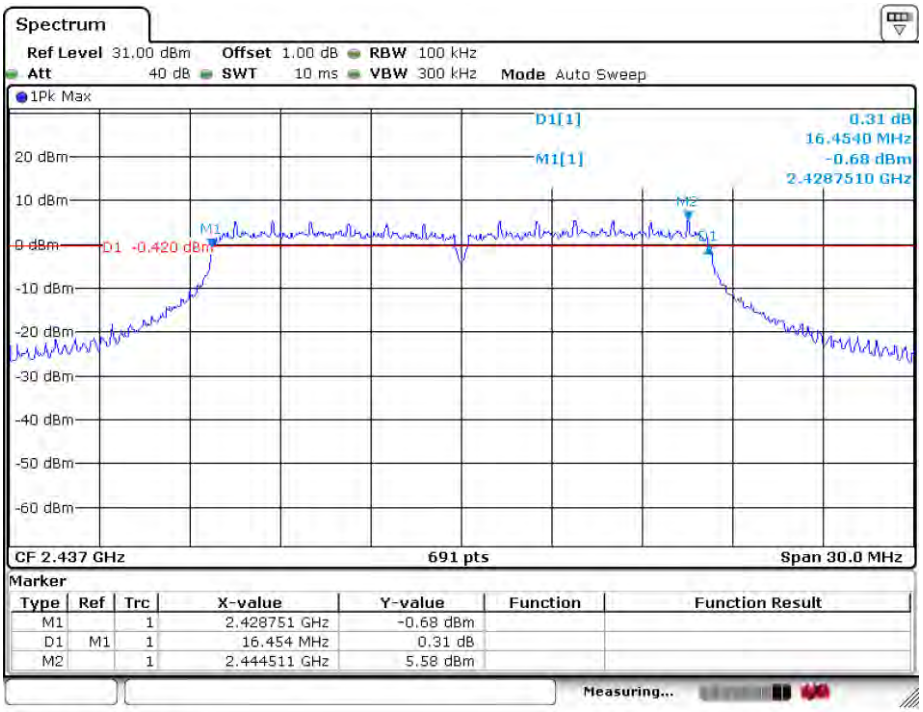

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Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.428751 GHz	-0.68 dBm		
D1	M1	1	16.454 MHz	0.31 dB		
M2		1	2.444511 GHz	5.58 dBm		

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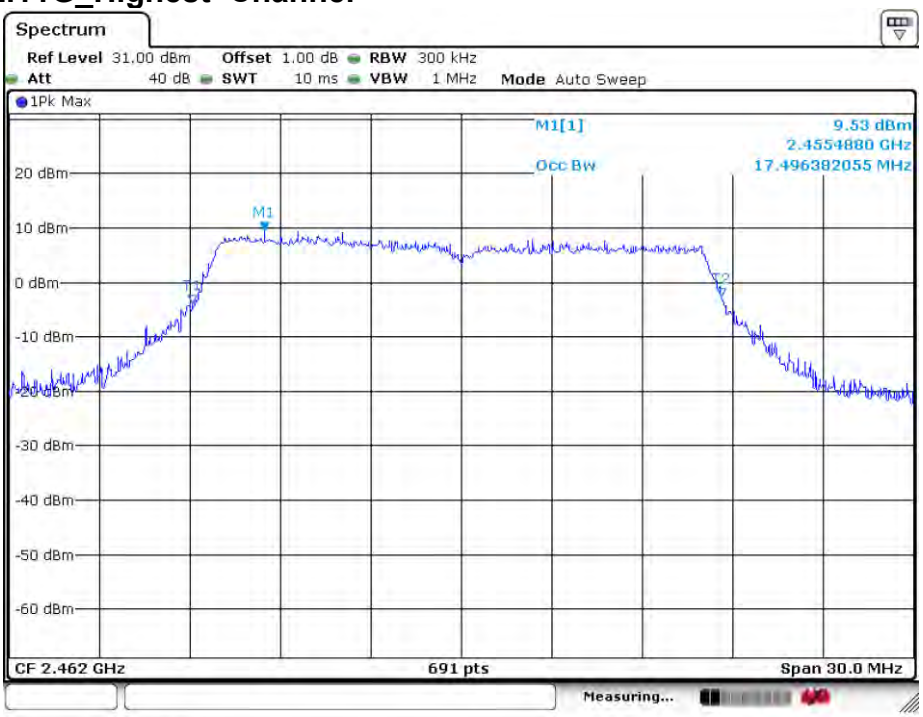
4.5.2.1.6 802.11G_Highest Channel



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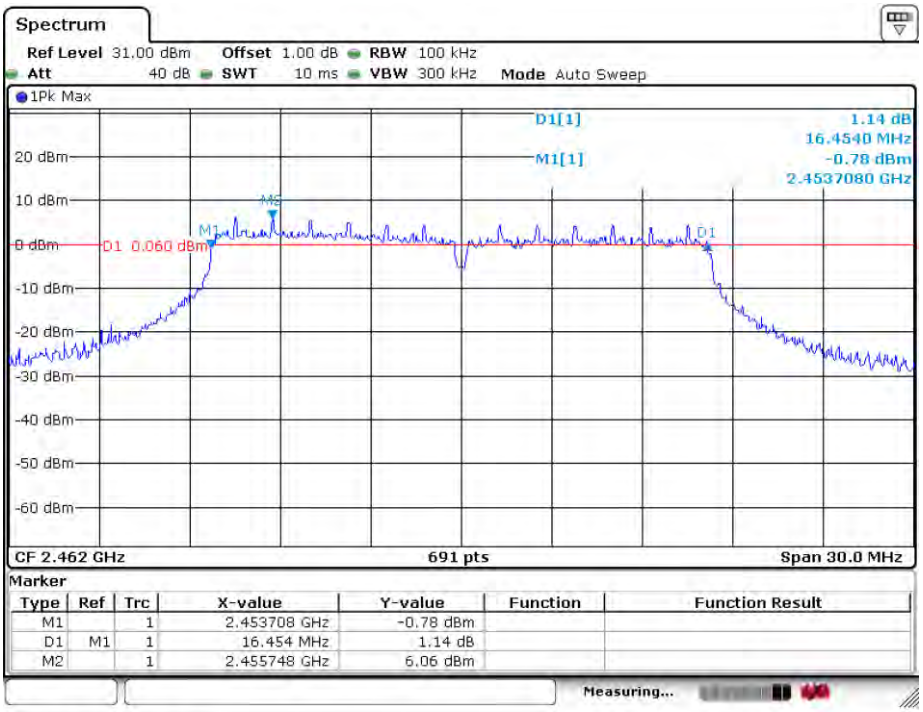

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Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.453708 GHz	-0.78 dBm		
D1	M1	1	16.454 MHz	1.14 dB		
M2		1	2.455748 GHz	6.06 dBm		

Date: 8.NOV.2020 14:21:02

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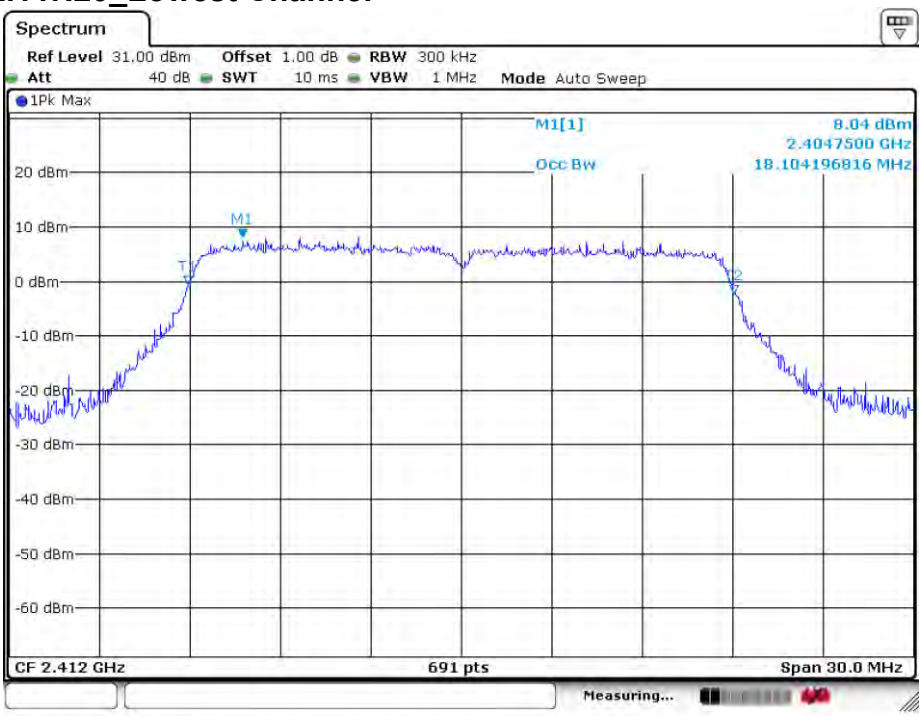
4.5.2.1.7 802.11N20_Lowest Channel



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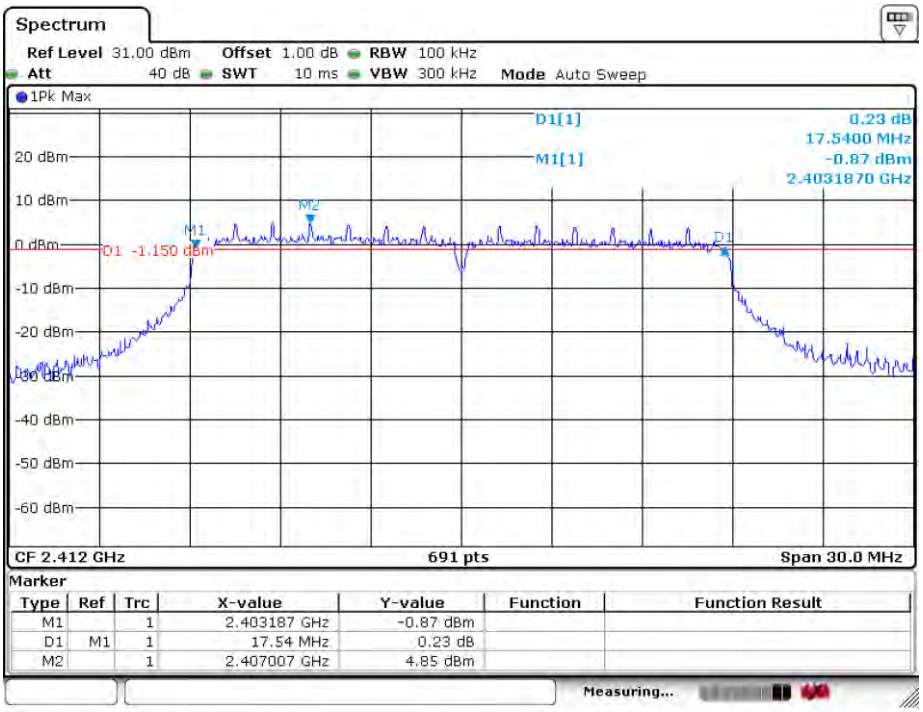

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Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.403187 GHz	-0.87 dBm		
D1	M1	1	17.54 MHz	0.23 dB		
M2		1	2.407007 GHz	4.85 dBm		

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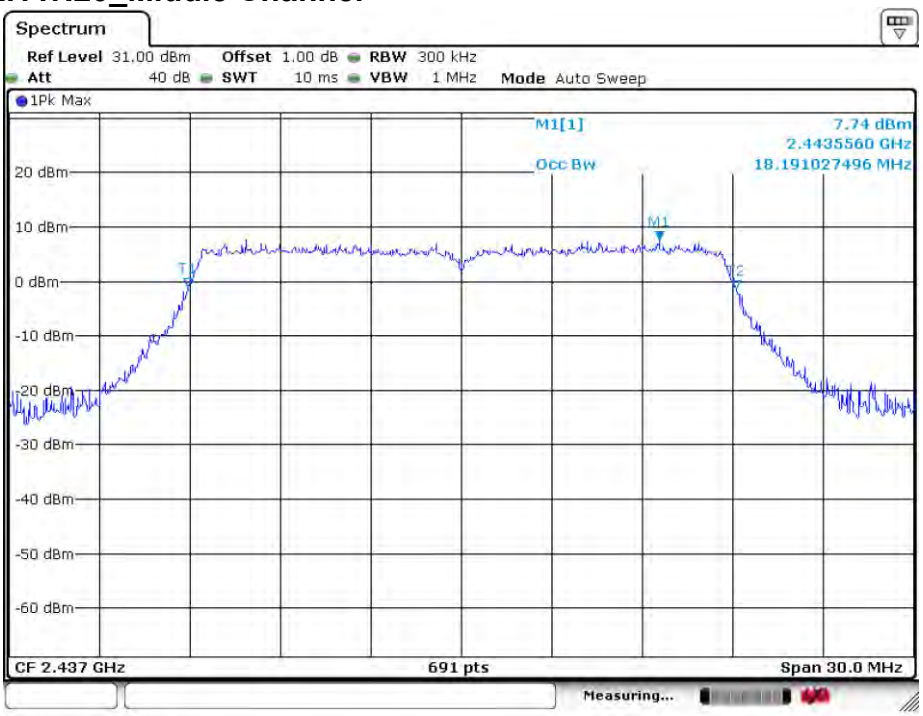
4.5.2.1.8 802.11N20_Middle Channel



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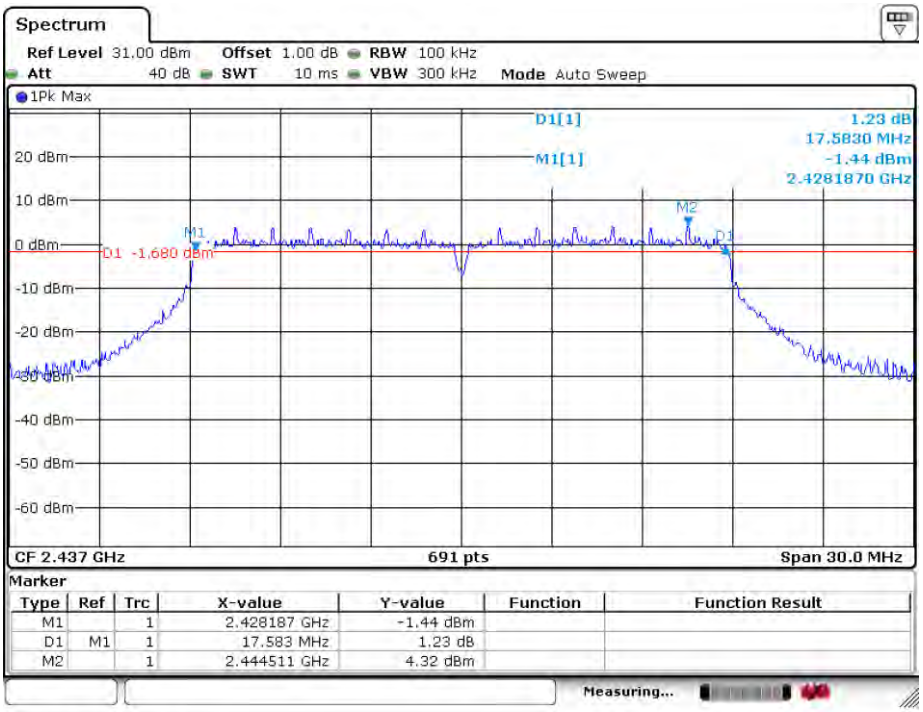

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.428187 GHz	-1.44 dBm		
D1	M1	1	17.583 MHz	1.23 dB		
M2		1	2.444511 GHz	4.32 dBm		

Date: 8.NOV.2020 14:19:01

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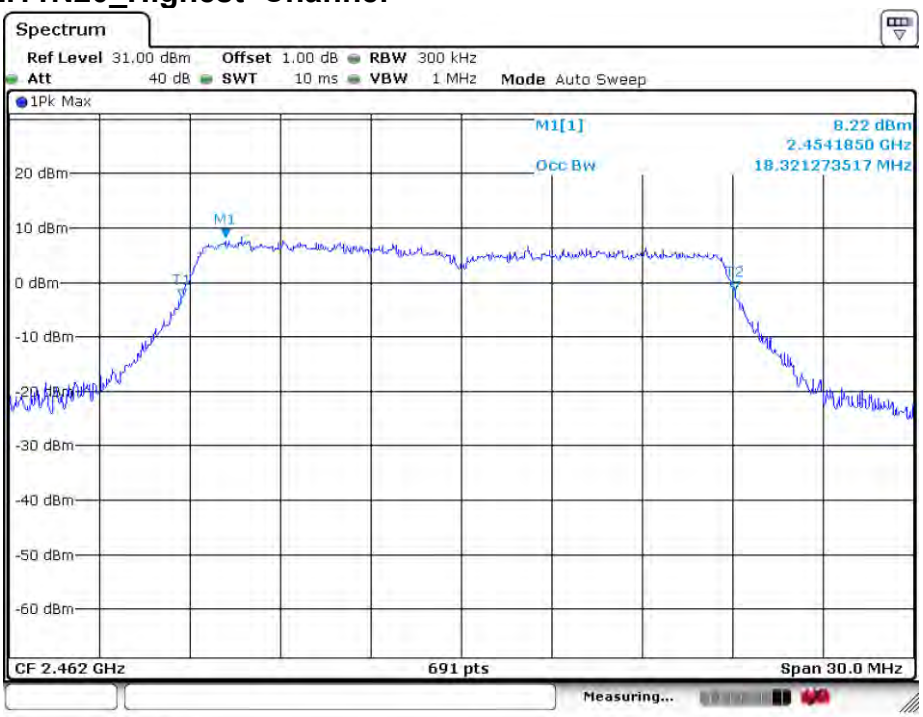
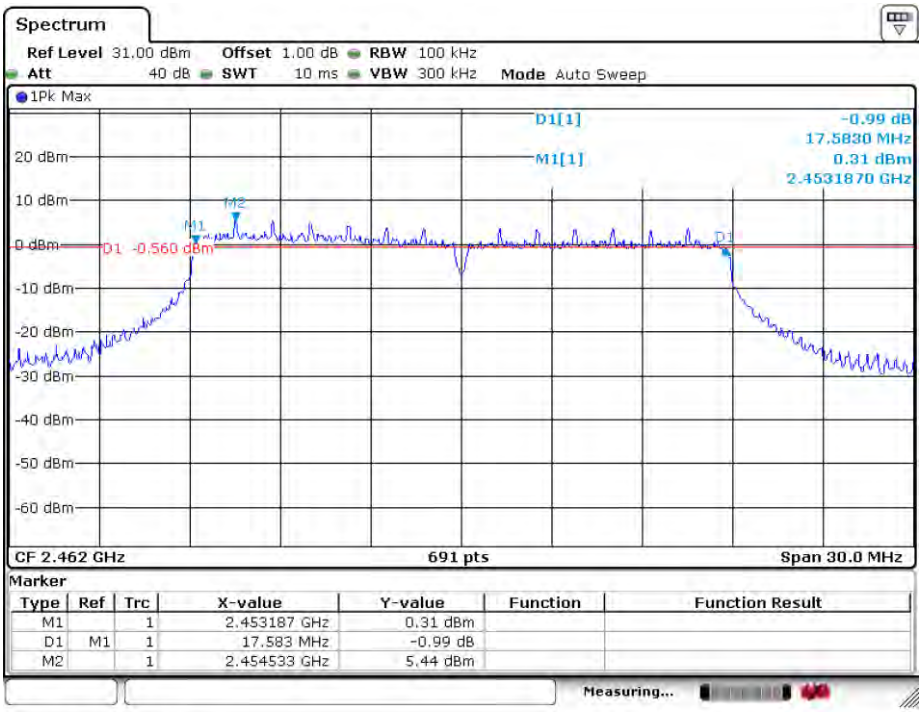
4.5.2.1.9 802.11N20_Highest Channel



Date: 8.NOV.2020 14:42:13



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.453187 GHz	0.31 dBm		
D1	M1	1	17.583 MHz	-0.99 dB		
M2		1	2.454533 GHz	5.44 dBm		

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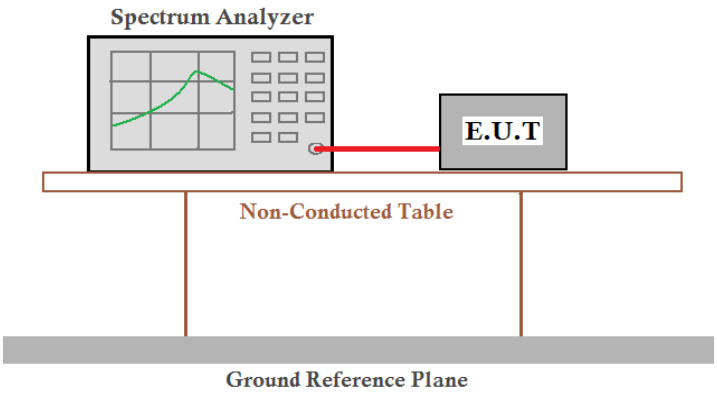
4.6 Power Spectral Density

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);
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	-1.98	≤8.00	Pass
	Middle	-2.44	≤8.00	Pass
	Highest	-2.14	≤8.00	Pass
802.11G	Lowest	-7.02	≤8.00	Pass
	Middle	-5.99	≤8.00	Pass
	Highest	-6.47	≤8.00	Pass
802.11N20	Lowest	-8.04	≤8.00	Pass
	Middle	-8.66	≤8.00	Pass
	Highest	-9.00	≤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

Date: 8.NOV.2020 14:47:08

4.6.2.1.3 802.11B_Highest Channel

Date: 8.NOV.2020 14:46:45

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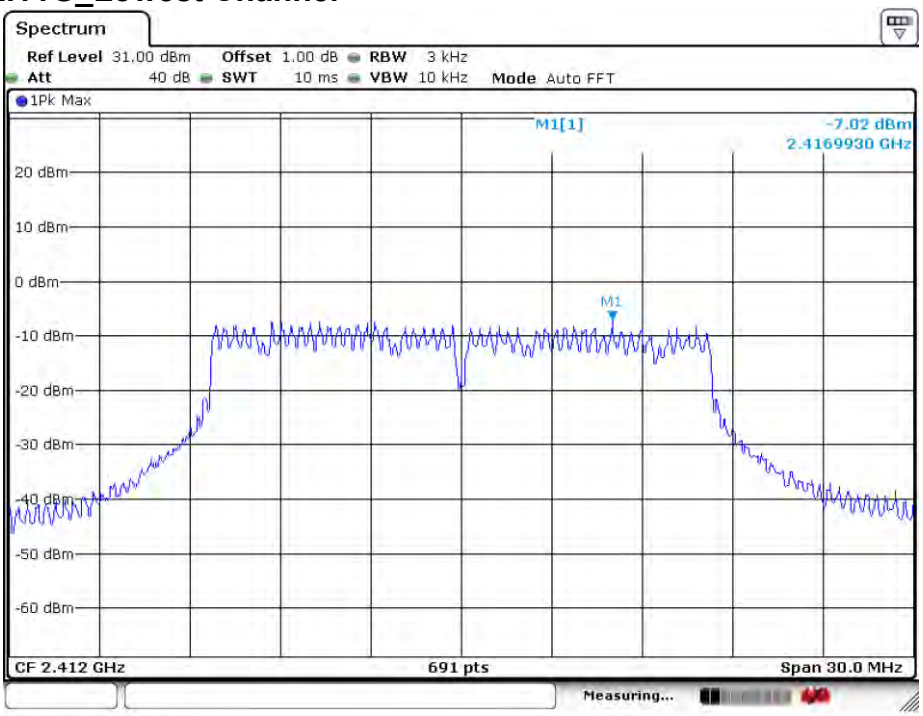
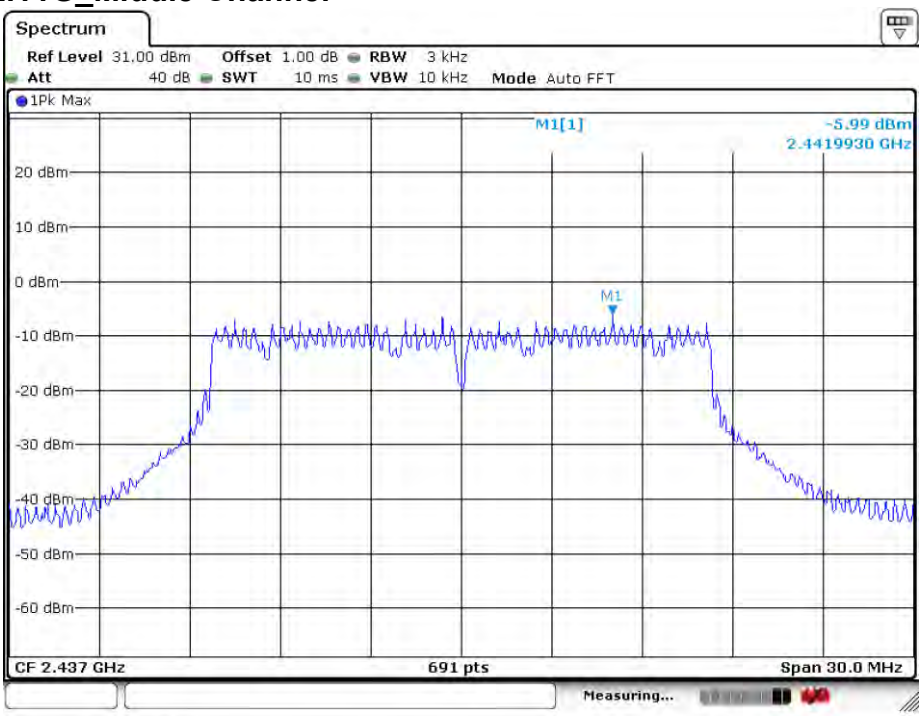
4.6.2.1.4 802.11G_Lowest Channel



Date: 8.NOV.2020 14:45:38

4.6.2.1.5 802.11G_Middle Channel



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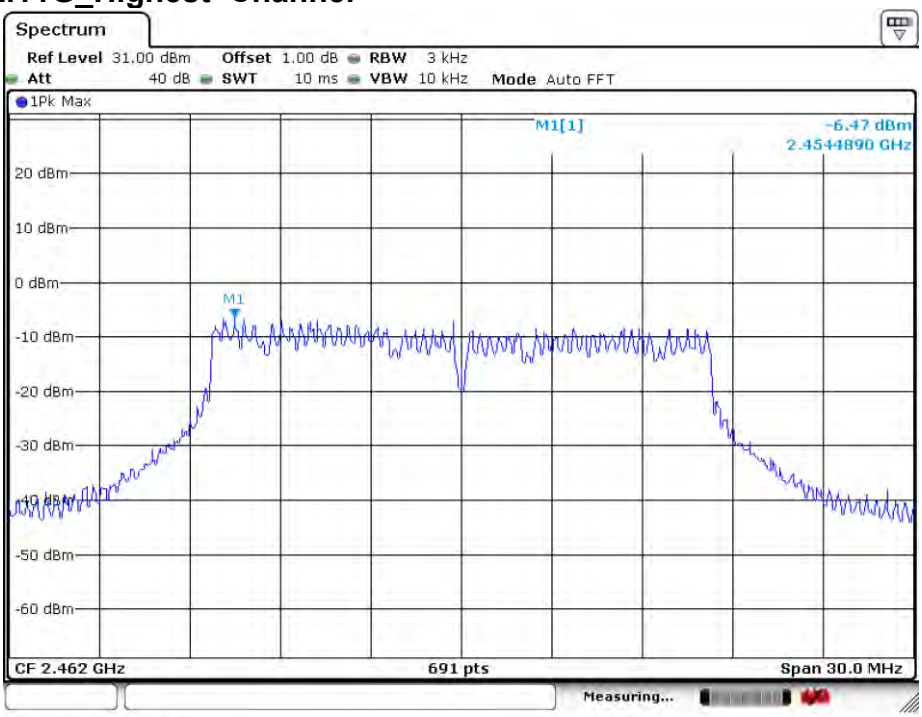
4.6.2.1.6 802.11G_Highest Channel



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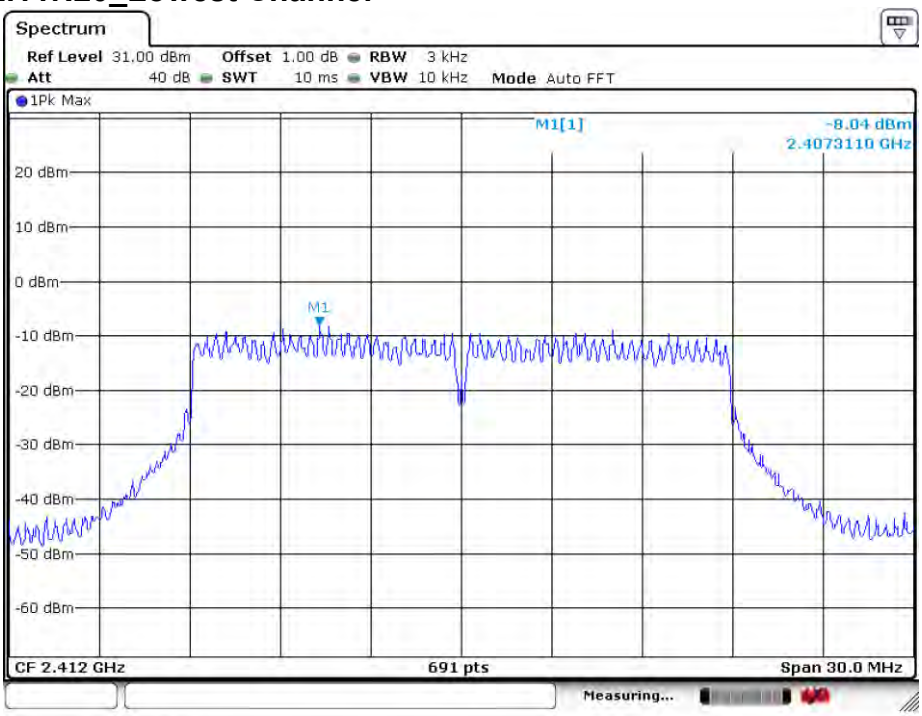
4.6.2.1.7 802.11N20_Lowest Channel



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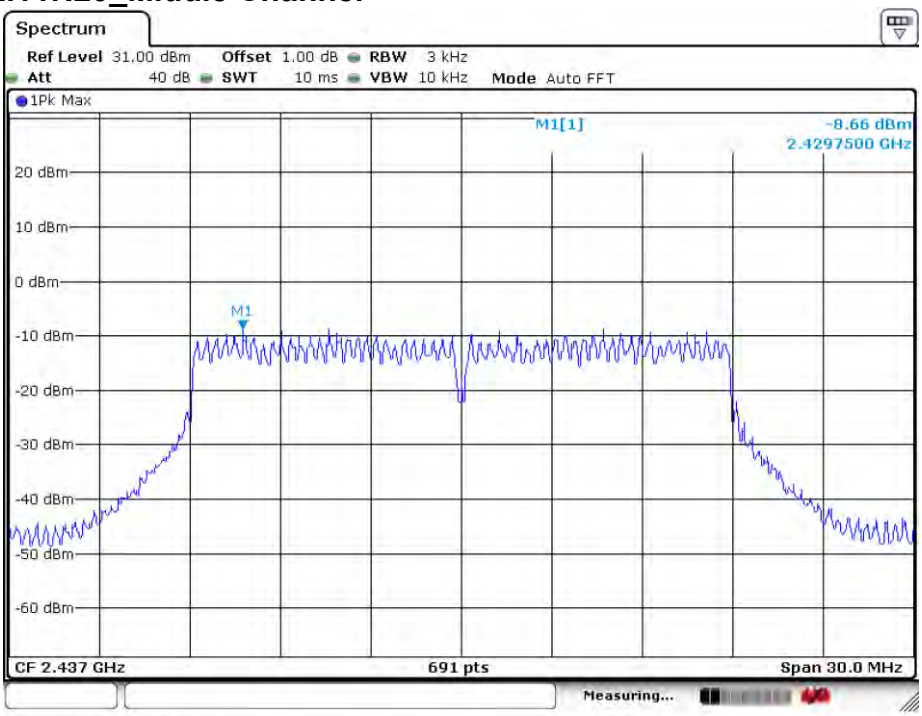
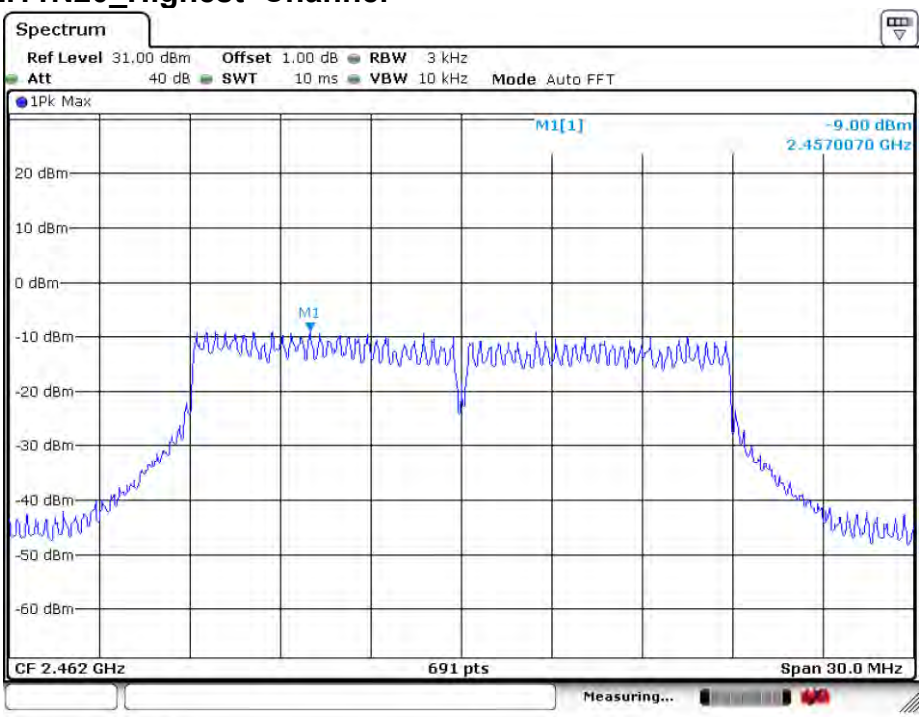
4.6.2.1.8 802.11N20_Middle Channel



Date: 8.NOV.2020 14:48:31

4.6.2.1.9 802.11N20_Highest Channel



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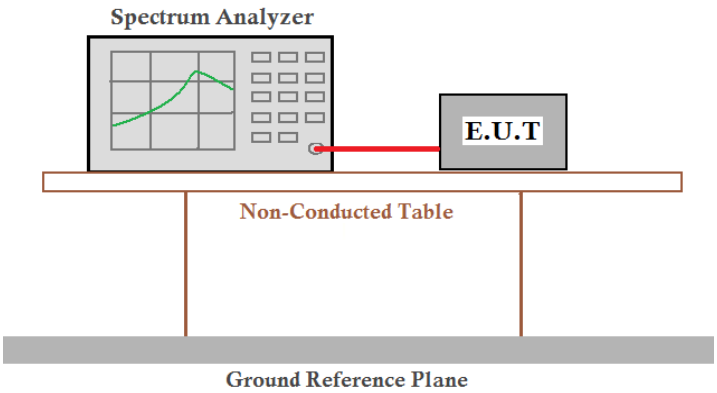
4.7 Band-edge for RF Conducted Emissions

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

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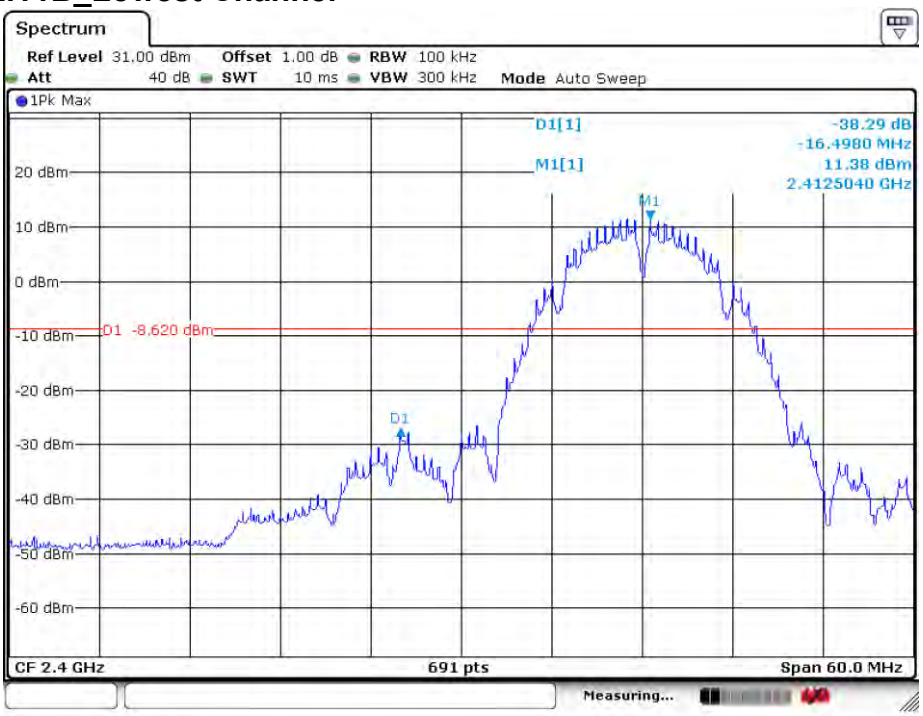
4.7.1 Test Plots

4.7.1.1 ANT1

4.7.1.1.1 802.11B_Lowest Channel



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4.7.1.1.2 802.11B_Highest Channel

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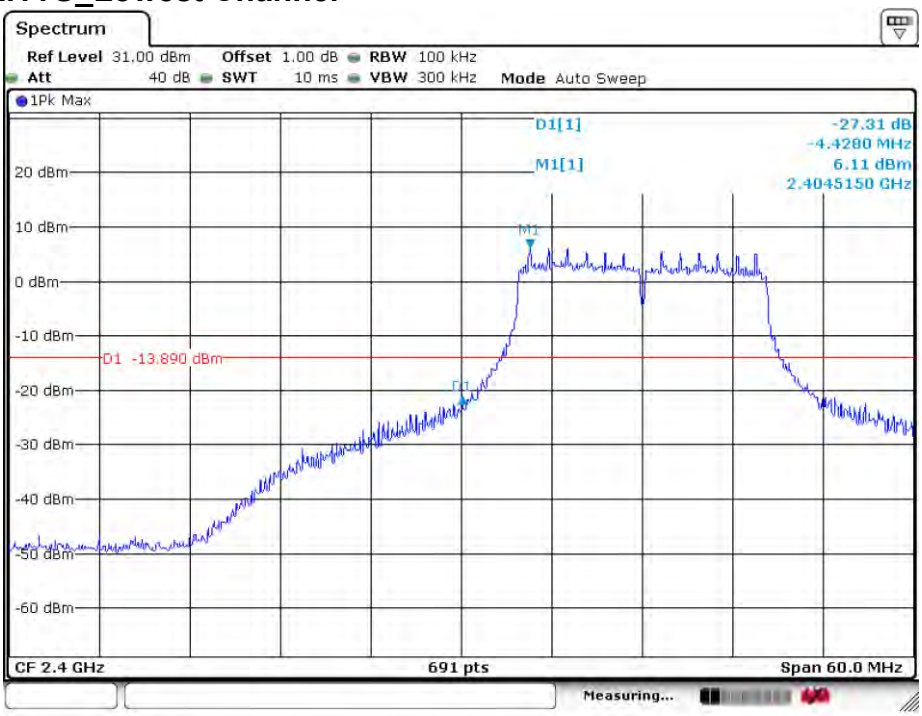
4.7.1.1.3 802.11G_Lowest Channel



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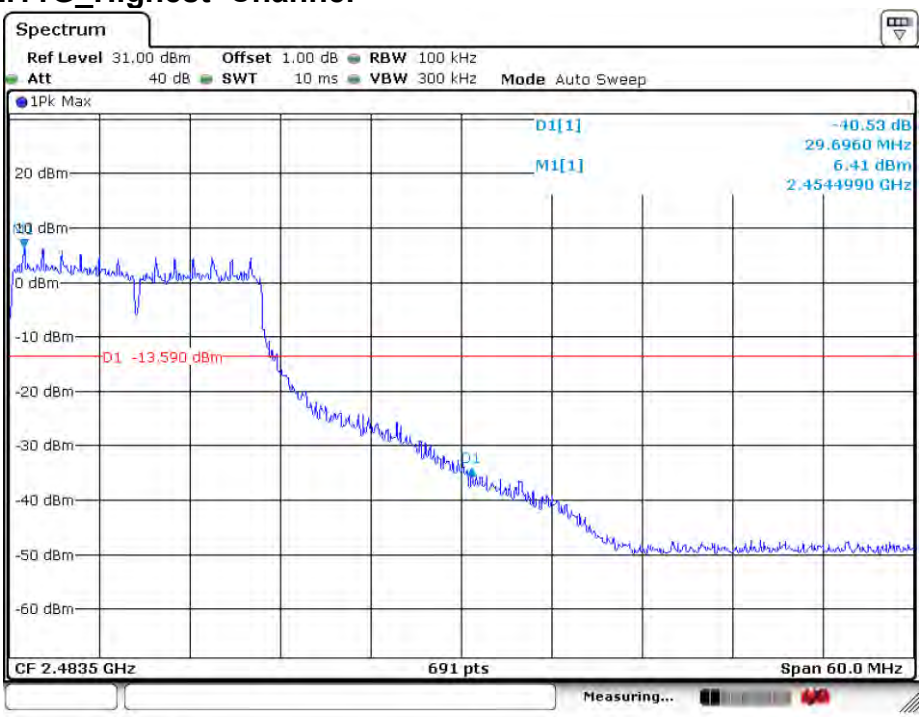
4.7.1.1.4 802.11G_Highest Channel



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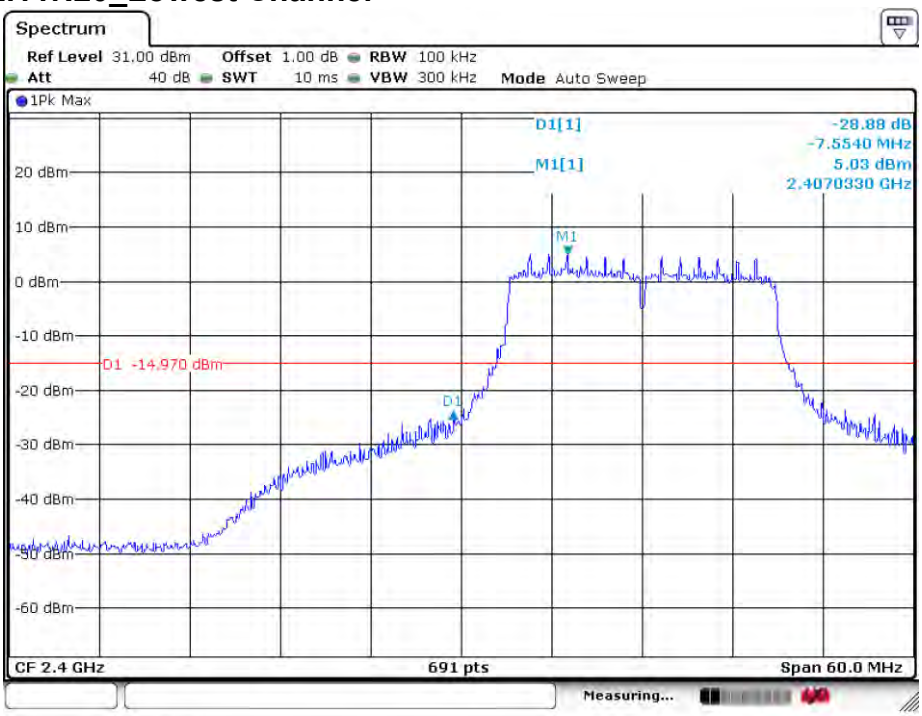
4.7.1.1.5 802.11N20_Lowest Channel



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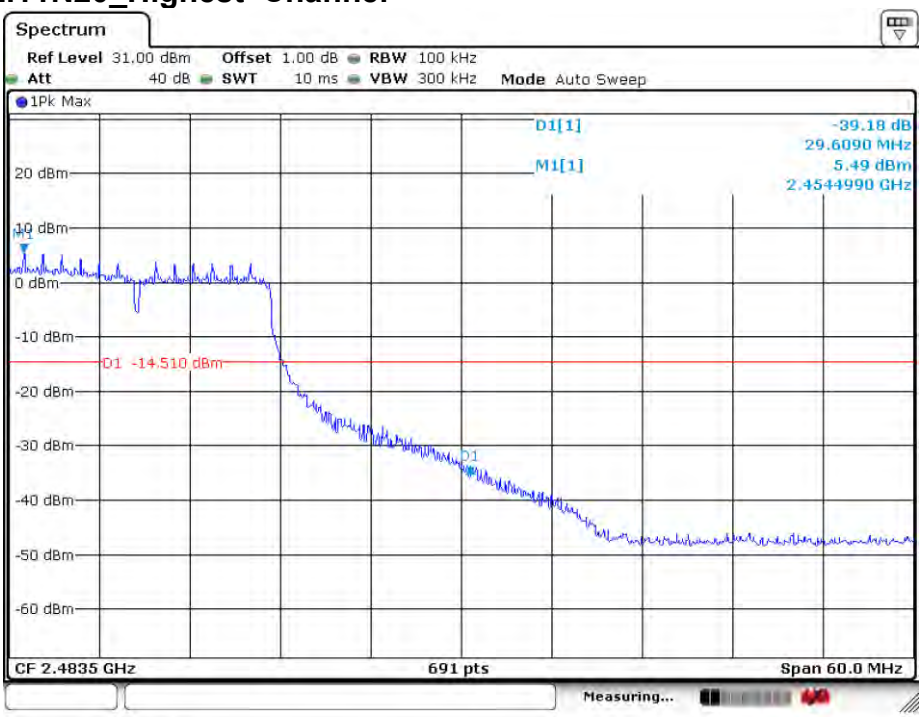
4.7.1.1.6 802.11N20_Highest Channel



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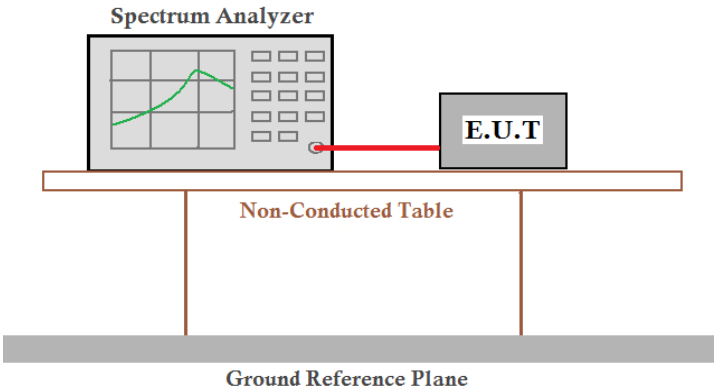
4.8 RF Conducted Spurious Emissions

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

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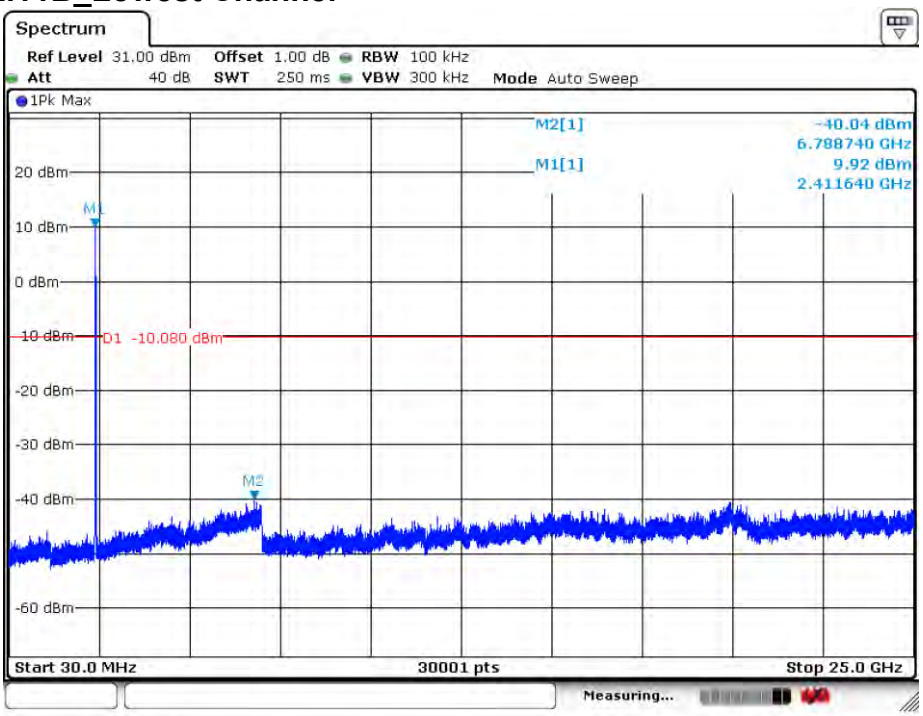
4.8.1 Test Plots

4.8.1.1 ANT1

4.8.1.1.1 802.11B_Lowest Channel



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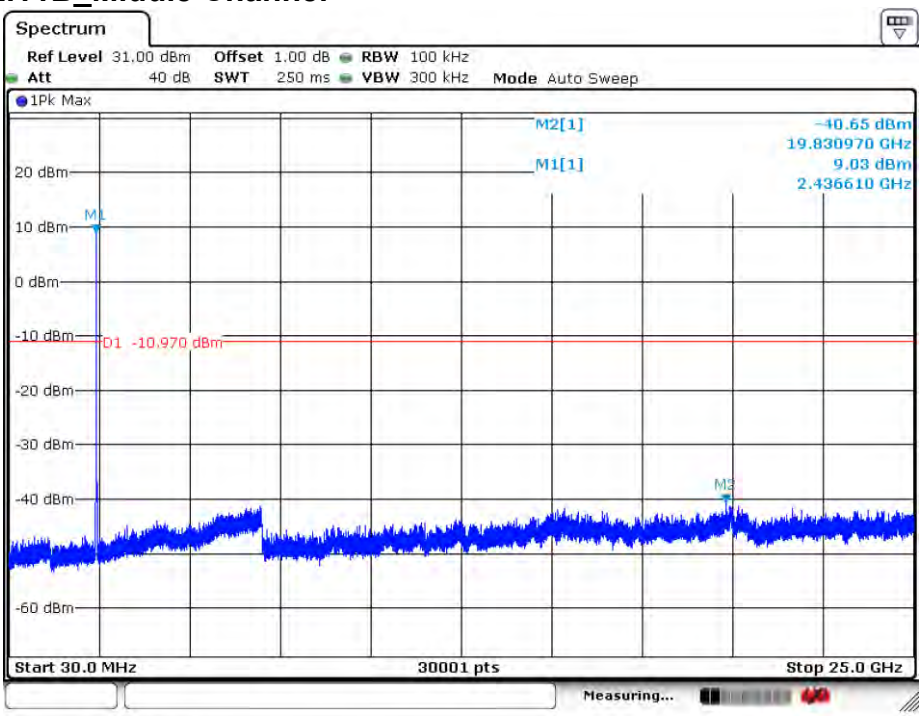
4.8.1.1.2 802.11B_Middle Channel



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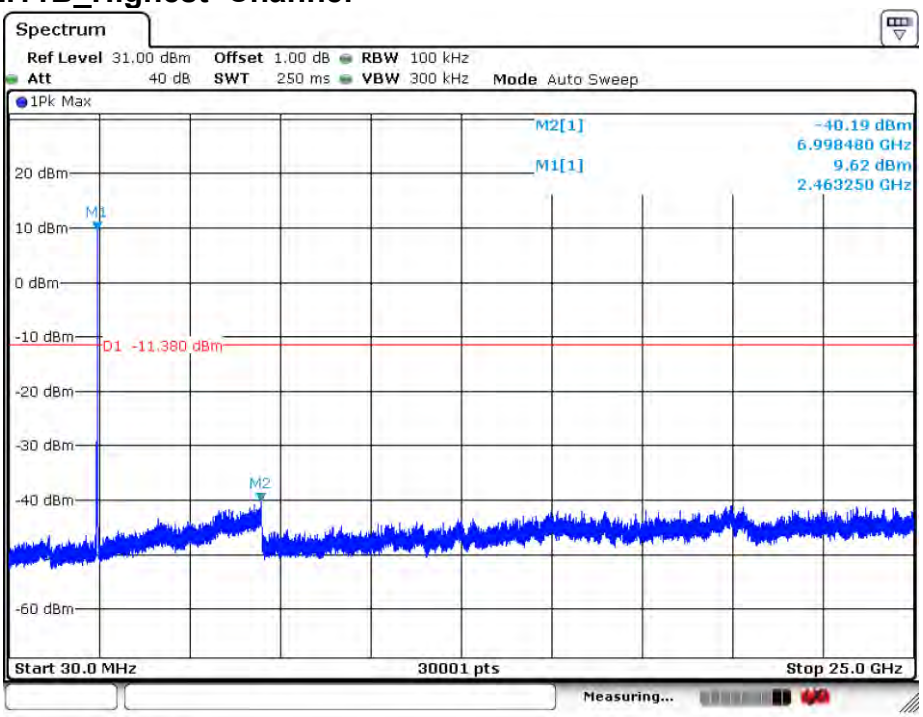
4.8.1.1.3 802.11B_Highest Channel



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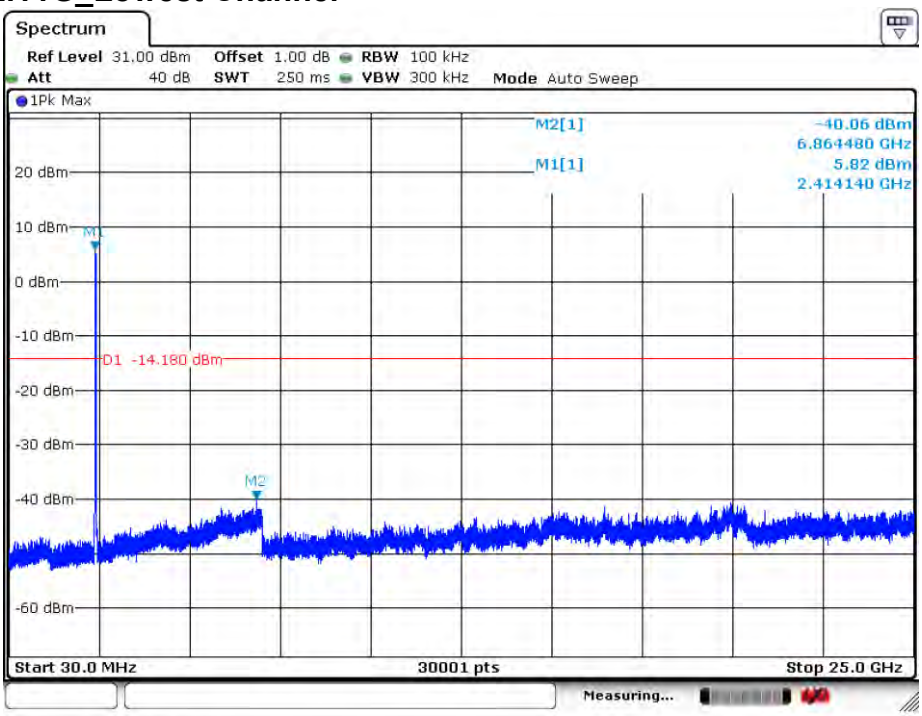
4.8.1.1.4 802.11G_Lowest Channel



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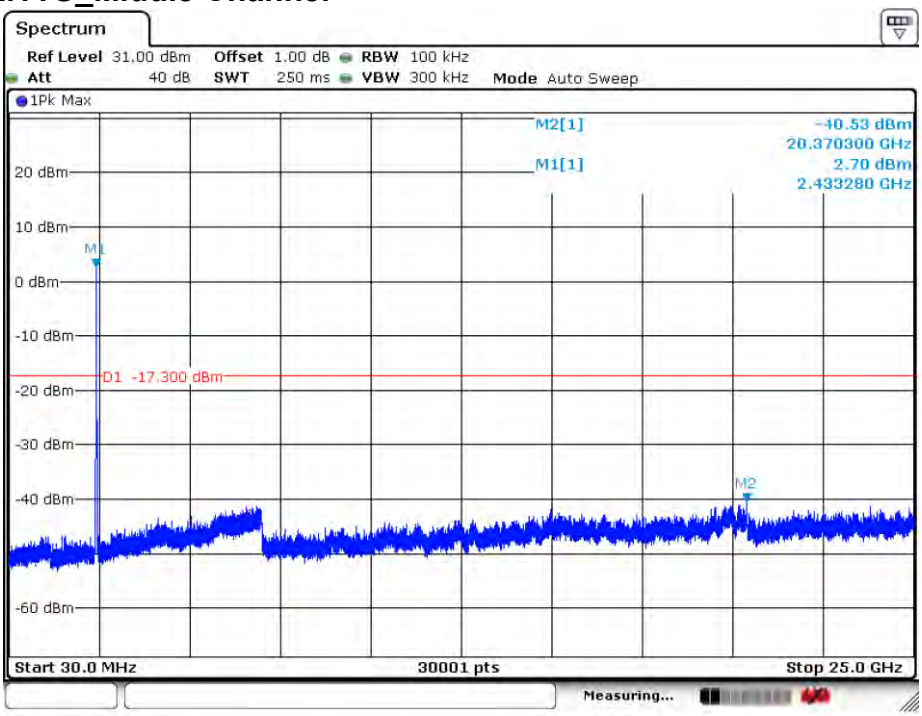
4.8.1.1.5 802.11G_Middle Channel



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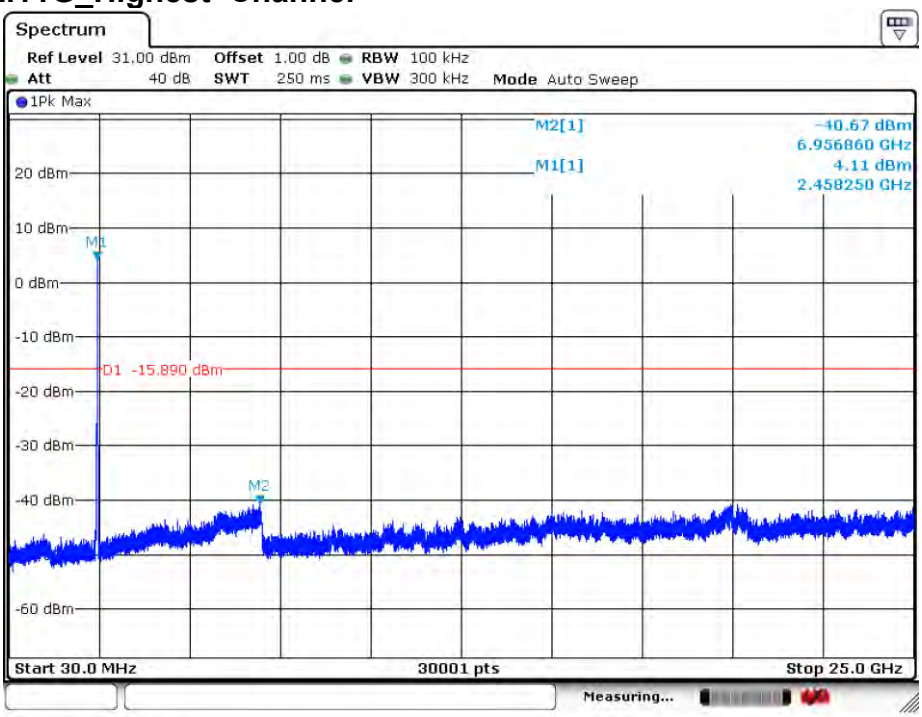
4.8.1.1.6 802.11G_Highest Channel



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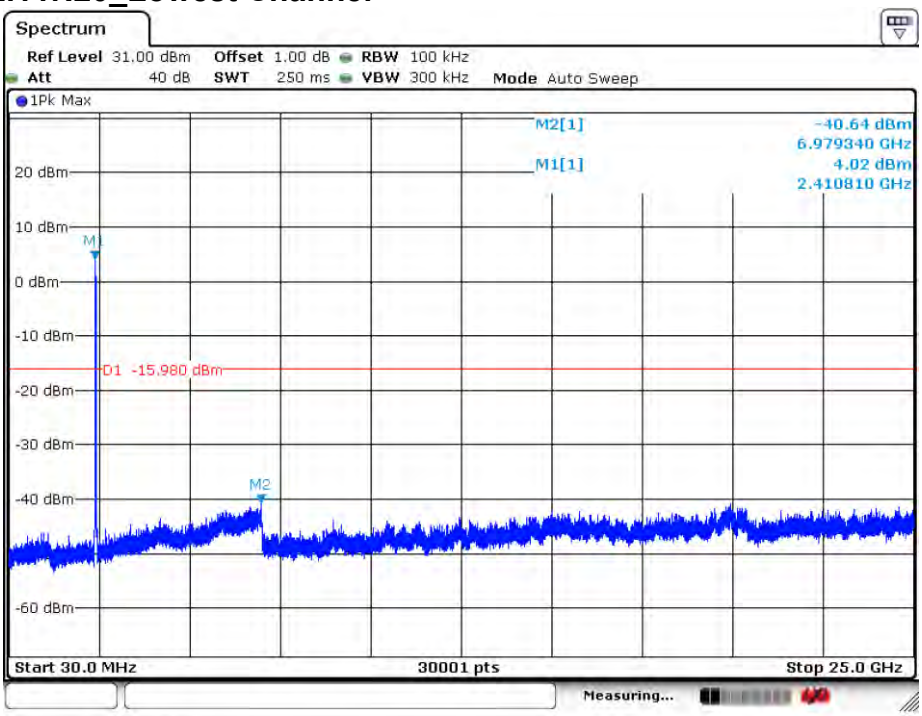
4.8.1.1.7 802.11N20_Lowest Channel



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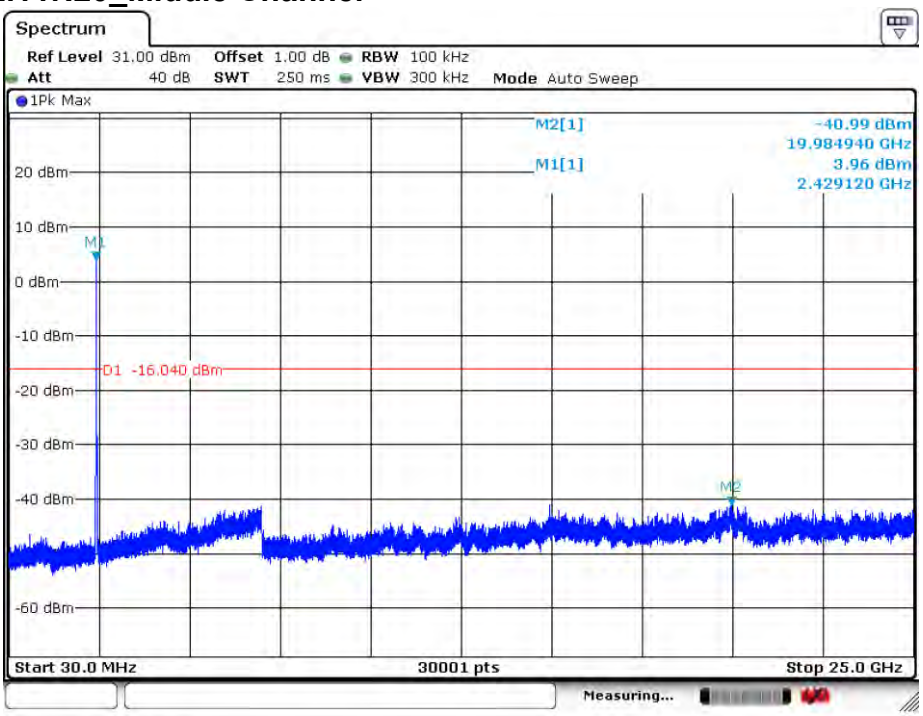
4.8.1.1.8 802.11N20_Middle Channel



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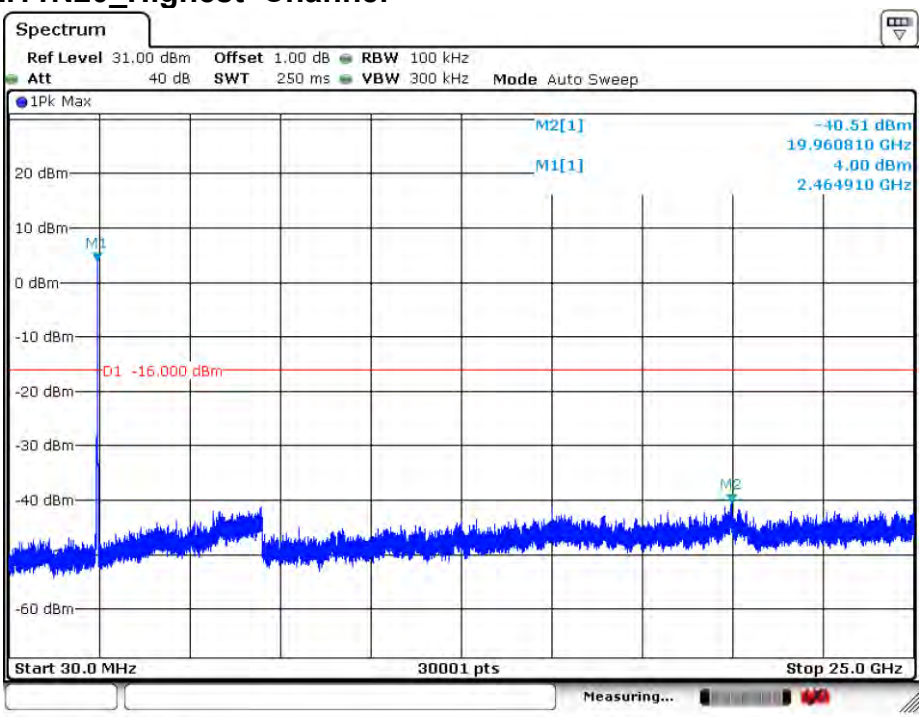
4.8.1.1.9 802.11N20_Highest Channel



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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	100kHz	30kHz	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.				

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Test Setup:

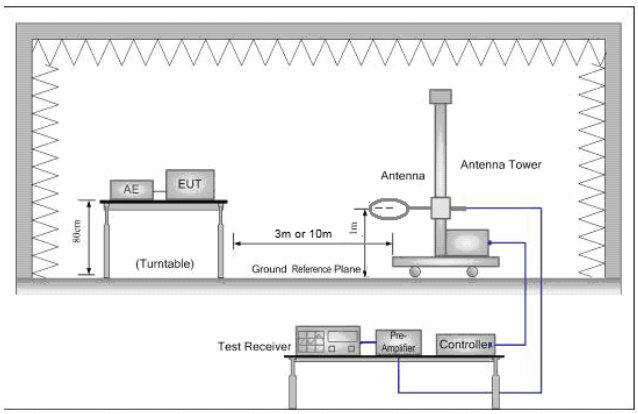

Figure 1. Below 30MHz

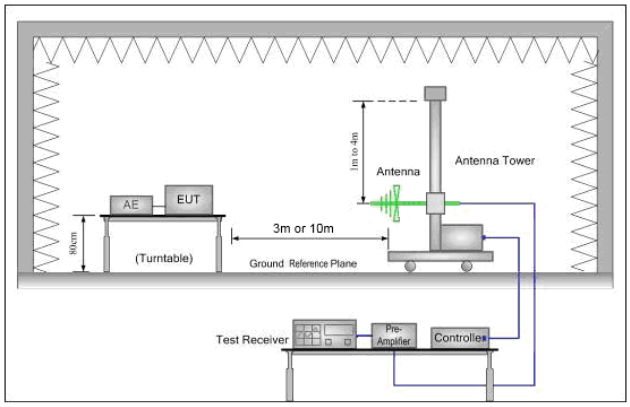

Figure 2. 30MHz to 1GHz

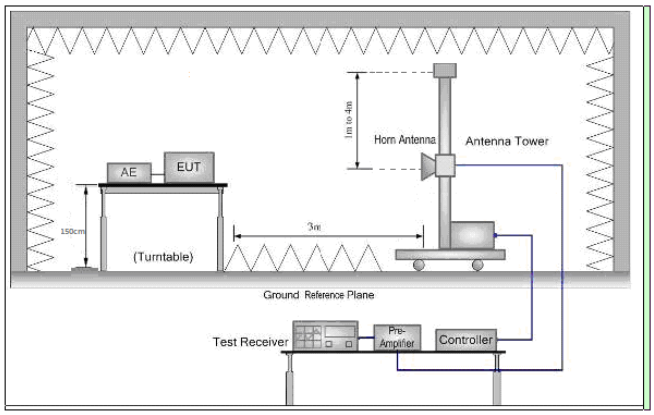

Figure 3. Above 1 GHz

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).

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	Duty cycle = On time/100 milliseconds 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 cycle) f. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters(for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. g. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. h. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. i. Test the EUT in the lowest channel, the middle channel ,the Highest channel. j. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the X axis positioning which it is worse case. k. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates. Charge + Transmitting mode.
Final Test Mode:	Pretest the EUT at Charge + Transmitting mode. Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G; 6.5Mbps of rate is the worst case of 802.11N(HT20); For below 1GHz, through Pre-scan, find the 1Mbps of rate of 802.11B at lowest channel is the worst case. Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

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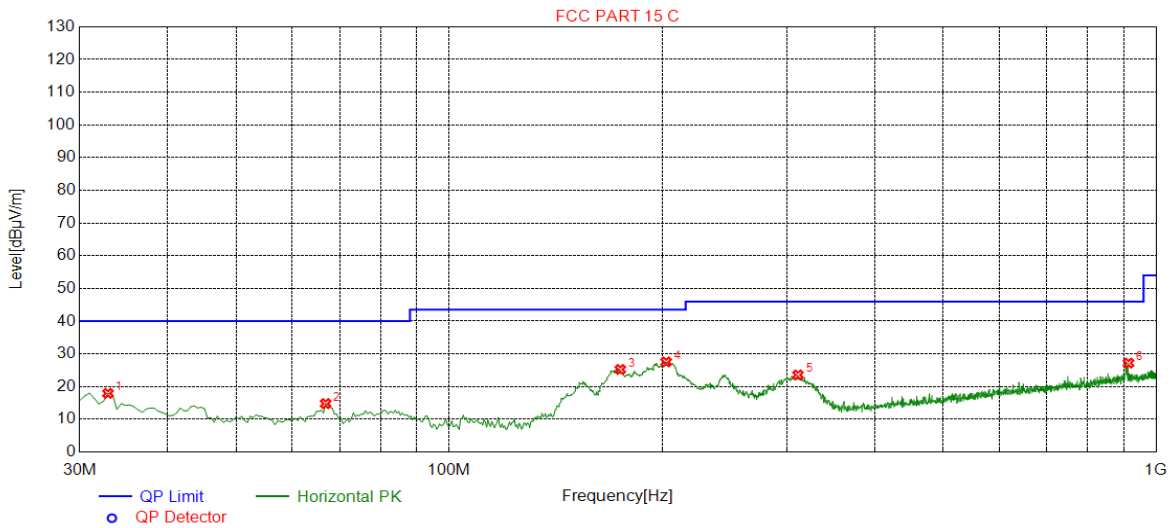
Firstly Supply:

4.9.1 Radiated emission below 1GHz

4.9.1.1 Charge + Transmitting



Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Polarity
1	32.9115	17.93	-32.79	40.00	22.07	150	Horizontal
2	66.8784	14.81	-33.39	40.00	25.19	150	Horizontal
3	174.6023	25.25	-33.29	43.50	18.25	150	Horizontal
4	202.7464	27.55	-30.76	43.50	15.95	150	Horizontal
5	311.4407	23.58	-27.52	46.00	22.42	150	Horizontal
6	914.1121	27.18	-15.02	46.00	18.82	150	Horizontal

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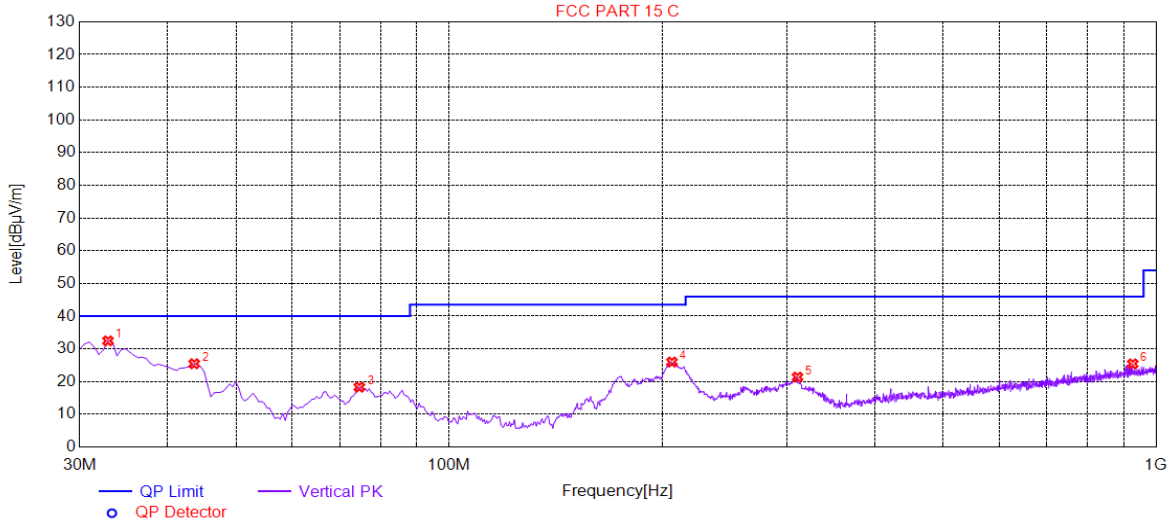

Suspected List							
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Polarity
1	32.9115	32.46	-32.79	40.00	7.54	150	Vertical
2	43.5868	25.46	-30.48	40.00	14.54	150	Vertical
3	74.6423	18.31	-34.96	40.00	21.69	150	Vertical
4	206.6283	25.98	-30.68	43.50	17.52	150	Vertical
5	310.9555	21.38	-27.53	46.00	24.62	150	Vertical
6	926.7284	25.43	-14.82	46.00	20.57	150	Vertical

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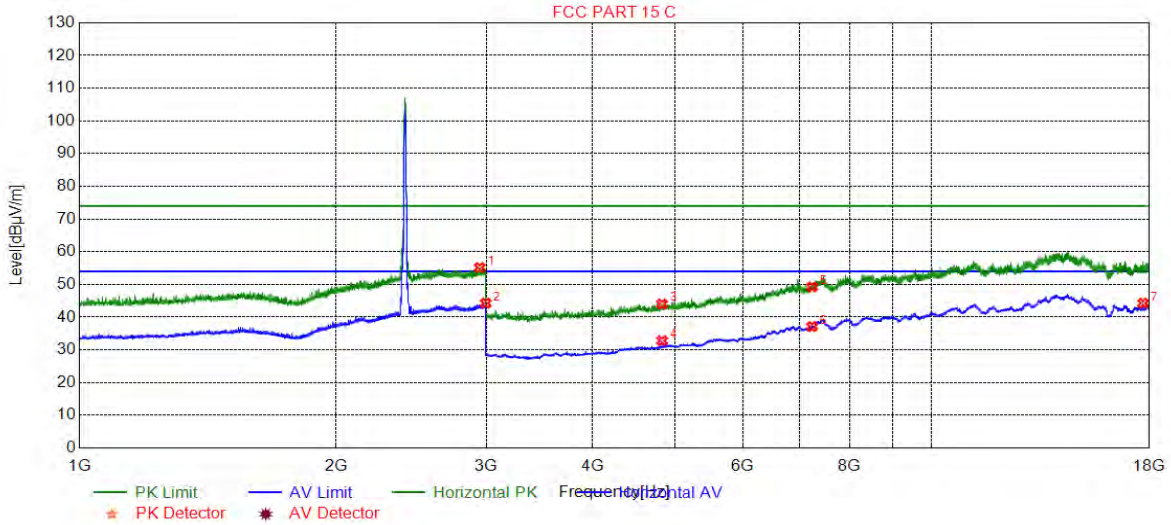
4.9.2 Transmitter emission above 1GHz

4.9.2.1 802.11B_Channel 1



Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2948.48	55.18	9.66	74.00	18.82	150	164	Horizontal
2	2996.49	44.28	9.47	54.00	9.72	150	178	Horizontal
3	4824.00	44.03	-17.13	74.00	29.97	100	14	Horizontal
4	4825.68	32.80	-17.12	54.00	21.20	100	327	Horizontal
5	7236.00	49.25	-8.48	74.00	24.75	100	146	Horizontal
6	7236.00	37.13	-8.48	54.00	16.87	300	344	Horizontal
7	17689.4	44.26	-0.65	54.00	9.74	300	63	Horizontal

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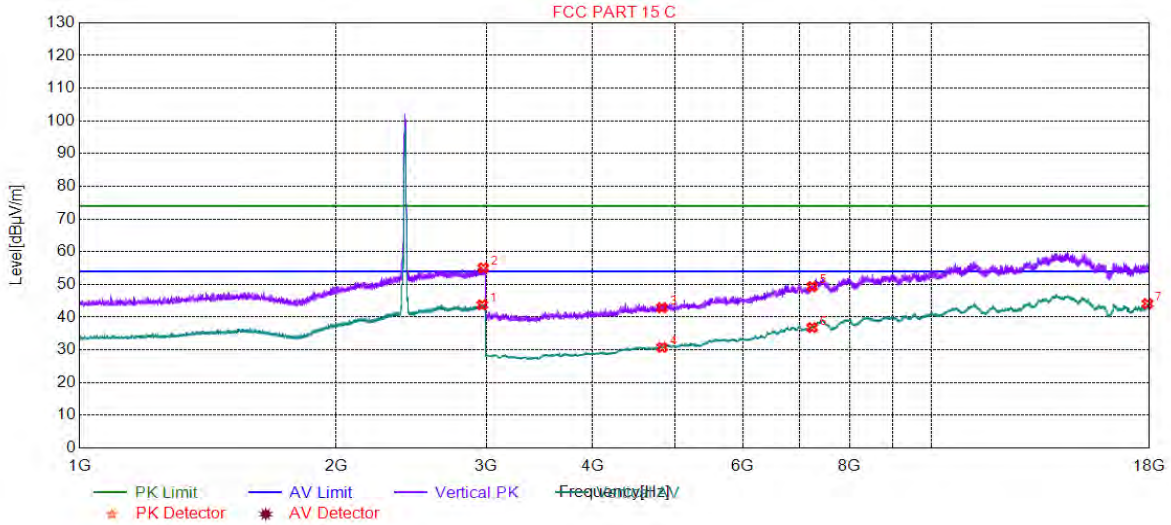
4.9.2.2 802.11B_Channel 1



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2967.49	43.76	9.60	54.00	10.24	150	325	Vertical
2	2976.49	55.07	9.56	74.00	18.93	150	132	Vertical
3	4824.00	42.89	-17.13	74.00	31.11	100	82	Vertical
4	4824.00	30.76	-17.13	54.00	23.24	200	343	Vertical
5	7236.00	49.36	-8.48	74.00	24.64	100	82	Vertical
6	7236.00	36.83	-8.48	54.00	17.17	100	115	Vertical
7	17902.4	44.13	-1.31	54.00	9.87	100	82	Vertical

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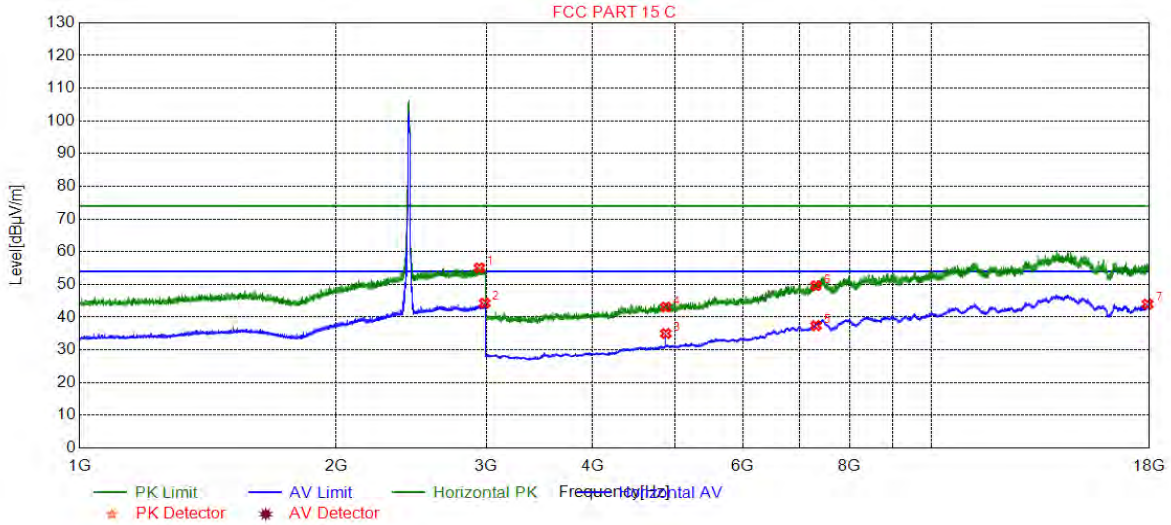
4.9.2.3 802.11B_Channel 6



Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2944.98	55.09	9.63	74.00	18.91	150	95	Horizontal
2	2987.49	44.29	9.51	54.00	9.71	150	54	Horizontal
3	4874.00	35.02	-16.97	54.00	18.98	150	1	Horizontal
4	4874.00	43.09	-16.97	74.00	30.91	150	99	Horizontal
5	7311.00	37.41	-8.10	54.00	16.59	150	99	Horizontal
6	7311.00	49.63	-8.10	74.00	24.37	150	297	Horizontal
7	17905.4	44.00	-1.31	54.00	10.00	150	215	Horizontal

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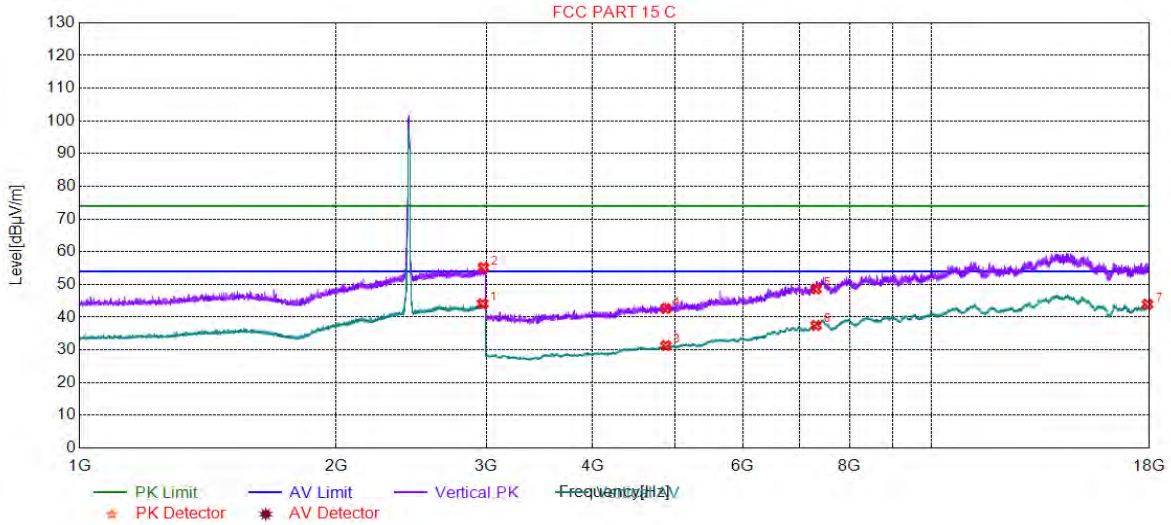
4.9.2.4 802.11B_Channel 6



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2970.99	44.11	9.58	54.00	9.89	150	306	Vertical
2	2977.99	55.20	9.55	74.00	18.80	150	100	Vertical
3	4874.00	31.32	-16.97	54.00	22.68	150	146	Vertical
4	4874.00	42.65	-16.97	74.00	31.35	150	30	Vertical
5	7311.00	48.64	-8.10	74.00	25.36	150	63	Vertical
6	7311.00	37.48	-8.10	54.00	16.52	150	262	Vertical
7	17903.9	43.97	-1.31	54.00	10.03	150	212	Vertical

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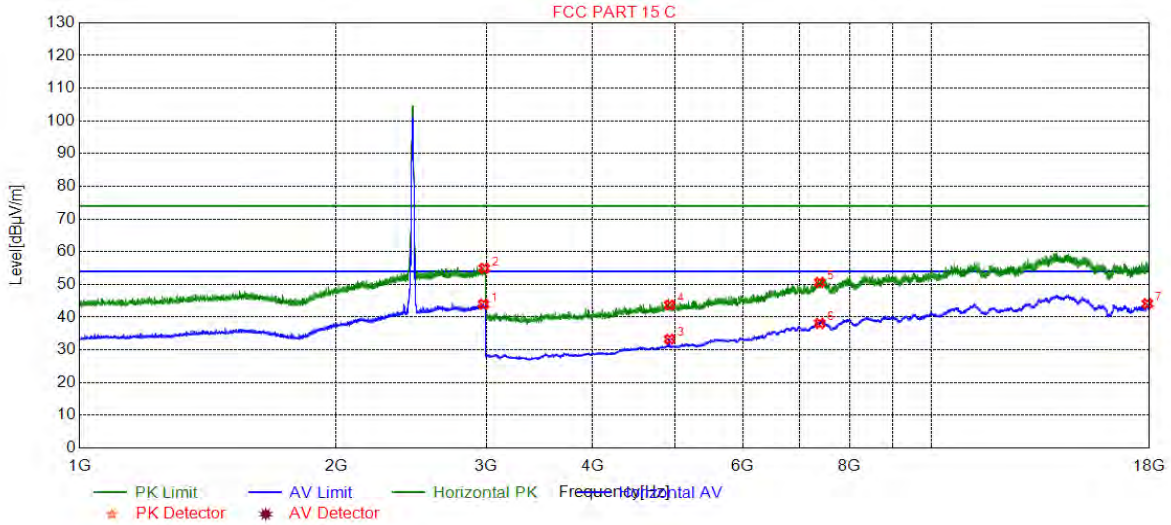
4.9.2.5 802.11B_Channel 11



Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2978.49	43.97	9.55	54.00	10.03	150	204	Horizontal
2	2984.49	54.96	9.52	74.00	19.04	150	190	Horizontal
3	4924.00	33.29	-16.81	54.00	20.71	150	16	Horizontal
4	4924.00	43.74	-16.81	74.00	30.26	150	330	Horizontal
5	7386.00	50.60	-7.78	74.00	23.40	150	346	Horizontal
6	7386.00	38.10	-7.78	54.00	15.90	150	65	Horizontal
7	17900.9	44.15	-1.31	54.00	9.85	150	297	Horizontal

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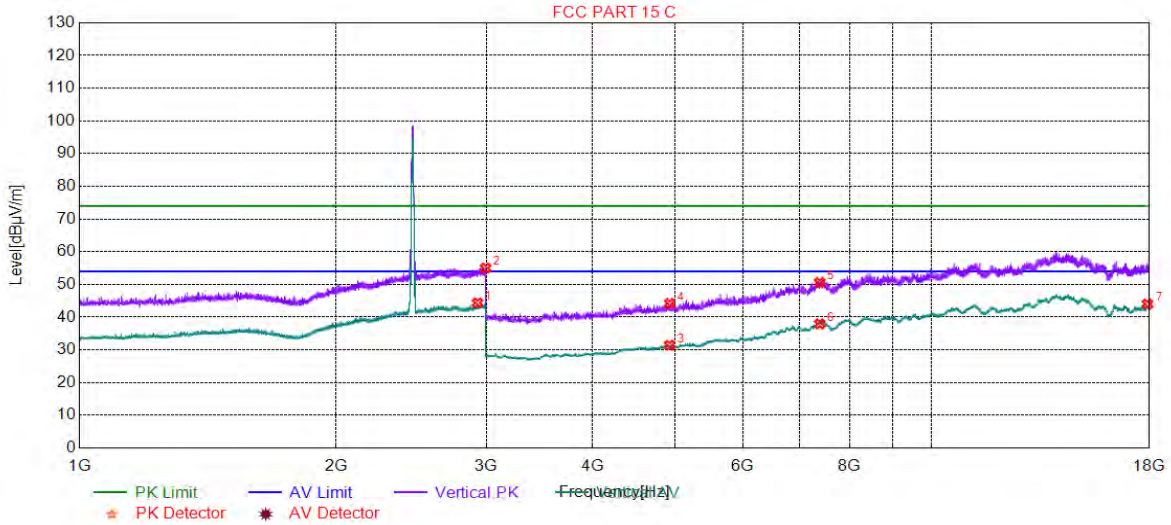
4.9.2.6 802.11B_Channel 11



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2930.48	44.39	9.47	54.00	9.61	150	320	Vertical
2	2995.99	55.02	9.47	74.00	18.98	150	18	Vertical
3	4924.00	31.43	-16.81	54.00	22.57	150	277	Vertical
4	4924.00	44.18	-16.81	74.00	29.82	150	145	Vertical
5	7386.00	50.59	-7.78	74.00	23.41	150	343	Vertical
6	7386.00	37.95	-7.78	54.00	16.05	150	29	Vertical
7	17903.9	44.02	-1.31	54.00	9.98	150	96	Vertical

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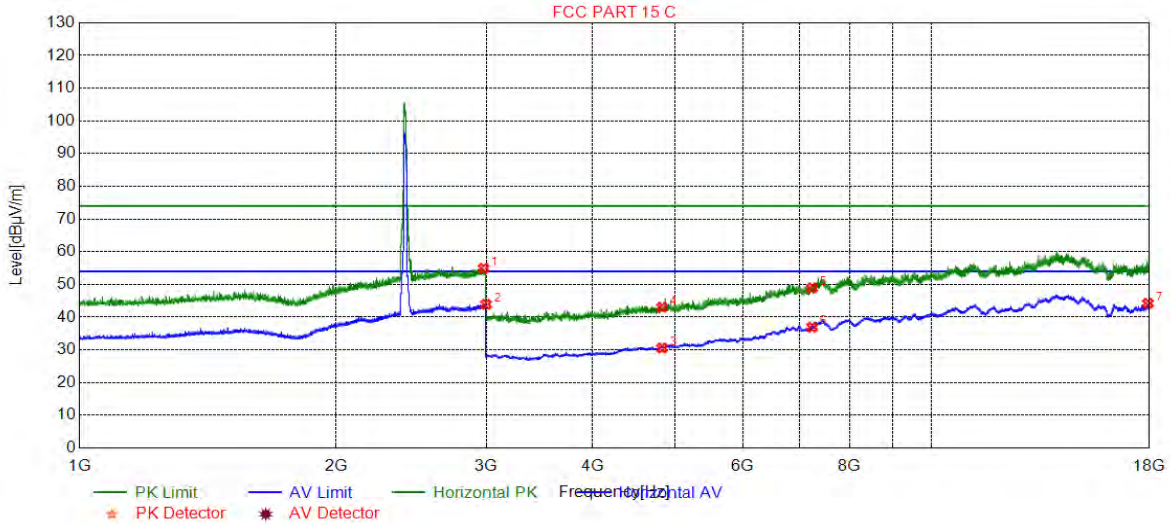
4.9.2.7 802.11G_Channel 1



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2979.49	54.93	9.54	74.00	19.07	150	237	Horizontal
2	2998.99	43.93	9.45	54.00	10.07	150	128	Horizontal
3	4824.00	30.60	-17.13	54.00	23.40	150	346	Horizontal
4	4824.00	43.03	-17.13	74.00	30.97	150	83	Horizontal
5	7236.00	48.94	-8.48	74.00	25.06	150	198	Horizontal
6	7236.00	36.96	-8.48	54.00	17.04	150	50	Horizontal
7	17921.9	44.24	-1.30	54.00	9.76	150	116	Horizontal

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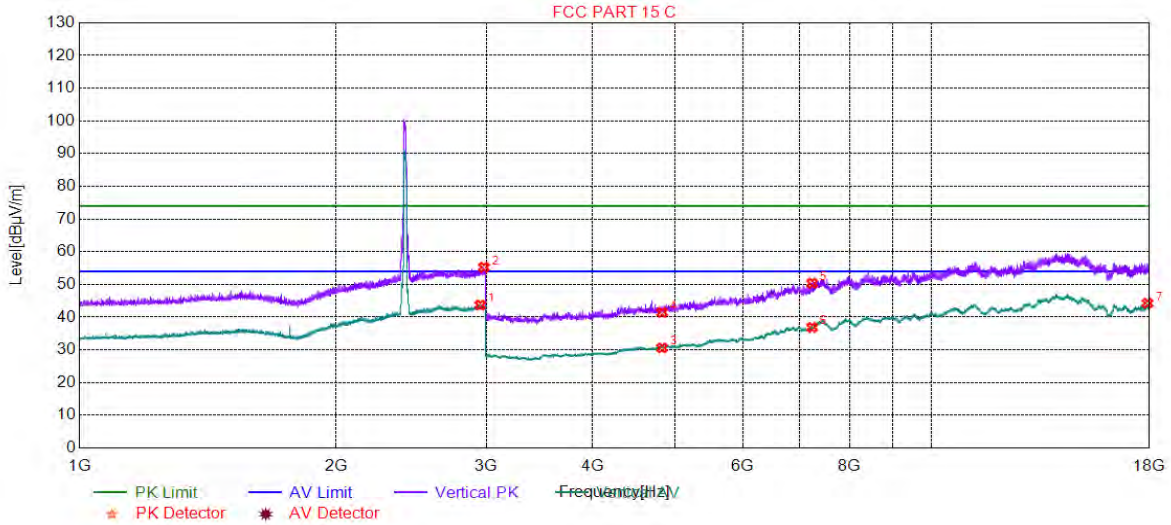
4.9.2.8 802.11G_Channel 1



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2951.48	43.72	9.67	54.00	10.28	150	40	Vertical
2	2981.49	55.26	9.54	74.00	18.74	150	82	Vertical
3	4824.00	30.62	-17.13	54.00	23.38	150	79	Vertical
4	4824.00	41.45	-17.13	74.00	32.55	150	63	Vertical
5	7236.00	50.42	-8.48	74.00	23.58	150	244	Vertical
6	7236.00	36.88	-8.48	54.00	17.12	150	293	Vertical
7	17903.9	44.26	-1.31	54.00	9.74	150	161	Vertical

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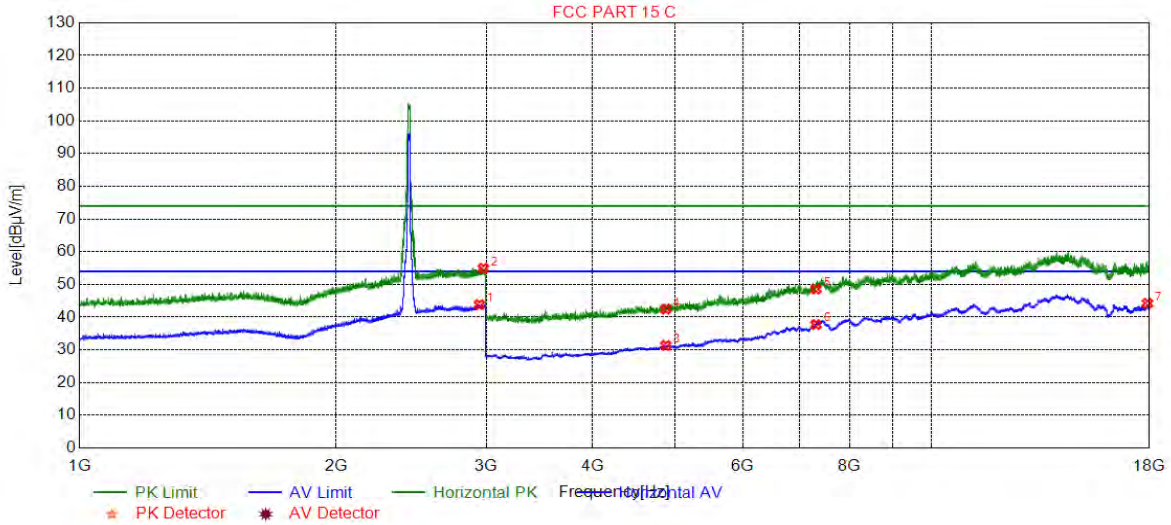
4.9.2.9 802.11G_Channel 6



Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2945.48	43.84	9.63	54.00	10.16	150	18	Horizontal
2	2976.99	54.94	9.56	74.00	19.06	150	18	Horizontal
3	4874.00	31.34	-16.97	54.00	22.66	150	1	Horizontal
4	4874.00	42.46	-16.97	74.00	31.54	150	66	Horizontal
5	7311.00	48.59	-8.10	74.00	25.41	150	264	Horizontal
6	7311.00	37.75	-8.10	54.00	16.25	150	33	Horizontal
7	17902.4	44.24	-1.31	54.00	9.76	150	248	Horizontal

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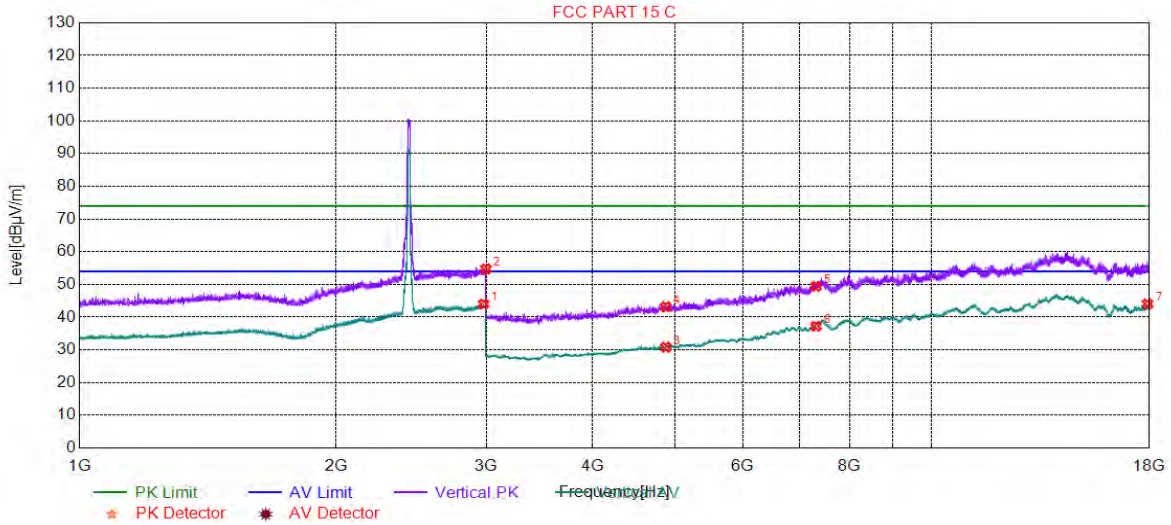
4.9.2.10 802.11G_Channel 6



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2979.49	44.02	9.54	54.00	9.98	150	204	Vertical
2	2997.99	54.75	9.46	74.00	19.25	150	190	Vertical
3	4874.00	30.83	-16.97	54.00	23.17	150	294	Vertical
4	4874.00	43.22	-16.97	74.00	30.78	150	63	Vertical
5	7311.00	49.44	-8.10	74.00	24.56	150	30	Vertical
6	7311.00	37.22	-8.10	54.00	16.78	150	46	Vertical
7	17908.4	44.05	-1.31	54.00	9.95	150	80	Vertical

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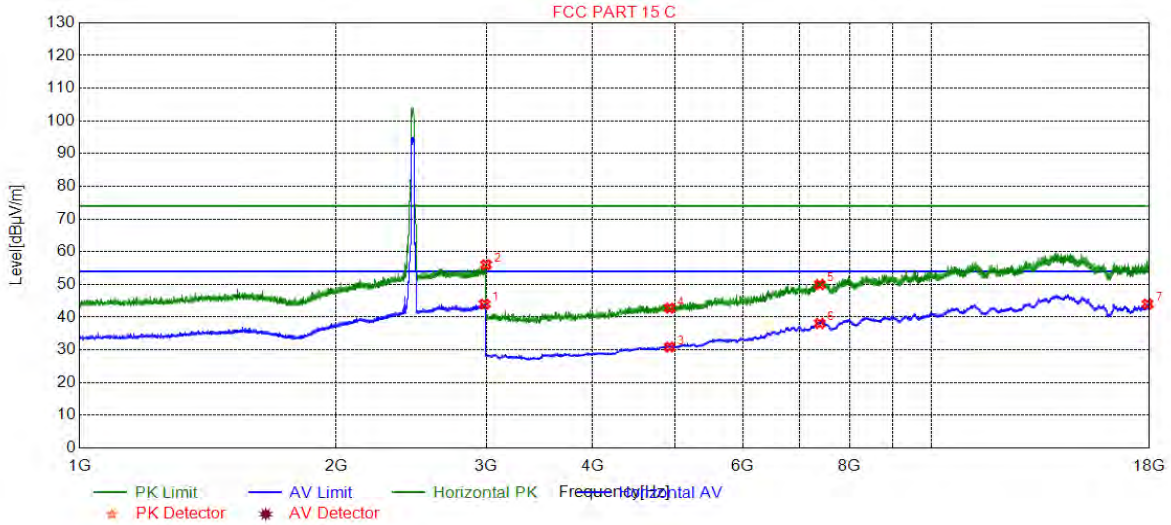
4.9.2.11 802.11G_Channel 11



Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2986.99	44.00	9.51	54.00	10.00	150	18	Horizontal
2	2998.99	56.05	9.45	74.00	17.95	150	358	Horizontal
3	4924.00	30.88	-16.81	54.00	23.12	150	232	Horizontal
4	4924.00	42.78	-16.81	74.00	31.22	150	50	Horizontal
5	7386.00	49.97	-7.78	74.00	24.03	150	346	Horizontal
6	7386.00	38.10	-7.78	54.00	15.90	150	265	Horizontal
7	17905.4	44.02	-1.31	54.00	9.98	150	198	Horizontal

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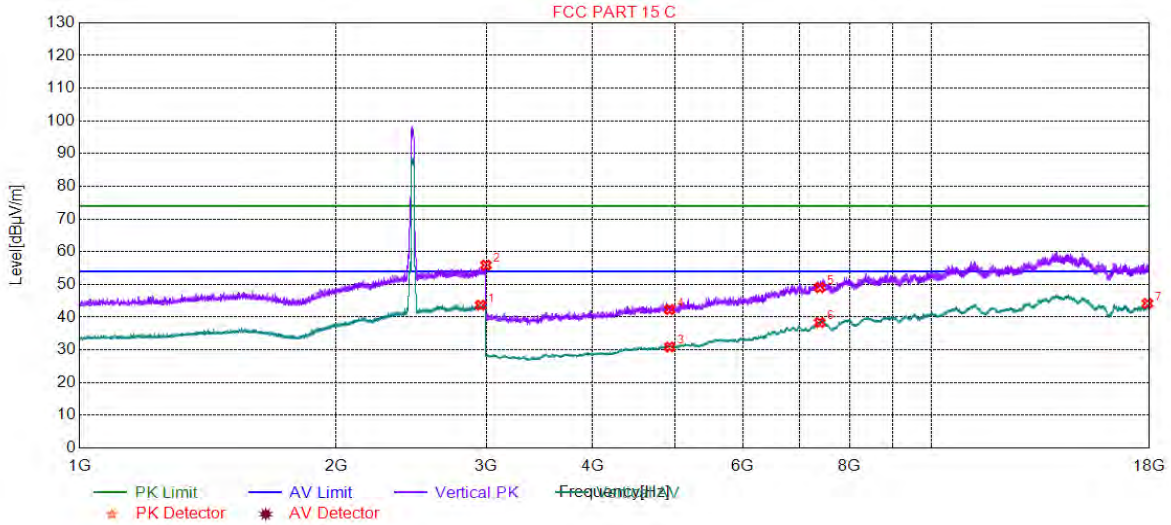
4.9.2.12 802.11G_Channel 11



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2954.48	43.65	9.66	54.00	10.35	150	2	Vertical
2	2997.99	55.92	9.46	74.00	18.08	150	163	Vertical
3	4924.00	30.91	-16.81	54.00	23.09	150	195	Vertical
4	4924.00	42.32	-16.81	74.00	31.68	150	30	Vertical
5	7386.00	49.05	-7.78	74.00	24.95	150	14	Vertical
6	7386.00	38.36	-7.78	54.00	15.64	150	112	Vertical
7	17902.4	44.21	-1.31	54.00	9.79	150	359	Vertical

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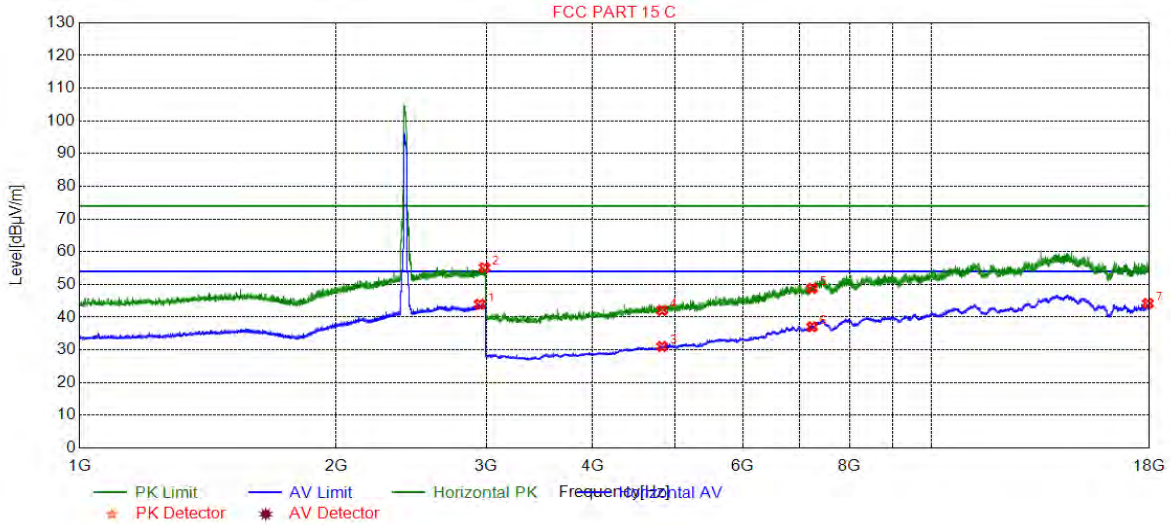
4.9.2.13 802.11N20_Channel 1



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2947.98	43.96	9.66	54.00	10.04	150	224	Horizontal
2	2986.49	55.17	9.51	74.00	18.83	150	334	Horizontal
3	4824.00	31.06	-17.13	54.00	22.94	150	33	Horizontal
4	4824.00	42.08	-17.13	74.00	31.92	150	50	Horizontal
5	7236.00	48.80	-8.48	74.00	25.20	150	313	Horizontal
6	7236.00	37.07	-8.48	54.00	16.93	150	214	Horizontal
7	17920.4	44.20	-1.30	54.00	9.80	150	2	Horizontal

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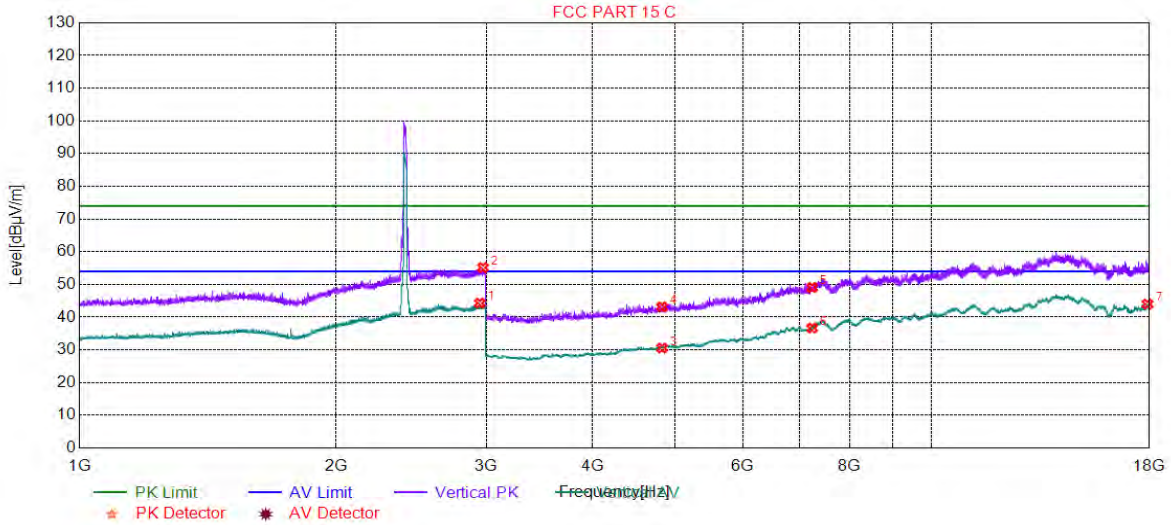
4.9.2.14 802.11N20_Channel 1



Suspected List								
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1	2948.48	44.30	9.66	54.00	9.70	150	13	Vertical
2	2973.49	55.18	9.57	74.00	18.82	150	40	Vertical
3	4824.00	30.56	-17.13	54.00	23.44	150	62	Vertical
4	4824.00	43.15	-17.13	74.00	30.85	150	292	Vertical
5	7236.00	49.09	-8.48	74.00	24.91	150	177	Vertical
6	7236.00	36.69	-8.48	54.00	17.31	150	342	Vertical
7	17903.9	44.00	-1.31	54.00	10.00	150	358	Vertical

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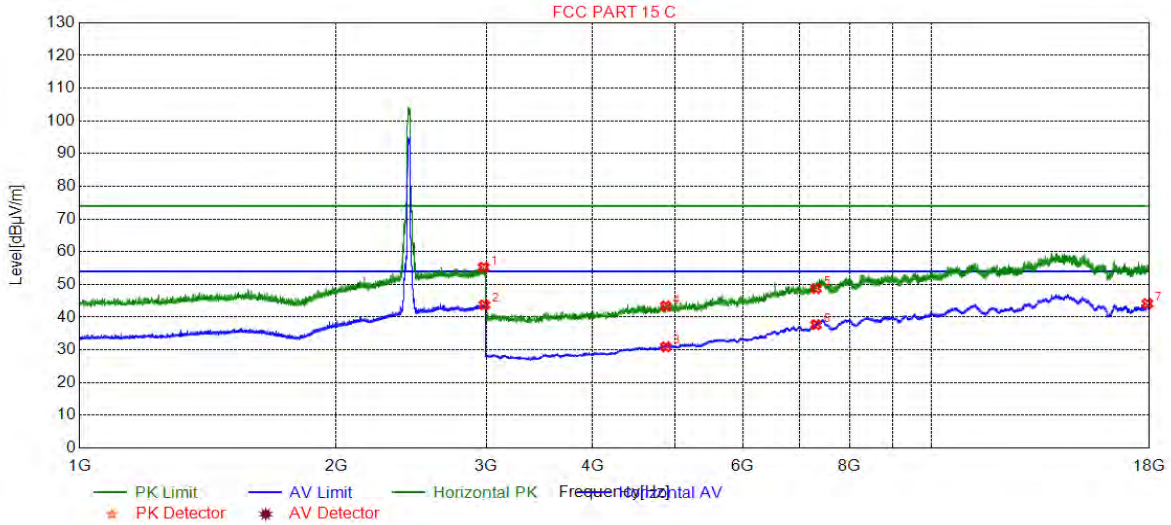
4.9.2.15 802.11N20_Channel 6



Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2980.49	55.26	9.54	74.00	18.74	150	194	Horizontal
2	2985.99	43.75	9.51	54.00	10.25	150	44	Horizontal
3	4874.00	30.93	-16.97	54.00	23.07	150	133	Horizontal
4	4874.00	43.38	-16.97	74.00	30.62	150	314	Horizontal
5	7311.00	48.77	-8.10	74.00	25.23	150	116	Horizontal
6	7311.00	37.71	-8.10	54.00	16.29	150	17	Horizontal
7	17897.9	44.16	-1.34	54.00	9.84	150	346	Horizontal

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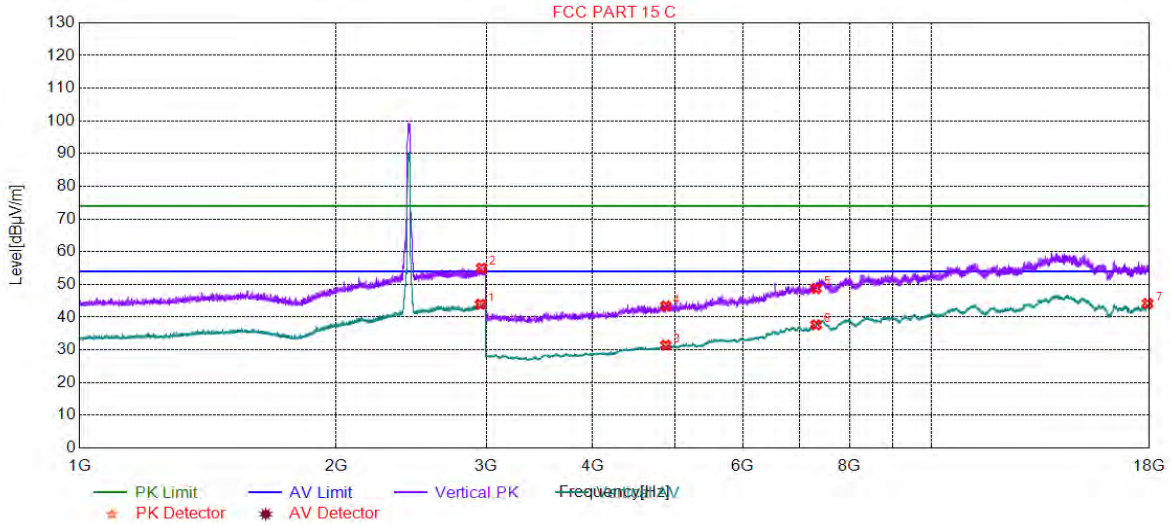
4.9.2.16 802.11N20_Channel 6



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2953.48	43.94	9.66	54.00	10.06	150	11	Vertical
2	2962.99	55.01	9.62	74.00	18.99	150	121	Vertical
3	4874.00	31.44	-16.97	54.00	22.56	150	14	Vertical
4	4874.00	43.38	-16.97	74.00	30.62	150	314	Vertical
5	7311.00	48.77	-8.10	74.00	25.23	150	116	Vertical
6	7311.00	37.65	-8.10	54.00	16.35	150	343	Vertical
7	17905.4	44.18	-1.31	54.00	9.82	150	326	Vertical

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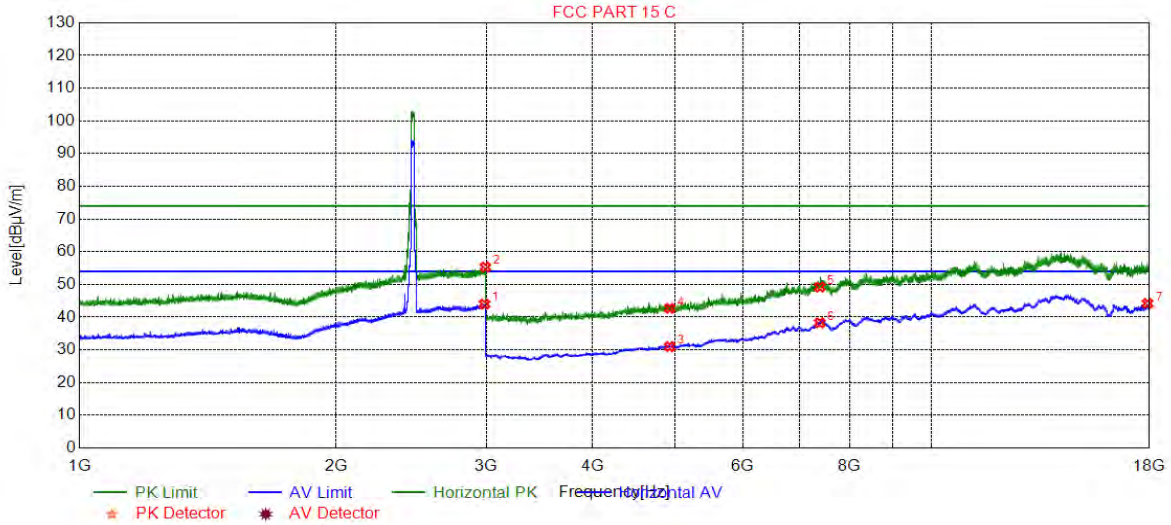
4.9.2.17 802.11N20_Channel 11



Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2985.99	44.00	9.51	54.00	10.00	150	264	Horizontal
2	2993.49	55.31	9.48	74.00	18.69	150	18	Horizontal
3	4924.00	31.00	-16.81	54.00	23.00	150	181	Horizontal
4	4924.00	42.72	-16.81	74.00	31.28	150	82	Horizontal
5	7386.00	49.22	-7.78	74.00	24.78	150	281	Horizontal
6	7386.00	38.28	-7.78	54.00	15.72	150	297	Horizontal
7	17903.9	44.21	-1.31	54.00	9.79	150	264	Horizontal

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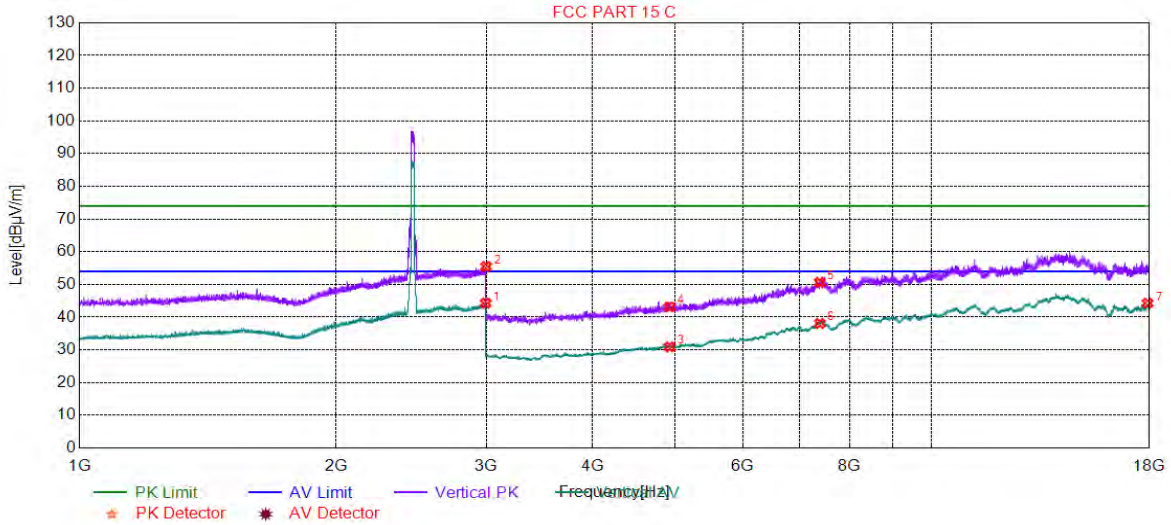
4.9.2.18 802.11N20_Channel 11



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2995.99	44.27	9.47	54.00	9.73	150	274	Vertical
2	2998.49	55.47	9.46	74.00	18.53	150	301	Vertical
3	4924.00	30.93	-16.81	54.00	23.07	150	96	Vertical
4	4924.00	43.18	-16.81	74.00	30.82	150	212	Vertical
5	7386.00	50.62	-7.78	74.00	23.38	150	63	Vertical
6	7386.00	38.08	-7.78	54.00	15.92	150	228	Vertical
7	17906.9	44.27	-1.31	54.00	9.73	150	245	Vertical

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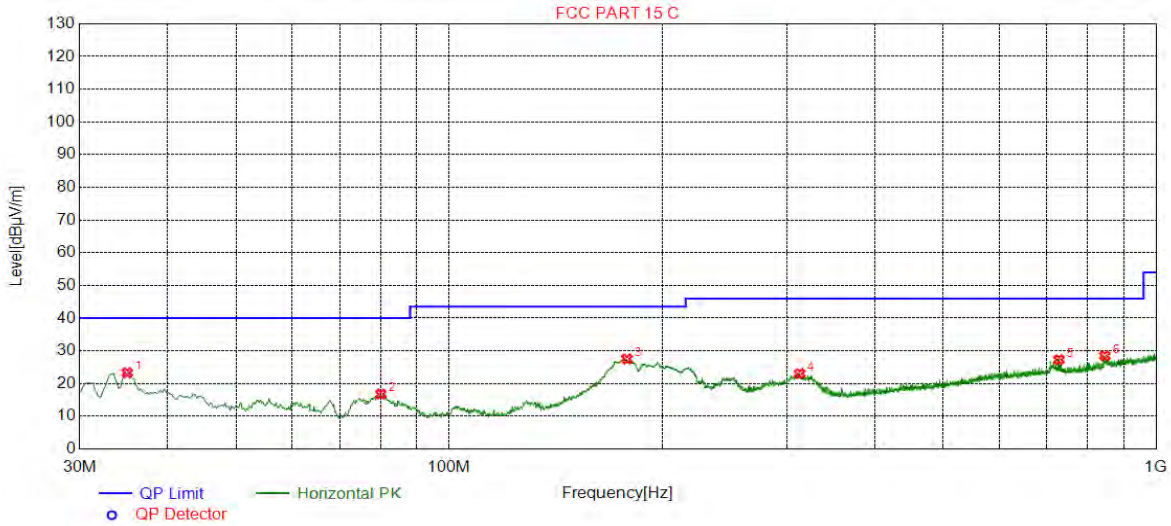
Secondly Supply:

4.9.3 Radiated emission below 1GHz

4.9.3.1 Charge + Transmitting



Suspected List					
NO.	Freq. [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Polarity
1	35.0450	23.34	40.00	16.66	Horizontal
2	80.0620	16.80	40.00	23.20	Horizontal
3	178.4397	27.53	43.50	15.97	Horizontal
4	313.2967	23.08	46.00	22.92	Horizontal
5	728.9278	27.31	46.00	18.69	Horizontal
6	846.1272	28.51	46.00	17.49	Horizontal

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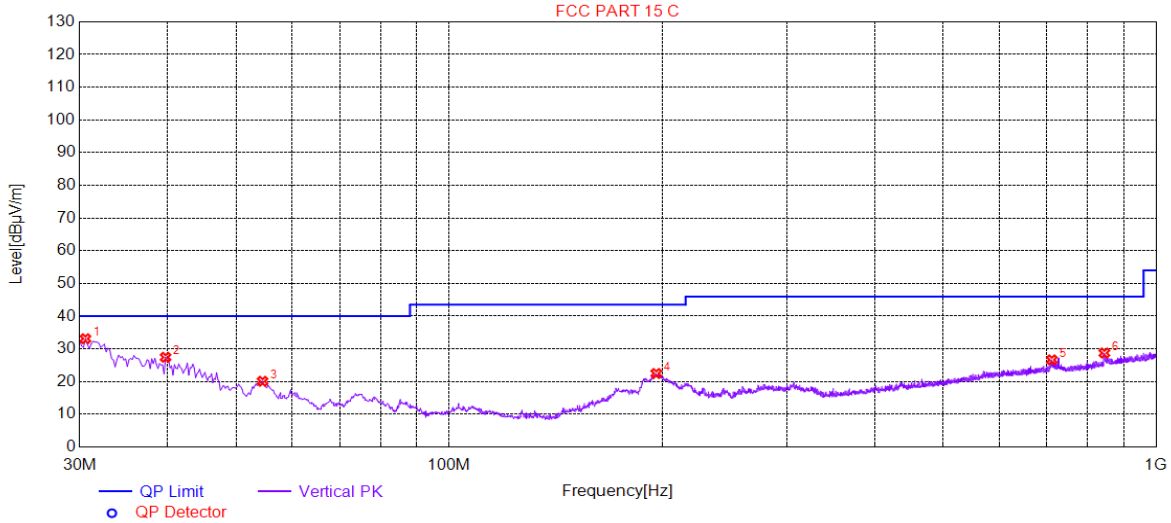

Suspected List					
NO.	Freq. [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Polarity
1	30.5821	33.12	40.00	6.88	Vertical
2	39.7019	27.44	40.00	12.56	Vertical
3	54.4489	20.11	40.00	19.89	Vertical
4	196.2913	22.50	43.50	21.00	Vertical
5	712.0464	26.66	46.00	19.34	Vertical
6	844.9630	28.75	46.00	17.25	Vertical

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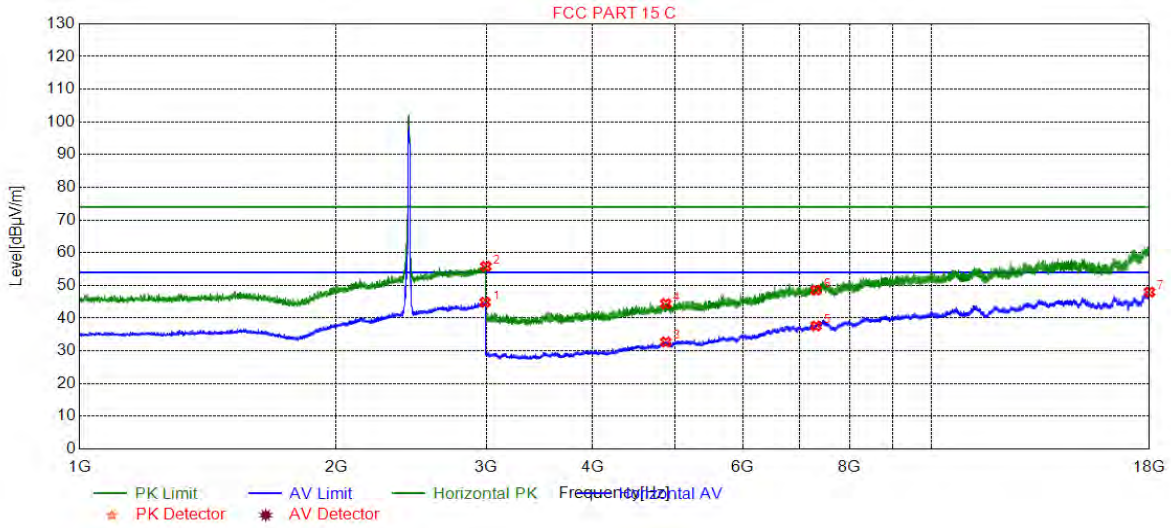
4.9.4 Transmitter emission above 1GHz

4.9.4.1 802.11B_Channel 6



Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Polarity
1	2990.497	44.88	10.46	54.00	9.12	150	Horizontal
2	2996.999	55.83	10.44	74.00	18.17	150	Horizontal
3	4874.000	32.72	-16.84	54.00	21.28	150	Horizontal
4	4874.000	44.46	-16.84	74.00	29.54	150	Horizontal
5	7311.000	37.61	-9.32	54.00	16.39	150	Horizontal
6	7311.000	48.57	-9.32	74.00	25.43	150	Horizontal
7	18000.00	47.97	2.82	54.00	6.03	150	Horizontal

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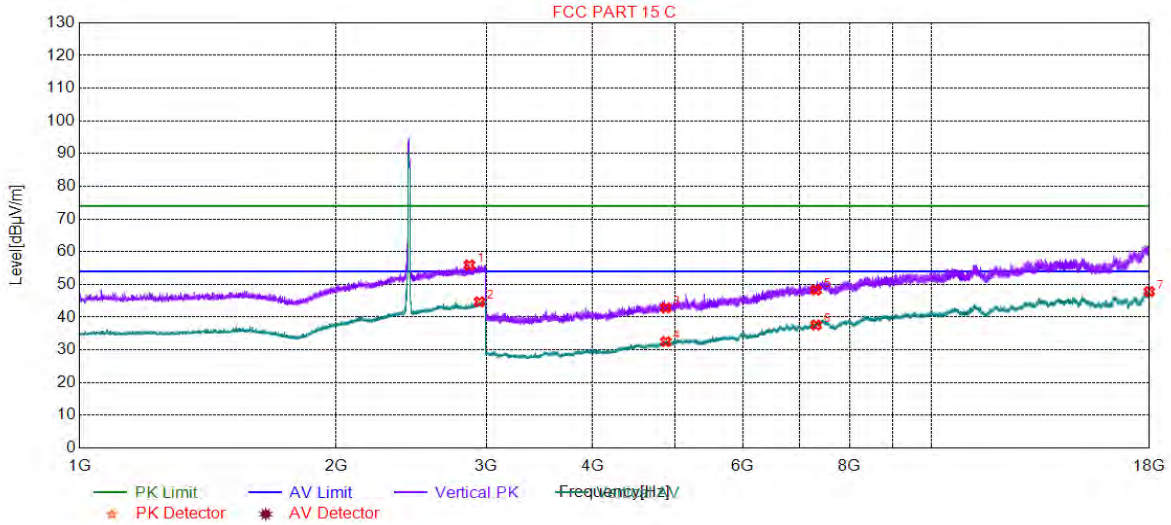
4.9.4.2 802.11B_Channel 6



Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Polarity
1	2867.466	55.95	9.93	74.00	18.05	150	Vertical
2	2945.986	44.70	10.51	54.00	9.30	150	Vertical
3	4874.000	42.82	-16.84	74.00	31.18	150	Vertical
4	4874.000	32.51	-16.84	54.00	21.49	150	Vertical
5	7311.000	48.32	-9.32	74.00	25.68	150	Vertical
6	7311.000	37.60	-9.32	54.00	16.40	150	Vertical
7	17990.24	47.83	2.76	54.00	6.17	150	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)	Remark
	30MHz-88MHz	40.0	Quasi-peak
	88MHz-216MHz	43.5	Quasi-peak
	216MHz-960MHz	46.0	Quasi-peak
	960MHz-1GHz	54.0	Quasi-peak
	Above 1GHz	54.0	Average Value
		74.0	Peak Value
Test Setup:			

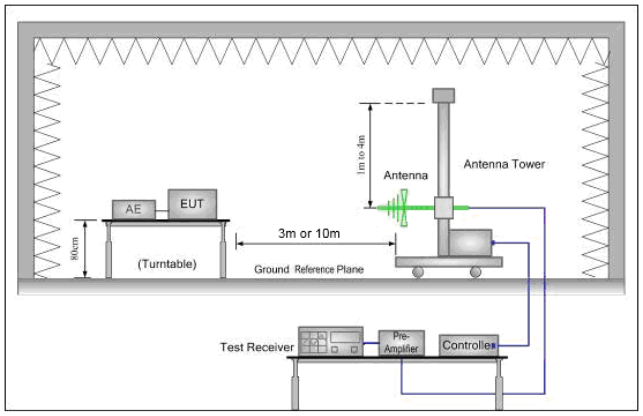

Figure 1. 30MHz to 1GHz

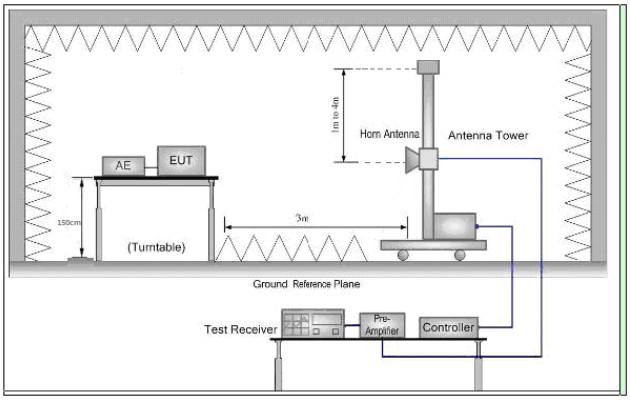

Figure 2. Above 1 GHz

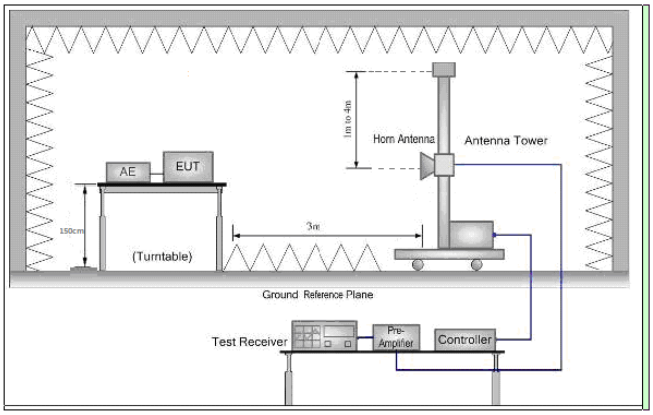

Figure 3. Above 1 GHz

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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); 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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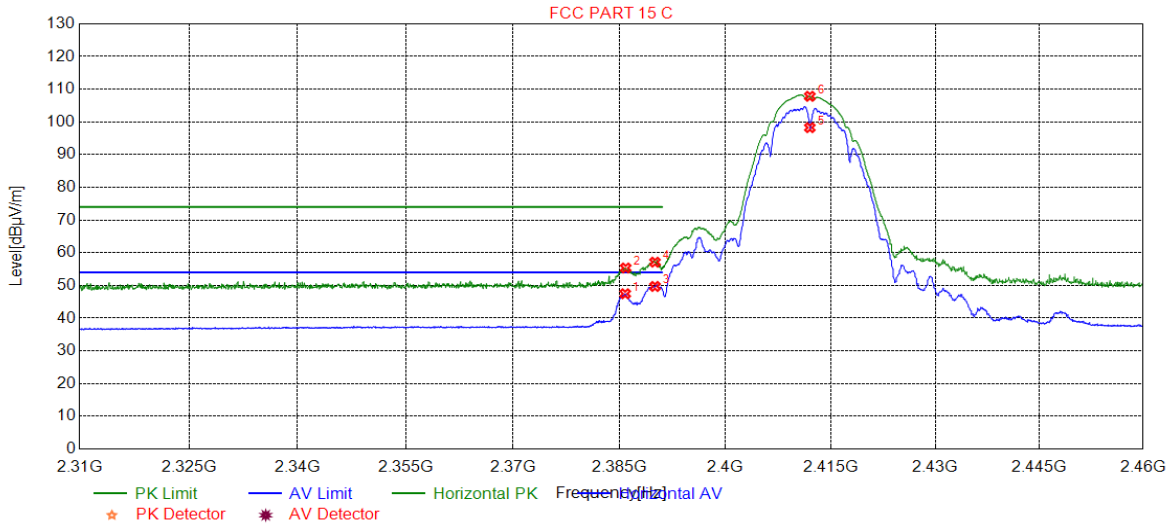
Firstly supply:

4.10.1 Test Plots

4.10.1.1 802.11B_Channel 1



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2385.78	47.48	7.77	54.00	6.52	150	57	Horizontal
2	2385.86	55.35	7.77	74.00	18.65	150	57	Horizontal
3	2390.00	49.71	7.77	54.00	4.29	150	57	Horizontal
4	2390.00	57.13	7.77	74.00	16.87	150	57	Horizontal
5	2412.00	98.26	7.81	0.00	-98.26	150	57	Horizontal
6	2412.00	107.84	7.81	0.00	-107.84	150	57	Horizontal

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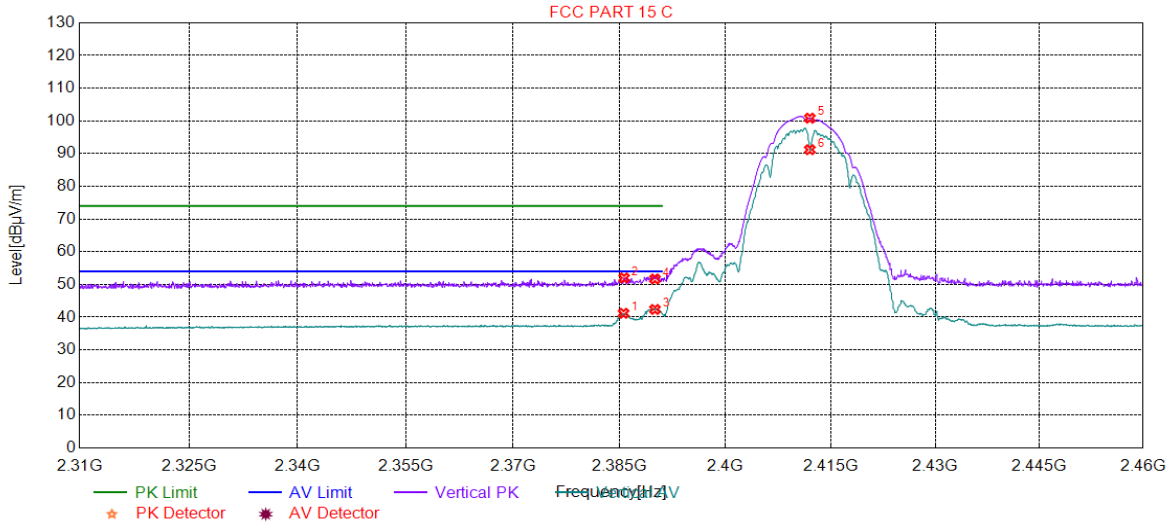
4.10.1.2 802.11B_Channel 1



Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2385.56	41.20	7.77	54.00	12.80	150	24	Vertical
2	2385.63	52.01	7.77	74.00	21.99	150	24	Vertical
3	2390.00	42.37	7.77	54.00	11.63	150	24	Vertical
4	2390.00	51.69	7.77	74.00	22.31	150	193	Vertical
5	2412.00	100.85	7.81	0.00	-100.85	150	18	Vertical
6	2412.00	91.21	7.81	0.00	-91.21	150	24	Vertical

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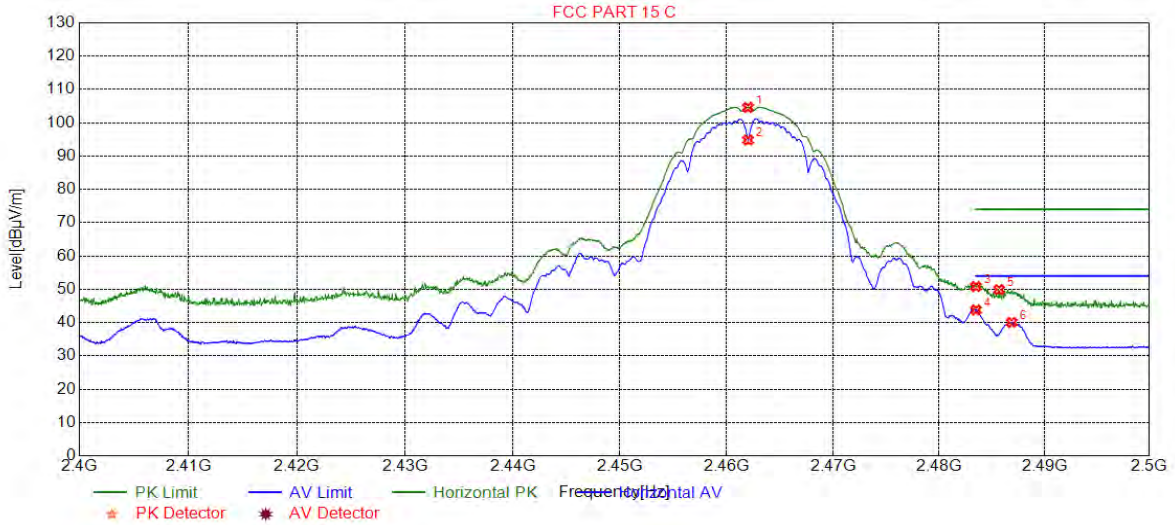
4.10.1.3 802.11B_Channel 11



Suspected List								
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1	2462.00	104.60	7.98	0.00	-104.60	150	202	Horizontal
2	2462.00	94.82	7.98	0.00	-94.82	150	202	Horizontal
3	2483.50	50.83	8.01	74.00	23.17	150	225	Horizontal
4	2483.50	43.81	8.01	54.00	10.19	150	208	Horizontal
5	2485.69	49.92	8.01	74.00	24.08	150	213	Horizontal
6	2486.89	40.09	8.01	54.00	13.91	150	208	Horizontal

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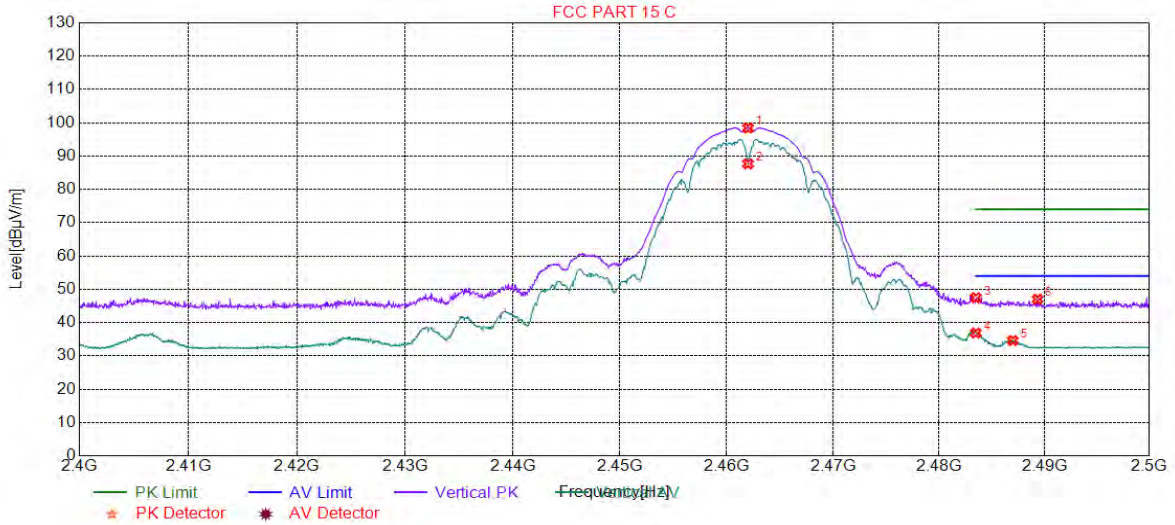
4.10.1.4 802.11B_Channel 11



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	98.40	7.98	0.00	-98.40	150	221	Vertical
2	2462.00	87.68	7.98	0.00	-87.68	150	216	Vertical
3	2483.50	47.48	8.01	74.00	26.52	150	221	Vertical
4	2483.50	36.91	8.01	54.00	17.09	150	216	Vertical
5	2486.99	34.65	8.01	54.00	19.35	150	216	Vertical
6	2489.34	47.02	8.02	74.00	26.98	150	349	Vertical

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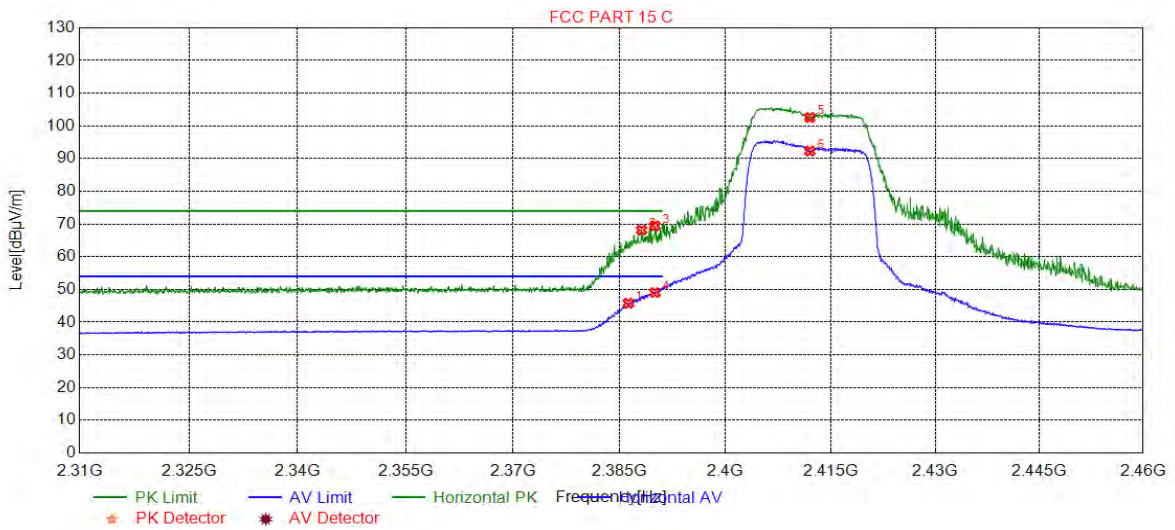
4.10.1.5 802.11G_Channel 1



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2386.23	45.82	7.77	54.00	8.18	150	207	Horizontal
2	2388.11	68.16	7.77	74.00	5.84	150	207	Horizontal
3	2390.00	69.48	7.77	74.00	4.52	150	207	Horizontal
4	2390.00	49.06	7.77	54.00	4.94	150	207	Horizontal
5	2412.00	102.58	7.81	0.00	-102.58	150	201	Horizontal
6	2412.00	92.34	7.81	0.00	-92.34	150	207	Horizontal

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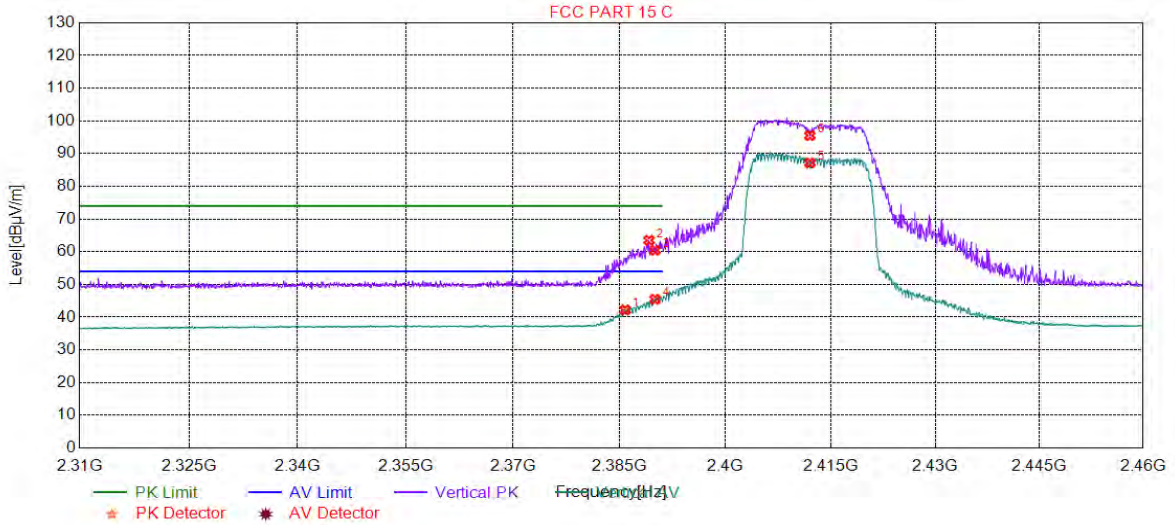
4.10.1.6 802.11G_Channel 1



Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2385.78	42.23	7.77	54.00	11.77	150	214	Vertical
2	2389.16	63.50	7.77	74.00	10.50	150	209	Vertical
3	2390.00	60.45	7.77	74.00	13.55	150	214	Vertical
4	2390.00	45.48	7.77	54.00	8.52	150	214	Vertical
5	2412.00	87.17	7.81	0.00	-87.17	150	214	Vertical
6	2412.00	95.51	7.81	0.00	-95.51	150	214	Vertical

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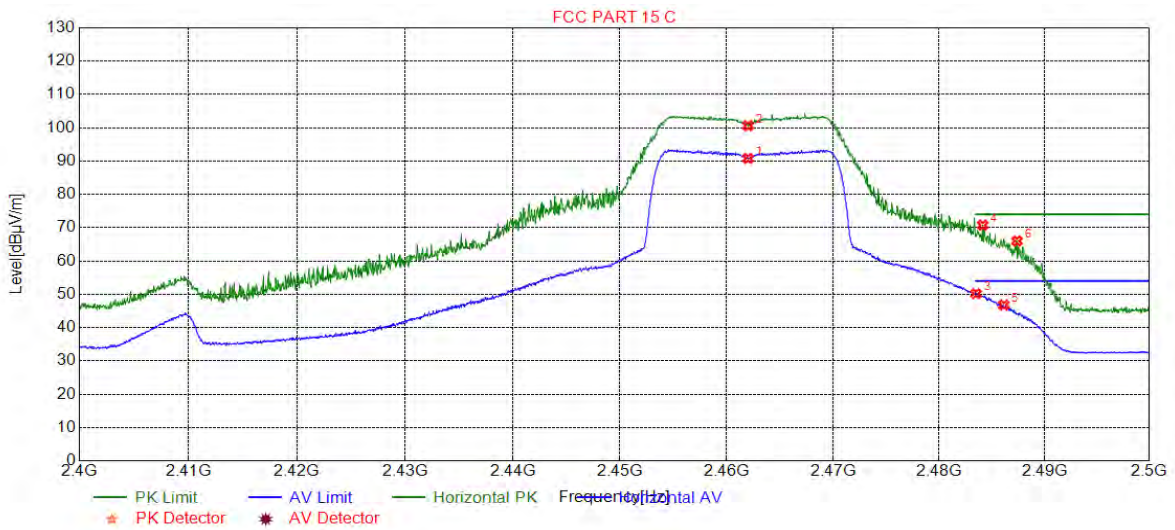
4.10.1.7 802.11G_Channel 11



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	90.80	7.98	0.00	-90.80	150	207	Horizontal
2	2462.00	100.62	7.98	0.00	-100.62	150	218	Horizontal
3	2483.50	50.18	8.01	54.00	3.82	150	212	Horizontal
4	2484.14	70.78	8.01	74.00	3.22	150	234	Horizontal
5	2486.14	46.81	8.01	54.00	7.19	150	212	Horizontal
6	2487.39	66.02	8.01	74.00	7.98	150	234	Horizontal

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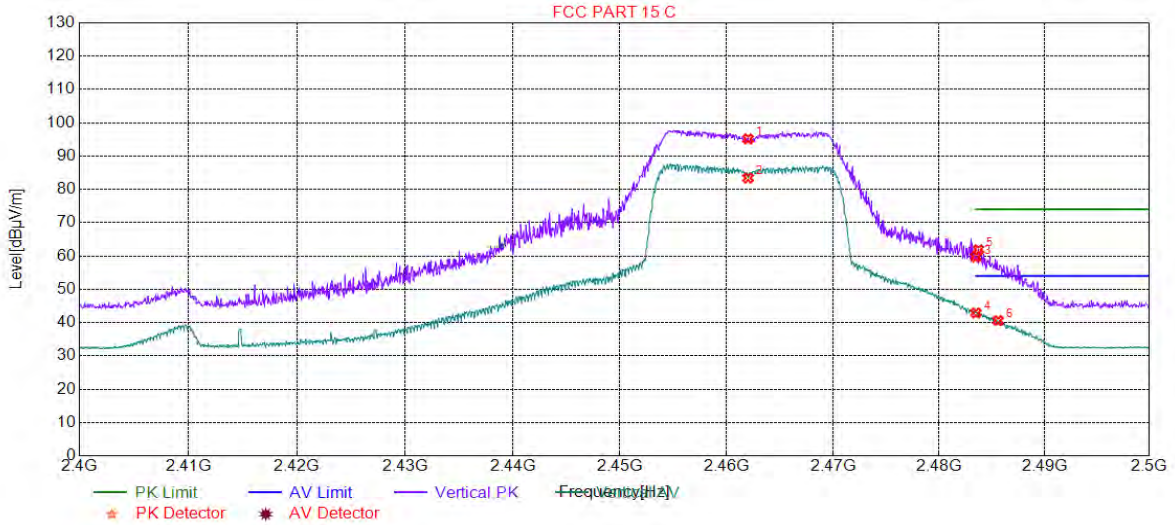
4.10.1.8 802.11G_Channel 11



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	95.16	7.98	0.00	-95.16	150	210	Vertical
2	2462.00	83.43	7.98	0.00	-83.43	150	216	Vertical
3	2483.50	59.75	8.01	74.00	14.25	150	216	Vertical
4	2483.50	42.92	8.01	54.00	11.08	150	216	Vertical
5	2483.74	61.91	8.01	74.00	12.09	150	210	Vertical
6	2485.59	40.63	8.01	54.00	13.37	150	216	Vertical

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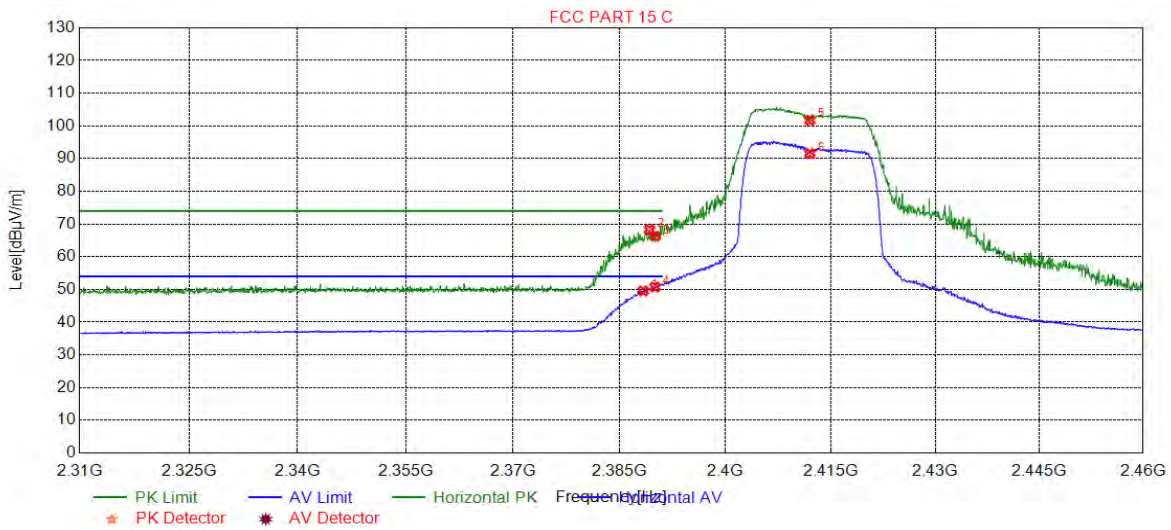
4.10.1.9 802.11N20_Channel 1



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2388.33	49.56	7.77	54.00	4.44	150	206	Horizontal
2	2389.23	68.30	7.77	74.00	5.70	150	195	Horizontal
3	2390.00	66.28	7.77	74.00	7.72	150	195	Horizontal
4	2390.00	50.76	7.77	54.00	3.24	150	206	Horizontal
5	2412.00	101.72	7.81	0.00	-101.72	150	212	Horizontal
6	2412.00	91.57	7.81	0.00	-91.57	150	206	Horizontal

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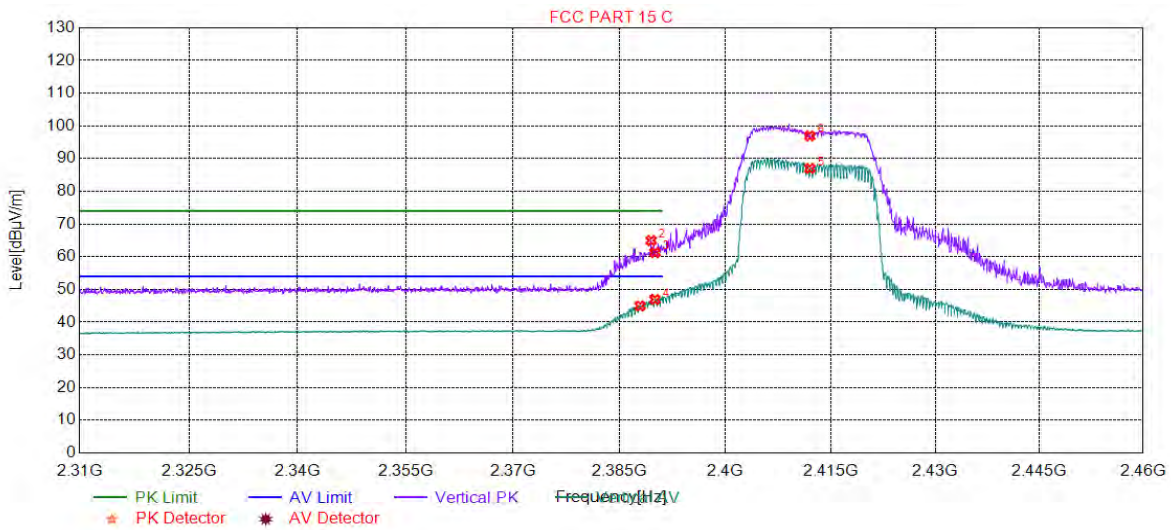
4.10.1.10 802.11N20_Channel 1



Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2387.88	44.97	7.77	54.00	9.03	150	215	Vertical
2	2389.46	64.96	7.77	74.00	9.04	150	215	Vertical
3	2390.00	61.26	7.77	74.00	12.74	150	94	Vertical
4	2390.00	46.94	7.77	54.00	7.06	150	215	Vertical
5	2412.00	87.01	7.81	0.00	-87.01	150	215	Vertical
6	2412.00	96.95	7.81	0.00	-96.95	150	209	Vertical

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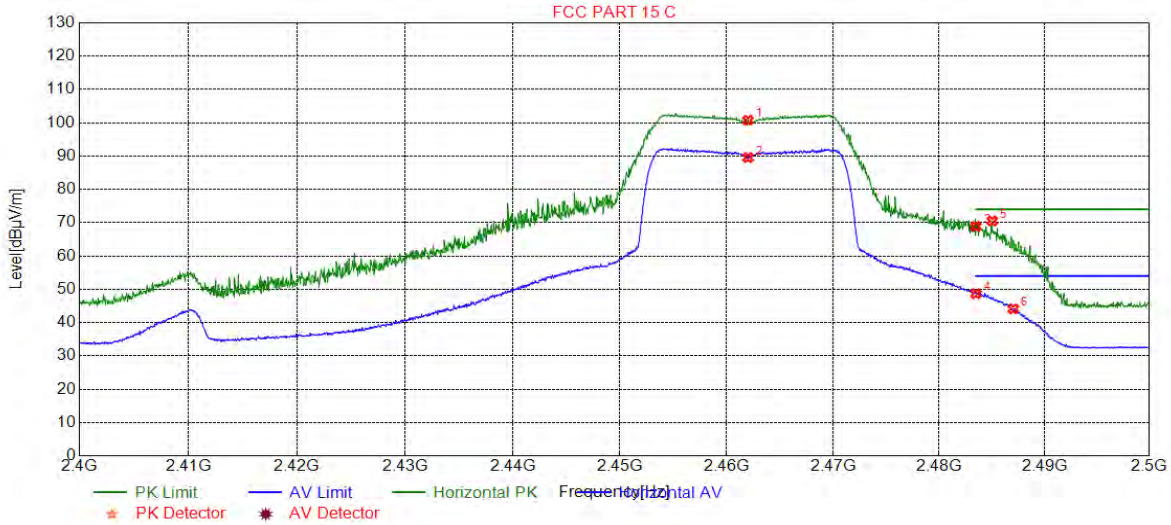
4.10.1.11 802.11N20_Channel 11



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	100.76	7.98	0.00	-100.76	150	204	Horizontal
2	2462.00	89.55	7.98	0.00	-89.55	150	209	Horizontal
3	2483.50	68.89	8.01	74.00	5.11	150	215	Horizontal
4	2483.50	48.69	8.01	54.00	5.31	150	237	Horizontal
5	2485.04	70.55	8.01	74.00	3.45	150	215	Horizontal
6	2487.04	44.14	8.01	54.00	9.86	150	231	Horizontal

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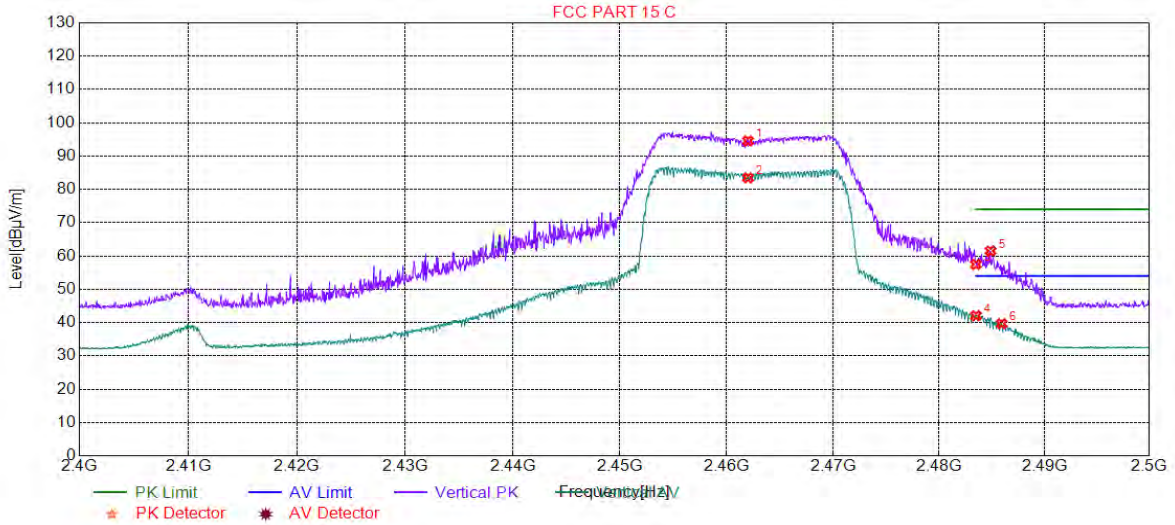
4.10.1.12 802.11N20_Channel 11



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	94.56	7.98	0.00	-94.56	150	212	Vertical
2	2462.00	83.46	7.98	0.00	-83.46	150	212	Vertical
3	2483.50	57.45	8.01	74.00	16.55	150	212	Vertical
4	2483.50	42.08	8.01	54.00	11.92	150	212	Vertical
5	2484.89	61.53	8.01	74.00	12.47	150	212	Vertical
6	2485.94	39.70	8.01	54.00	14.30	150	212	Vertical

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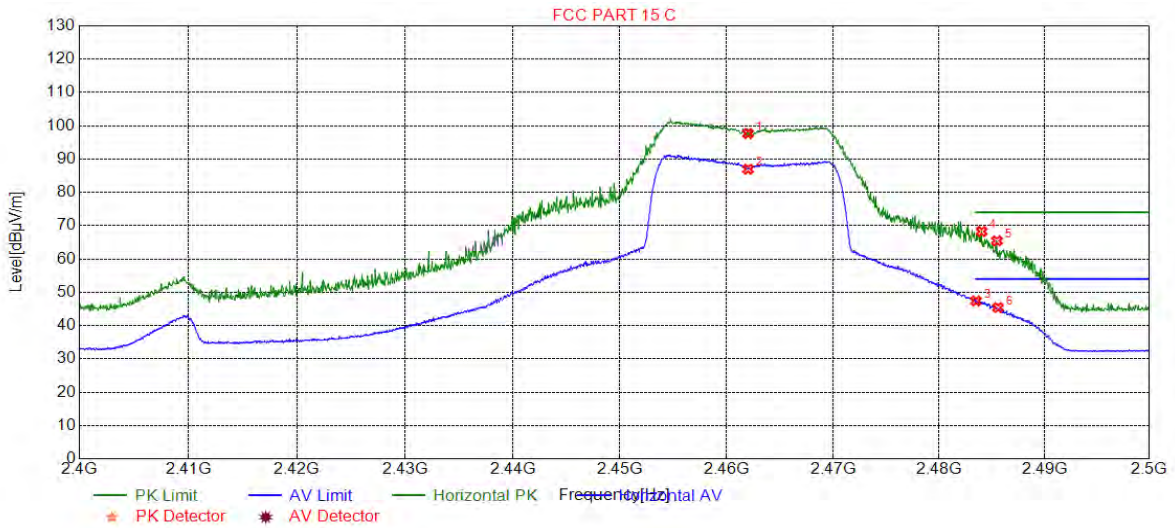
Secondly supply:

4.10.1.13 802.11G_Channel 11



Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Polarity
1	2462.000	97.66	8.04	0.00	-97.66	150	Horizontal
2	2462.000	86.97	8.04	0.00	-86.97	150	Horizontal
3	2483.500	47.42	8.05	54.00	6.58	150	Horizontal
4	2484.042	68.27	8.05	74.00	5.73	150	Horizontal
5	2485.492	65.46	8.05	74.00	8.54	150	Horizontal
6	2485.592	45.42	8.05	54.00	8.58	150	Horizontal

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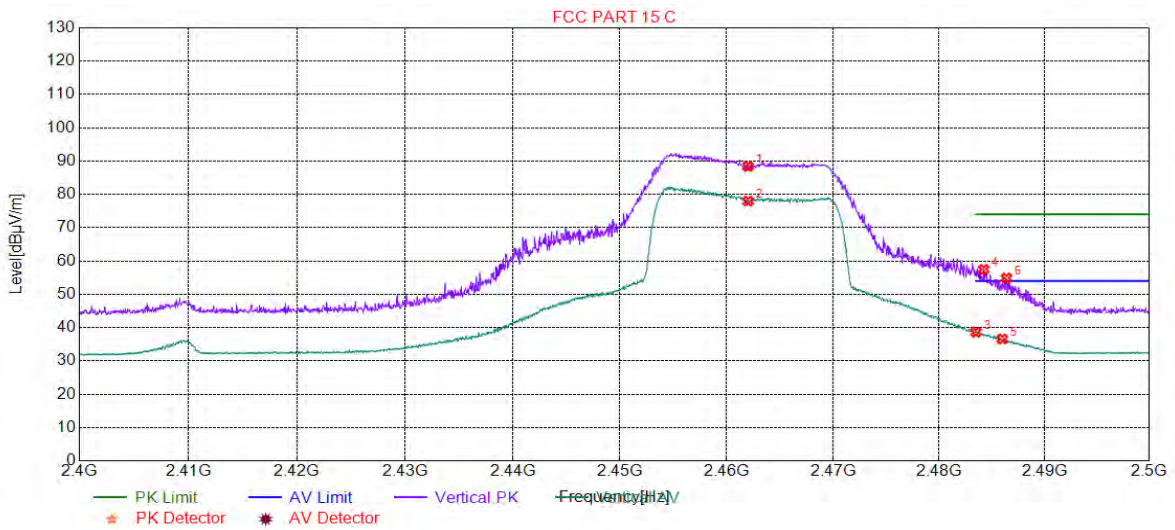
4.10.1.14 802.11G_Channel 11



Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Polarity
1	2462.000	88.40	8.04	0.00	-88.40	150	Vertical
2	2462.000	77.99	8.04	0.00	-77.99	150	Vertical
3	2483.500	38.66	8.05	54.00	15.34	150	Vertical
4	2484.242	57.50	8.05	74.00	16.50	150	Vertical
5	2485.993	36.61	8.05	54.00	17.39	150	Vertical
6	2486.393	54.89	8.05	74.00	19.11	150	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)

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	Radiated Spurious emission test	±4.5dB (30MHz-1GHz)
		±4.8dB (1GHz-25GHz)
5	Conduct emission test	±3.12 dB (9KHz- 30MHz)
6	Temperature test	±1°C
7	Humidity test	±3%
8	DC and low frequency voltages	±0.5%

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6 Equipment List

Conducted Emission					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Duedate (yyyy-mm-dd
Shielding Room	ZhongYu Electron	GB-88	SEM001-06	2020/5/10	2023/5/9
LISN	Rohde & Schwarz	ENV216	SEM007-01	2020/7/14	2021/7/14
LISN	ETS-LINDGREN	Feb-16	SEM007-02	2020/4/1	2021/3/31
Measurement Software	AUDIX	e3 V5.4.1221d	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM024-01	2020/6/12	2021/6/11
2 Line ISN	Fischer Custom Communications Inc	FCC-TLISN-T2-02	EMC0122	2020/2/11	2021/2/10
EMI Test Receiver	Rohde & Schwarz	ESCI	SEM004-02	2020/3/2	2021/3/1

RF conducted test					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Duedate (yyyy-mm-dd
DC Power Supply	Agilent Technologie 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
				2019/10/27	2020/10/27
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2020/7/14	2021/7/14

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RE in Chamber					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd	Cal.Due date (yyyy-mm-dd)
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018/3/13	2021/3/12
Measurement Software	AUDIX	e3V8.2014-6-2	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2020/6/12	2021/6/11
EXA Signal Analyzer (10Hz-26.5GHz)	Agilent Technologie Inc	N9010A	SEM004-09	2020/3/12	2021/3/11
BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-01	2020/6/27	2023/6/26
Horn Antenna (0.8-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2018/4/13	2021/4/12
Pre-amplifier(0.1-1.3GHz	HP	8447D	SEM005-02	2020/7/14	2021/7/14
Low Noise Amplifier(100MHz-18GHz)	Black Diamond Series	BDLNA-0118-352810	SEM005-05	2020/9/3	2021/9/2
Horn Antenna (15-40GHz)	Schwarzbeck	BBHA 9170	SEM003-15	2020/10/17	2023/10/16
Pre-amplifier(18-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2020/3/2	2021/3/1
Band filter	N/A	N/A	SEM023-01	N/A	N/A

RE in Chamber					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd	Cal.Due date (yyyy-mm-dd)
3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2020/8/5	2023/8/4
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM025-01	2020/6/12	2021/6/11
MXE EMI Receiver (20Hz-8.4GHz)	Agilent Technologie	N9038A	SEM004-05	2020/7/14	2021/7/14
BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-01	2020/6/27	2023/6/26
Pre-amplifier (0.1-1.3GHz)	Agilent Technologie	8447D	SEM005-01	2020/3/2	2021/3/1

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RE in Chamber					
Test Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. Date (yyyy mm-dd)**	**Cal. Due date (yyyy-mm-dd)**
10m Semi-Anechoic Chamber	SAEMC	FSAC1018	SEM001-03	2018/3/31	2021/3/30
EMI Test Receiver (9k-7GHz)	Rohde & Schwarz	ESR	SEM004-03	2020/3/2	2021/3/1
Trilog-Broadband Antenna(25M-2GHz)	Schwarzbeck	VULB9168	SEM003-18	2020/3/15	2022/3/14
Pre-amplifier (9k-1GHz)	Sonoma	310N	SEM005-03	2020/3/12	2021/3/11
Loop Antenna (9kHz-30MHz)	ETS-Lindgren	6502	SEM003-08	2020/8/22	2023/8/21
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM029-01	2020/6/12	2021/6/11

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7 Photographs - EUT Constructional Details

Refer to Appendix A - Photographs of Set-Up for ZR/2020/A0015.

The End

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