FCC TEST REPORT

Application No:	ZR/2020/90041
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:	Mobile Phone
Model No.:	TA-1337
Trade Mark:	NOKIA
FCC ID:	2AJOTTA-1337
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:	2020/9/22
Date of Test:	2020/9/22 to 2020/10/16
Date of Issue:	2021/4/16
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		2020/10/16		Original
02		2021/4/16	Jim Huang	1. Add test site Information 2.Modify data conversion error of antenna height 3.Update equipment list

*This report supersedes our previous report ZR/2020/9004102, issued on 2020-10-16, which is hereby deemed null and void.

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

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2 Test Summary

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

Remark：All test were performed by Lab A and B.
Parts of test items above were subcontracted to Lab B.
Lab A SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
Lab B SGS-CSTC STANDARDS TECHNICAL SERVICES (XI 'AN) CO., LTD.

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3 General Information

3.1 Client Information

Applicant:	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

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, Lean 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.:	TA-1337
Trade Mark:	NOKIA
Hardware Version:	MB_V3
Software Version:	00WW-A01
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:	-0.85dBi
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		
Operation Frequency of each channel (802.11N HT40)							
Channel	Frequency	Channel	Frequency	Channel	Frequency		
3	2422MHz	6	2437MHz	9	2452MHz		
4	2427MHz	7	2442MHz				
5	2432MHz	8	2447MHz				

Remark:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the

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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 -0.85dBi.	

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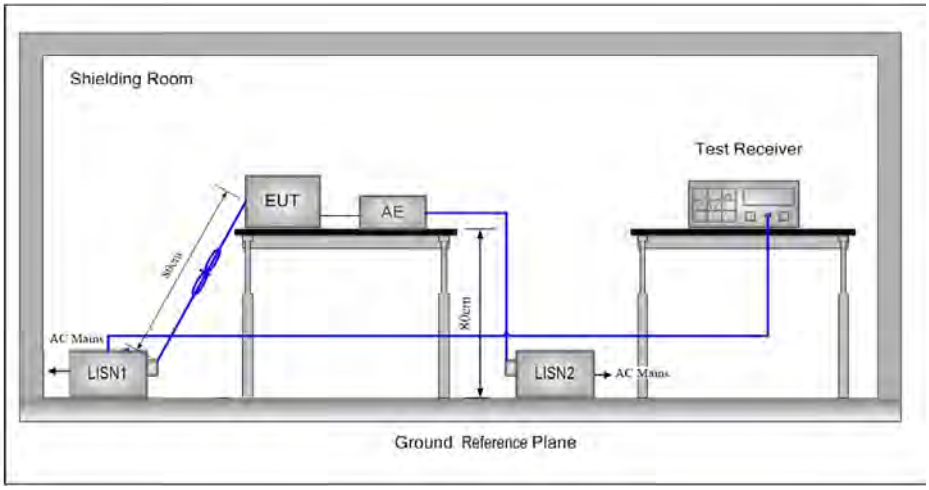
Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates at lowest, middle and highest channel. Charge + Transmitting mode.
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate of 802.11B at lowest channel is the worst case. Charge + Transmitting mode. Only the worst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

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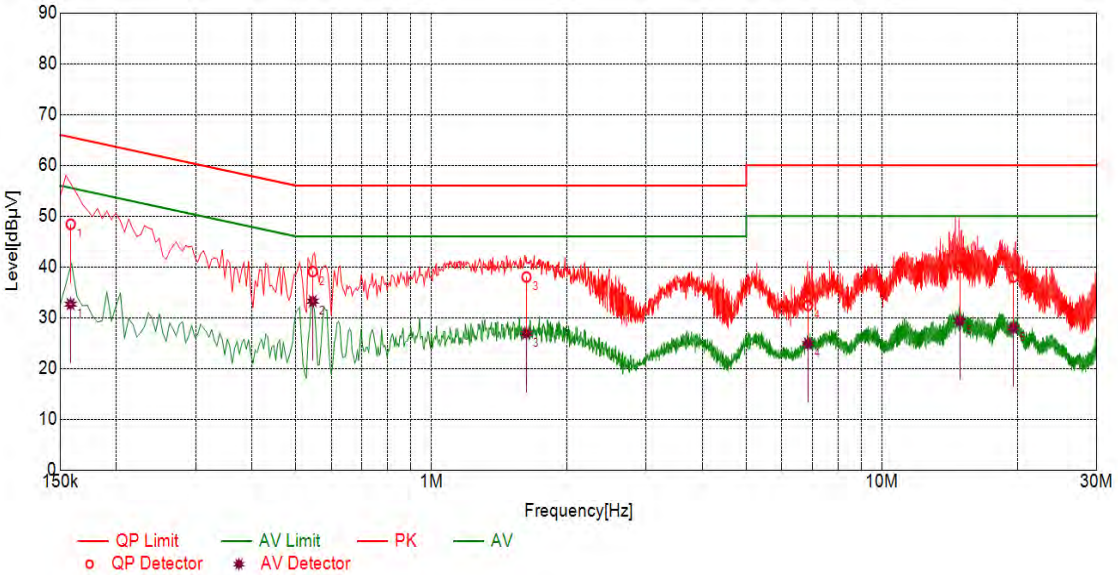
Measurement Data

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 [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Type
1	0.1583	10.10	48.40	65.55	17.15	32.66	55.55	22.89	L
2	0.5457	10.10	39.08	56.00	16.92	33.25	46.00	12.75	L
3	1.6263	10.10	38.00	56.00	18.00	26.89	46.00	19.11	L
4	6.8555	10.10	32.39	60.00	27.61	24.90	50.00	25.10	L
5	14.8956	10.11	39.96	60.00	20.04	29.36	50.00	20.64	L
6	19.5807	10.11	38.00	60.00	22.00	27.97	50.00	22.03	L

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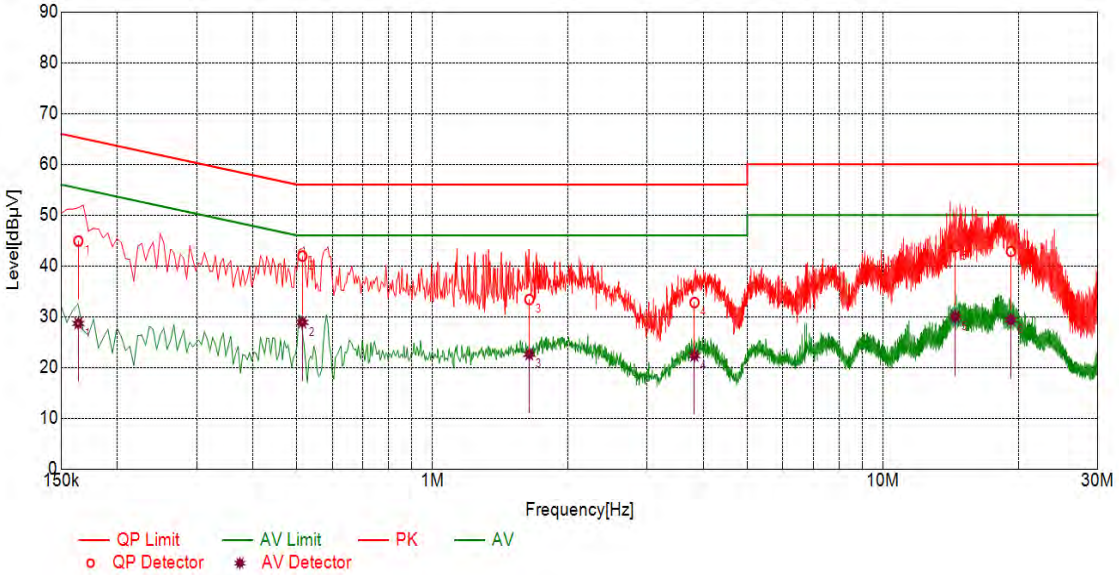
Neutral Line:



Test Graph

Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBμV]	QP Limit [dBμV]	QP Margin [dB]	AV Value [dBμV]	AV Limit [dBμV]	AV Margin [dB]	Type
1	0.1638	10.10	44.89	65.27	20.38	28.66	55.27	26.61	N
2	0.5146	10.10	41.93	56.00	14.07	28.88	46.00	17.12	N
3	1.6418	10.10	33.39	56.00	22.61	22.59	46.00	23.41	N
4	3.8186	10.10	32.78	56.00	23.22	22.32	46.00	23.68	N
5	14.4894	10.11	43.82	60.00	16.18	29.98	50.00	20.02	N
6	19.2461	10.11	42.84	60.00	17.16	29.37	50.00	20.63	N

Remarks:

1. The following Quasi-Peak and Average measurements were performed on the EUT:

2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.

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4.3 Duty Cycle

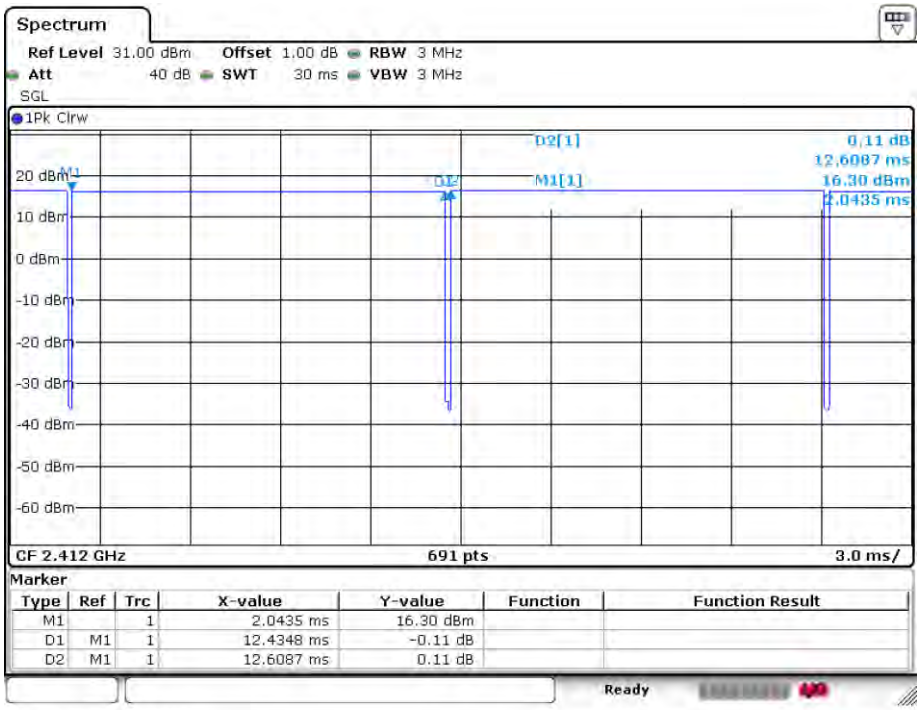
4.3.1 Test Results

Test Mode	TX Freq. [MHz]	Duty cycle [%]
11B	Ant 1: CH1,CH6,CH11	98.62
11G	Ant 1: CH1,CH6,CH11	98.35
11N20	Ant 1: CH1,CH6,CH11	98.22
11N40	Ant 1: CH3,CH6,CH9	93.94

4.3.1 Test Plots

4.3.1.1 ANT1

4.3.1.1.1 11B



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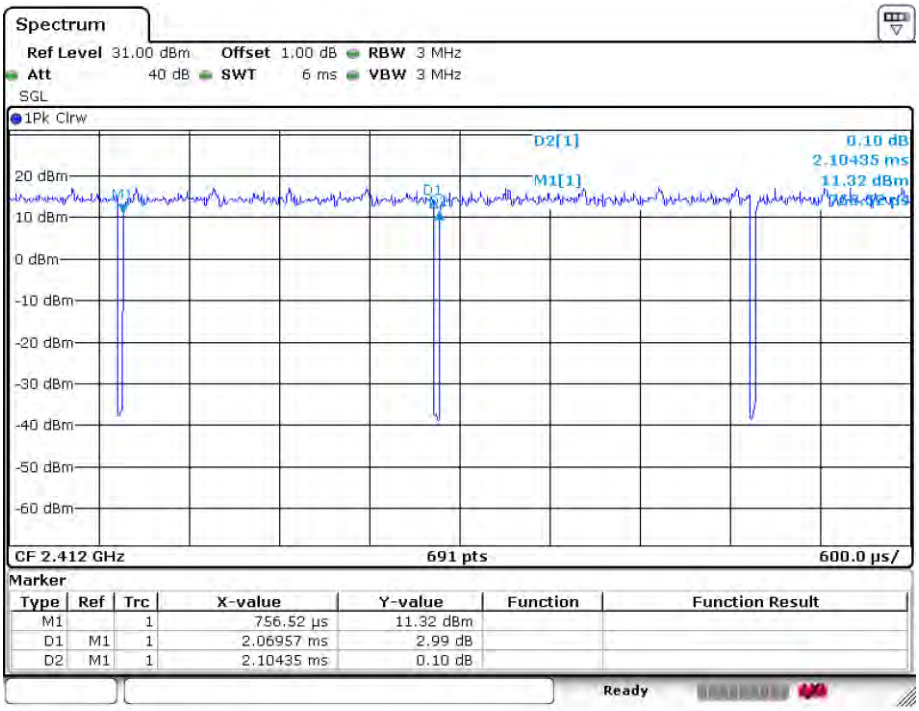
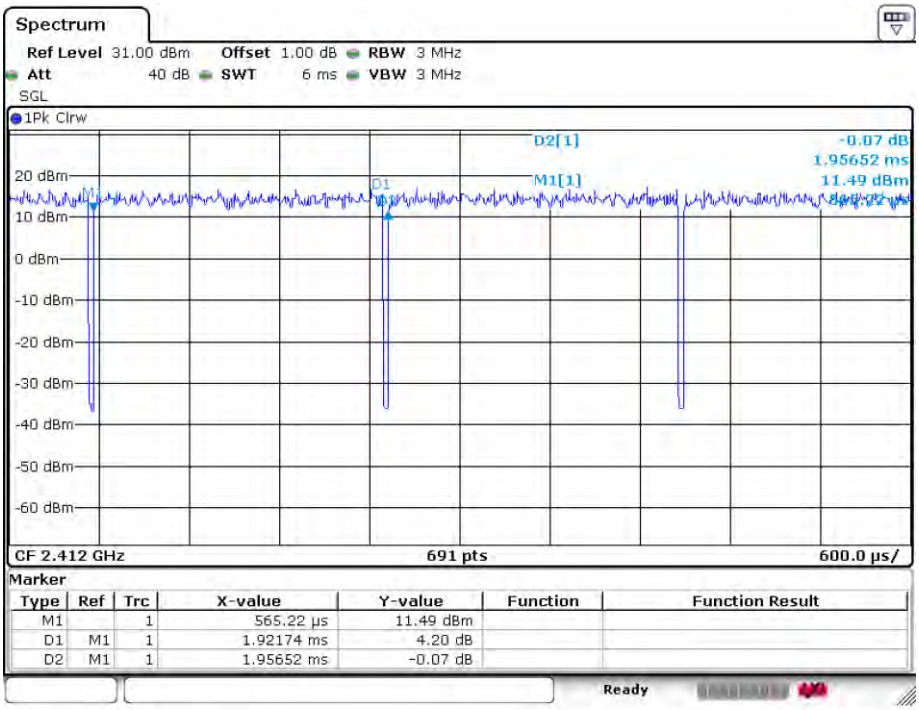
4.3.1.1.2 11G



Date: 27.SEP.2020 18:12:07

4.3.1.1.3 11N20



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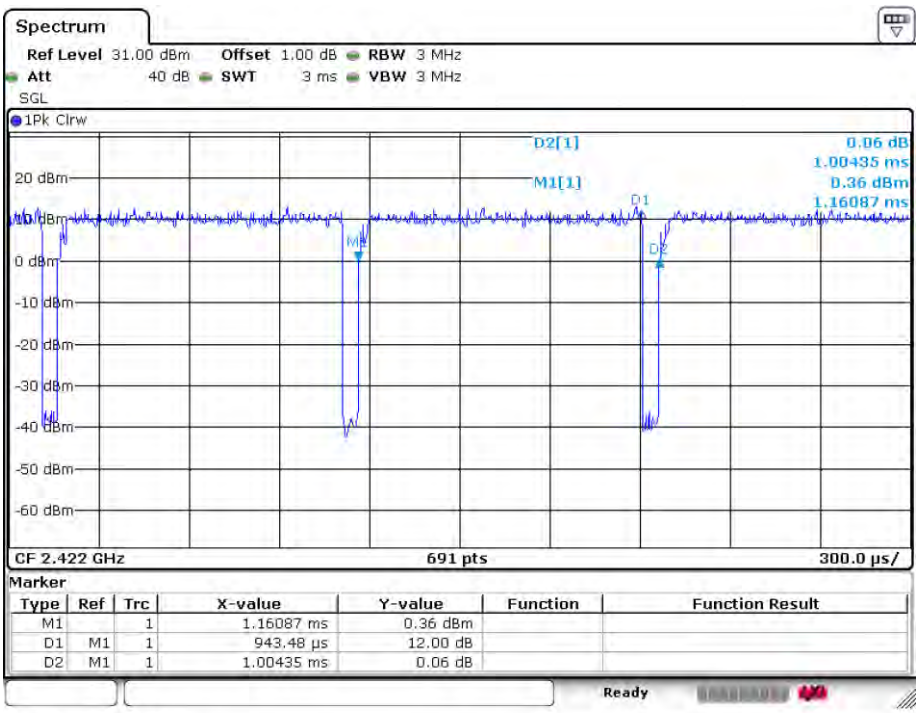
4.3.1.1.4 11N40



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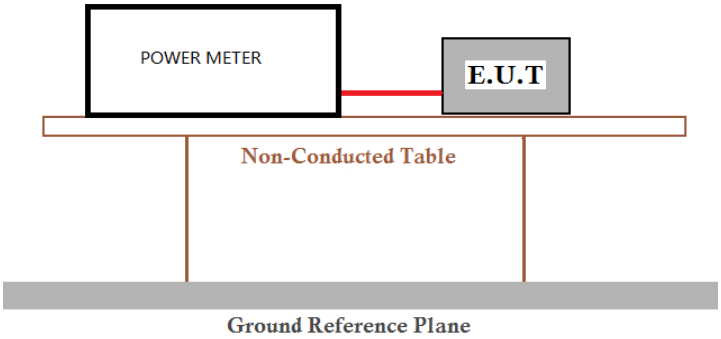
4.4 Conducted Output Power

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	16.66	30.00	Pass
	Middle	16.93	30.00	Pass
	Highest	16.99	30.00	Pass
802.11G	Lowest	15.15	30.00	Pass
	Middle	15.51	30.00	Pass
	Highest	15.22	30.00	Pass
802.11N20	Lowest	14.25	30.00	Pass
	Middle	14.59	30.00	Pass
	Highest	14.22	30.00	Pass
802.11N40	Lowest	15.05	30.00	Pass
	Middle	15.26	30.00	Pass
	Highest	15.40	30.00	Pass

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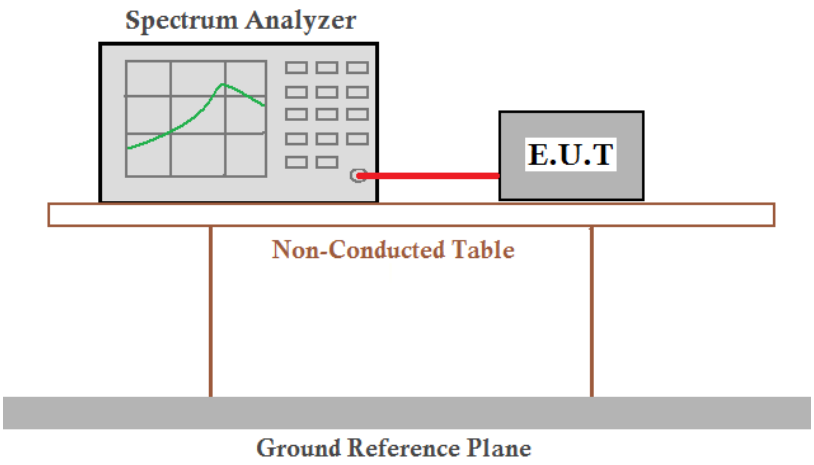
4.5 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)
Test Method:	ANSI C63.10: 2013 Section 11.8.1 Option 1
Test Setup:	
Instruments Used:	Refer to section 5.10 for details
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G; 6.5Mbps of rate is the worst case of 802.11N(HT20); 13.5Mbps of rate is the worst case of 802.11N(HT40).
Limit:	≥ 500 kHz
Test Results:	Pass

4.5.1 Test Results

Mode	Test Channel	Occupied Bandwidth (MHz)	6dB Emission Bandwidth (MHz)	Limit (kHz)	Result
802.11B	Lowest	13.81	8.08	≥500	Pass
	Middle	13.85	8.94	≥500	Pass
	Highest	13.63	8.03	≥500	Pass
802.11G	Lowest	16.67	16.06	≥500	Pass
	Middle	16.71	15.89	≥500	Pass
	Highest	16.67	15.63	≥500	Pass
802.11N20	Lowest	17.84	16.76	≥500	Pass
	Middle	17.84	16.89	≥500	Pass
	Highest	17.80	16.89	≥500	Pass
802.11N40	Lowest	36.21	36.30	≥500	Pass
	Middle	36.38	36.26	≥500	Pass
	Highest	36.38	36.28	≥500	Pass

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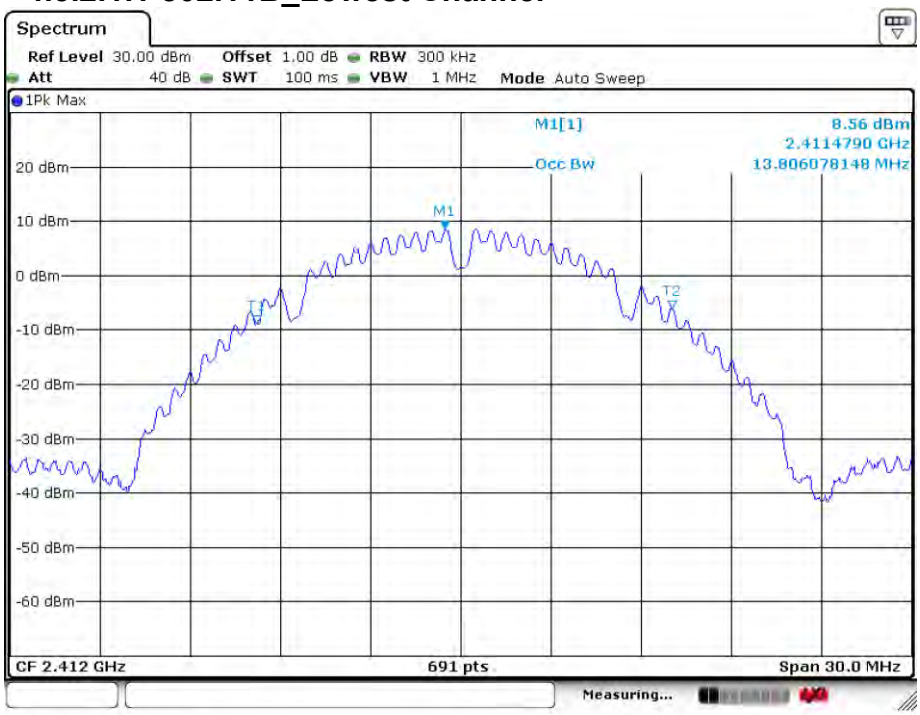
4.5.2 Test plots

4.5.2.1 ANT1

4.5.2.1.1 802.11B_Lowest Channel



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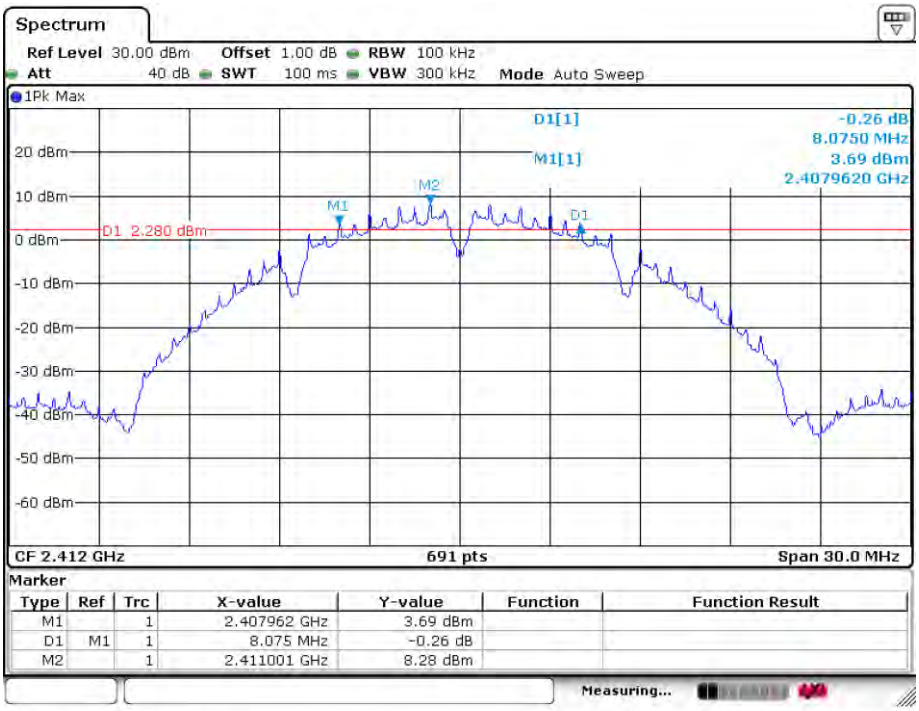

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.407962 GHz	3.69 dBm		
D1	M1	1	8.075 MHz	-0.26 dB		
M2		1	2.411001 GHz	8.28 dBm		

Date: 27.SEP.2020 17:02:44

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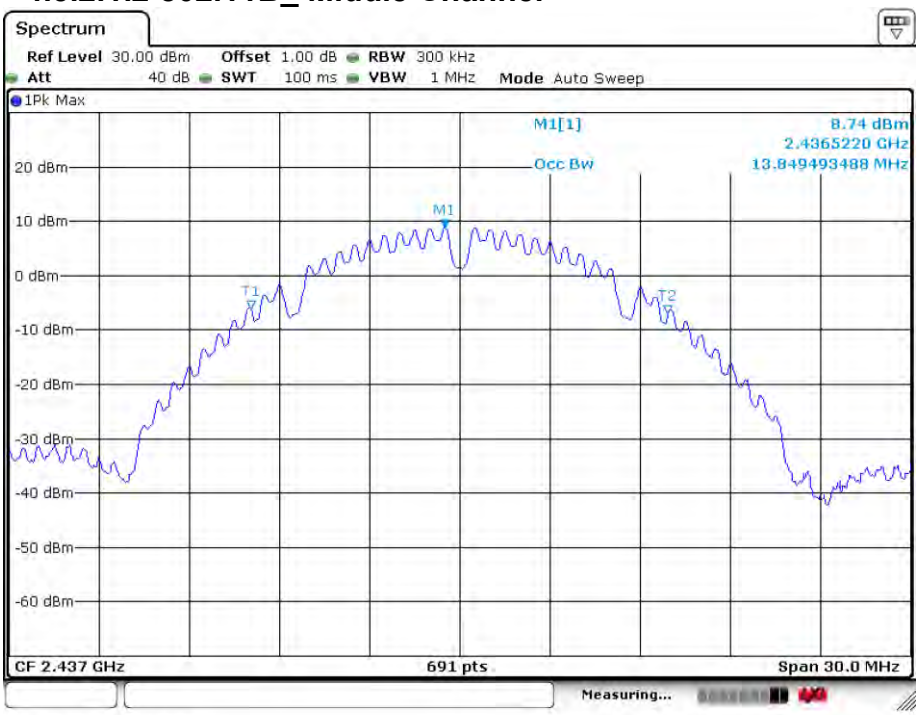
4.5.2.1.2 802.11B_ Middle Channel



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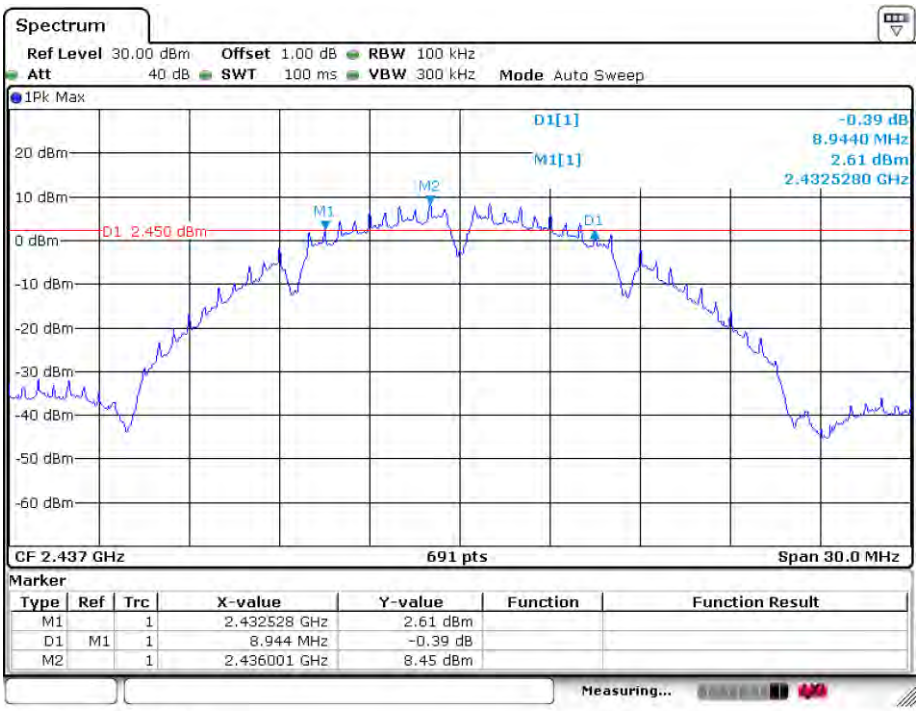

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.432528 GHz	2.61 dBm		
D1	M1	1	8.944 MHz	-0.39 dB		
M2		1	2.436001 GHz	8.45 dBm		

Date: 27.SEP.2020 17:01:56

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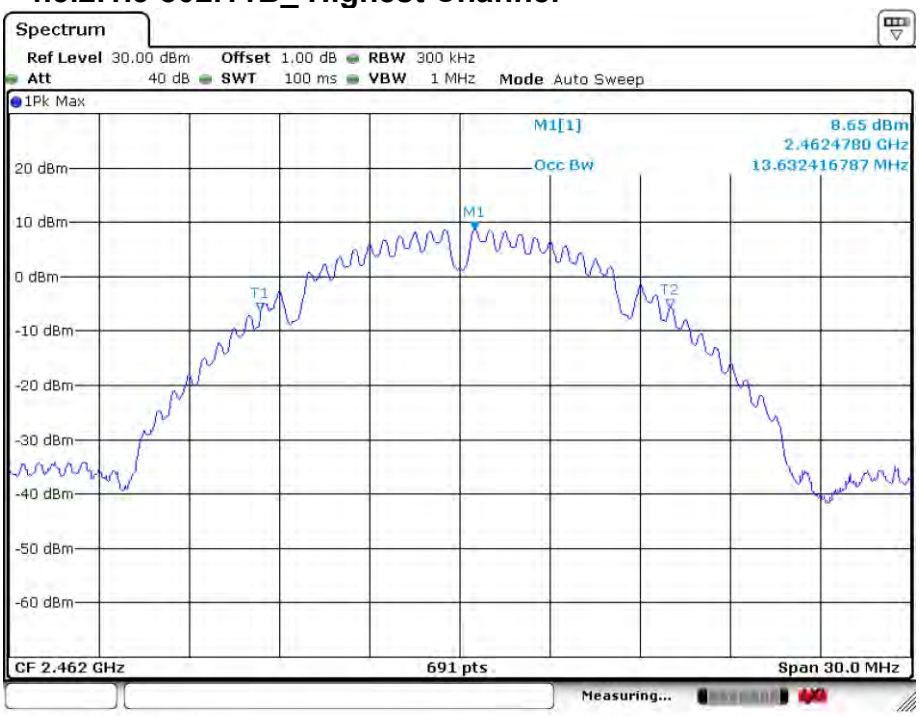
4.5.2.1.3 802.11B_ Highest Channel



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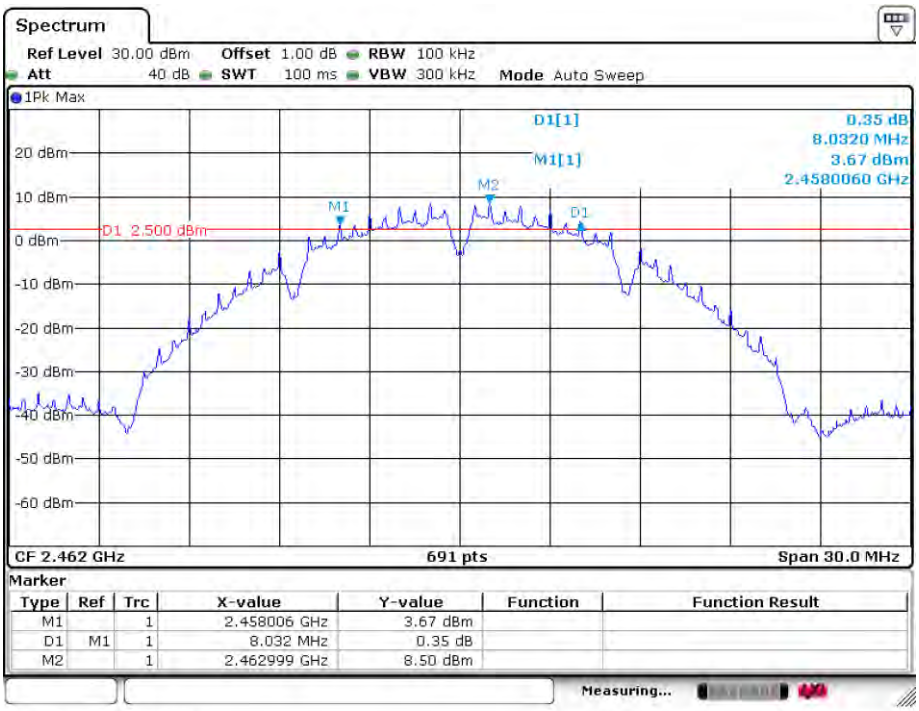

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.458006 GHz	3.67 dBm		
D1	M1	1	8.032 MHz	0.35 dB		
M2		1	2.462999 GHz	8.50 dBm		

Date: 27.SEP.2020 17:00:13

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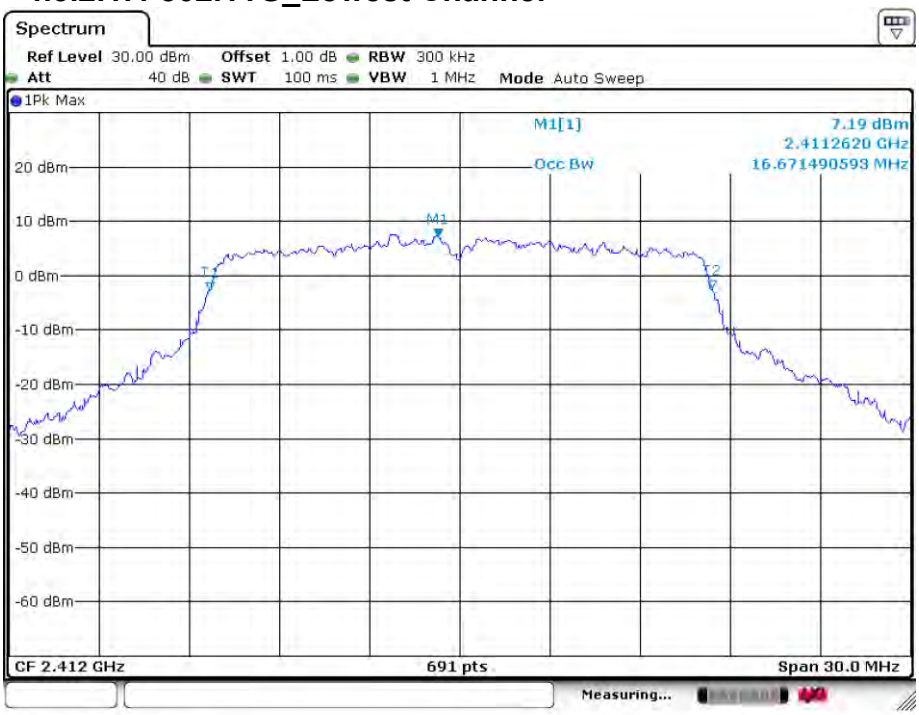
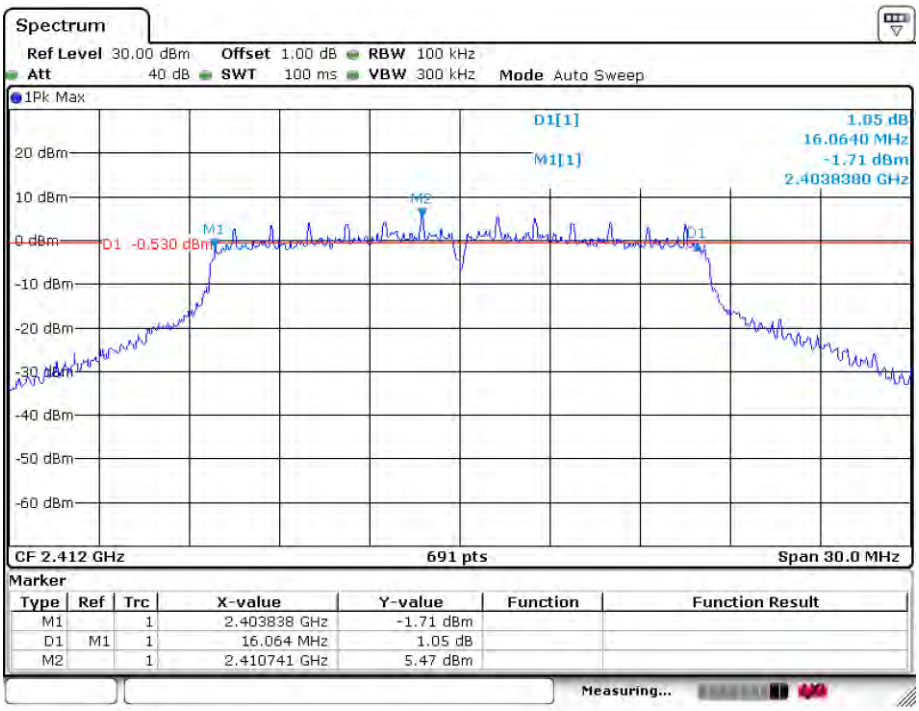
4.5.2.1.4 802.11G_Lowest Channel



Date: 27.SEP.2020 17:24:25



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.403838 GHz	-1.71 dBm		
D1	M1	1	16.064 MHz	1.05 dB		
M2		1	2.410741 GHz	5.47 dBm		

Date: 27.SEP.2020 17:06:17

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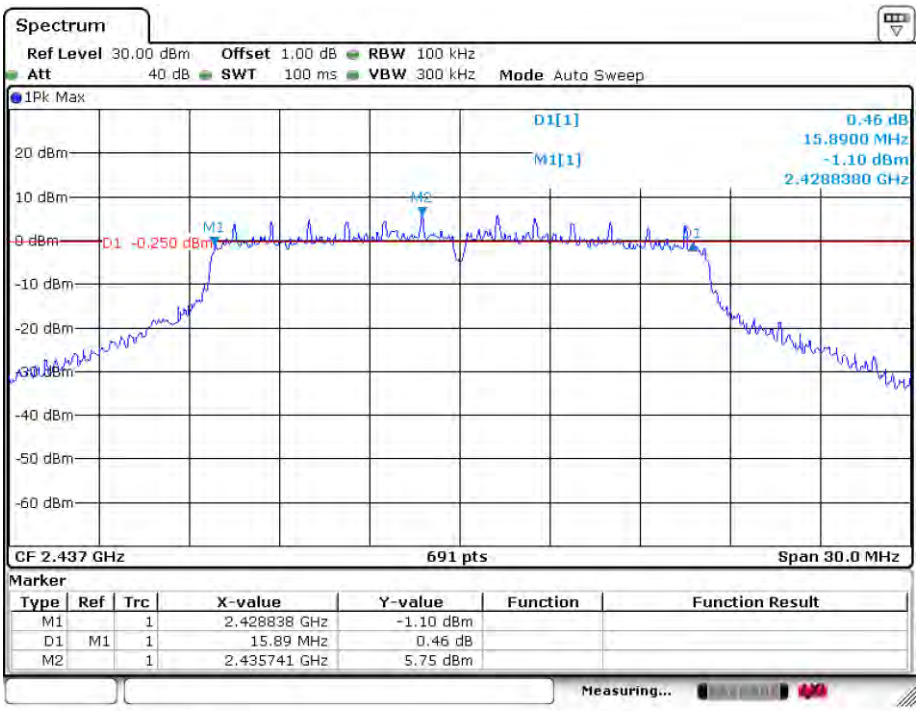
4.5.2.1.5 802.11G_ Middle Channel

Date: 27.SEP.2020 17:24:06



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.428838 GHz	-1.10 dBm		
D1	M1	1	15.89 MHz	0.46 dB		
M2		1	2.435741 GHz	5.75 dBm		

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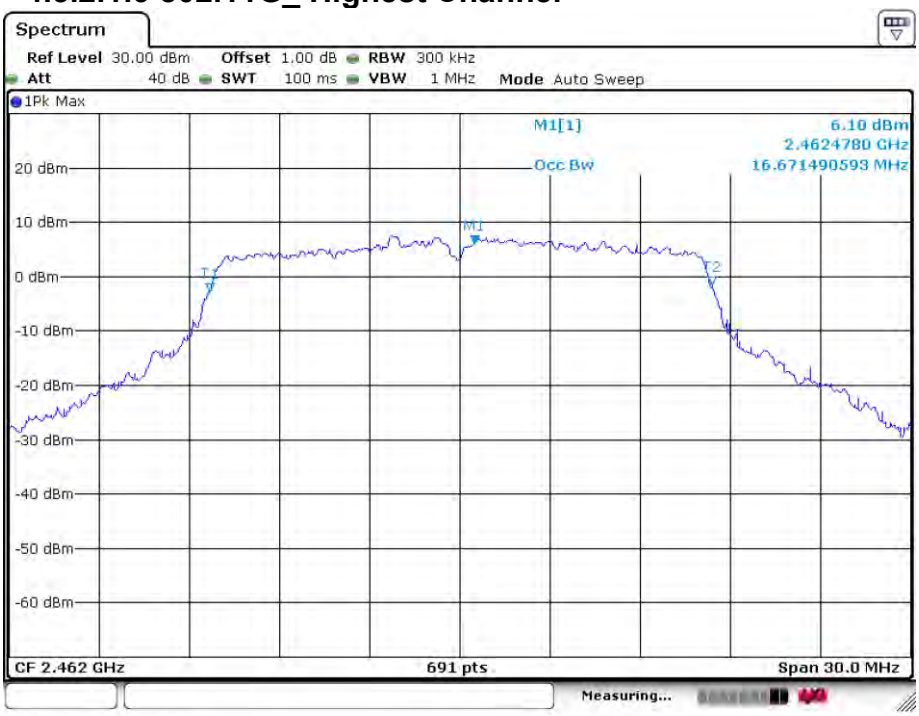
4.5.2.1.6 802.11G_ Highest Channel



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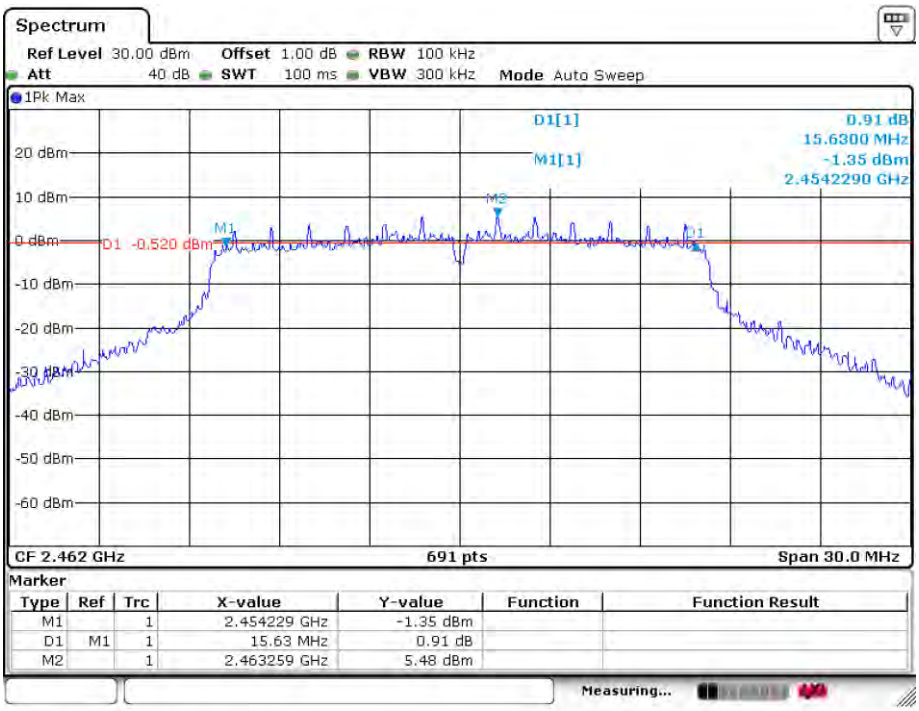

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.454229 GHz	-1.35 dBm		
D1	M1	1	15.63 MHz	0.91 dB		
M2		1	2.463259 GHz	5.48 dBm		

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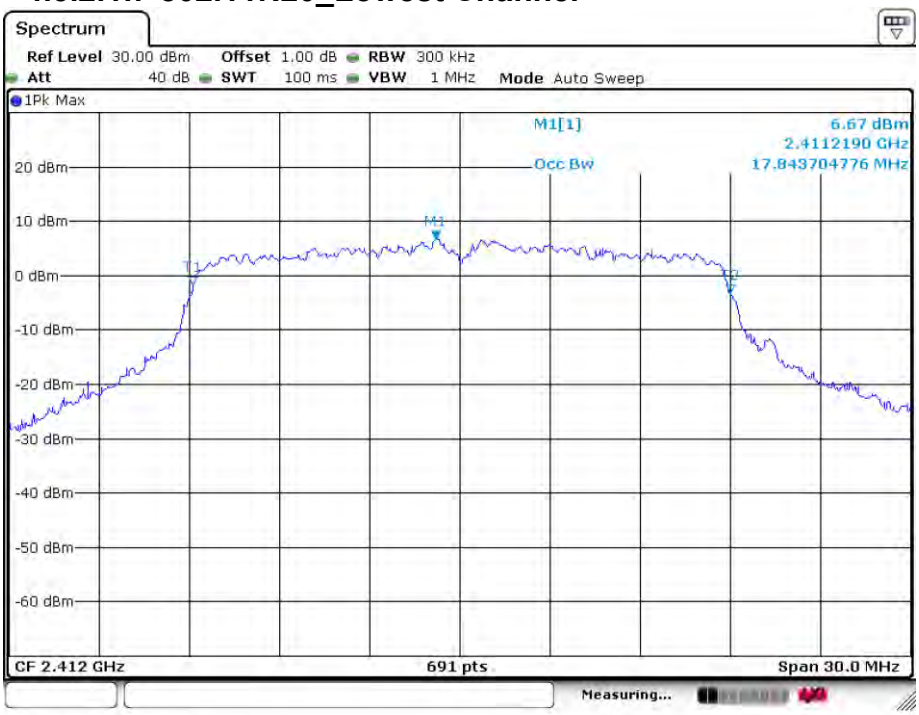
4.5.2.1.7 802.11N20_Lowest Channel



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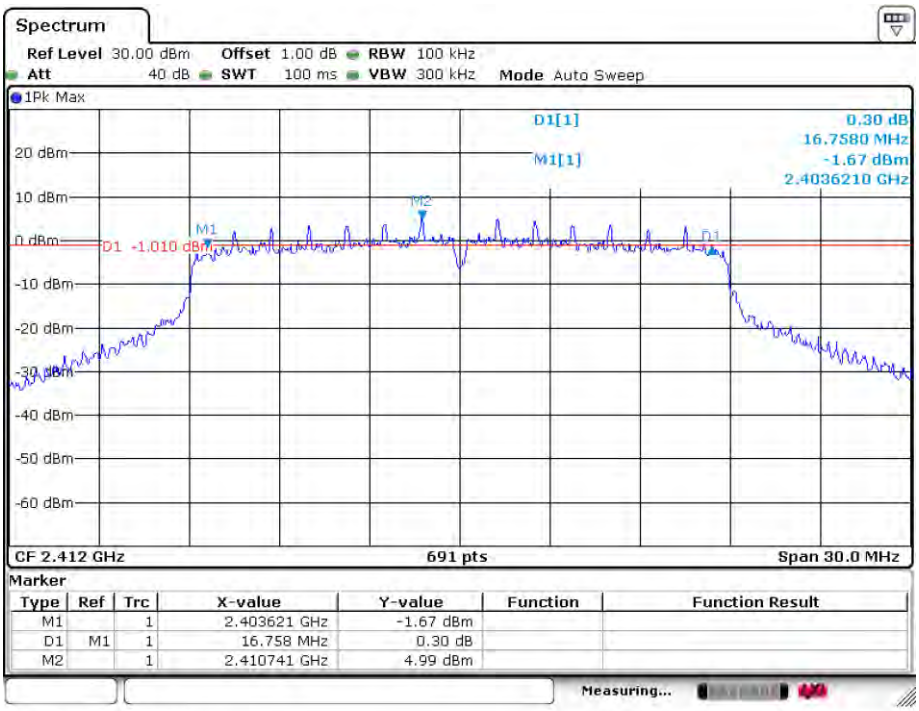

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.403621 GHz	-1.67 dBm		
D1	M1	1	16.758 MHz	0.30 dB		
M2		1	2.410741 GHz	4.99 dBm		

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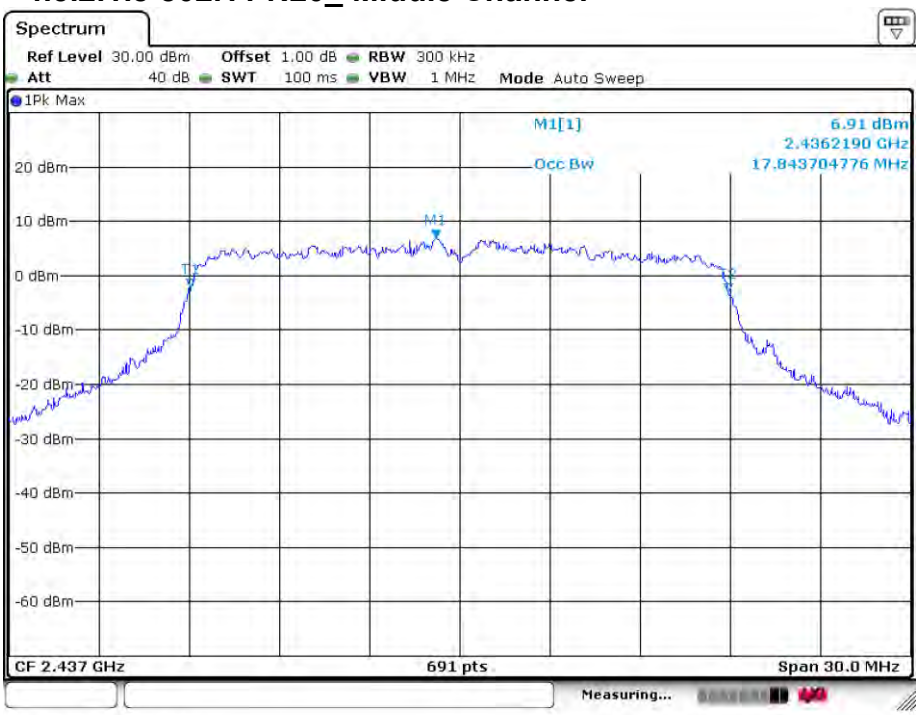
4.5.2.1.8 802.11 N20_ Middle Channel



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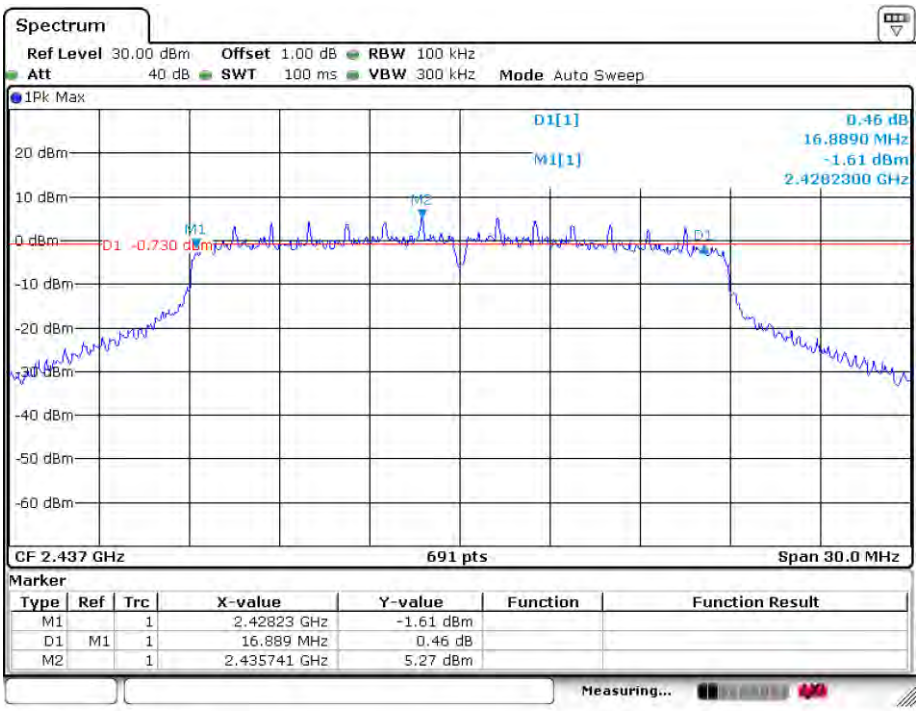

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.42823 GHz	-1.61 dBm		
D1	M1	1	16.889 MHz	0.46 dB		
M2		1	2.435741 GHz	5.27 dBm		

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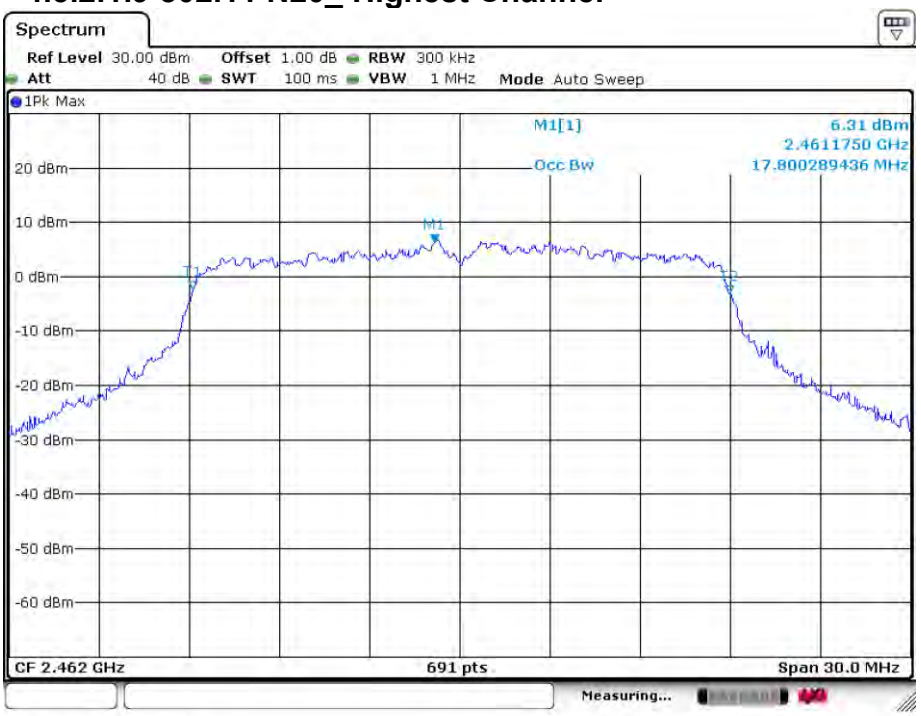
4.5.2.1.9 802.11 N20_ Highest Channel



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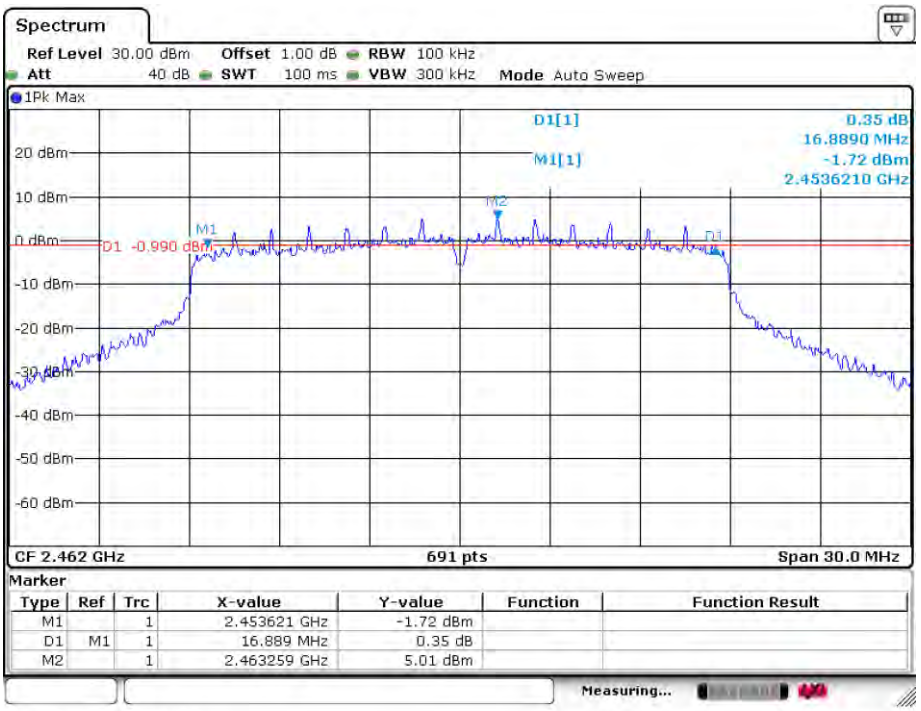

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.453621 GHz	-1.72 dBm		
D1	M1	1	16.889 MHz	0.35 dB		
M2		1	2.463259 GHz	5.01 dBm		

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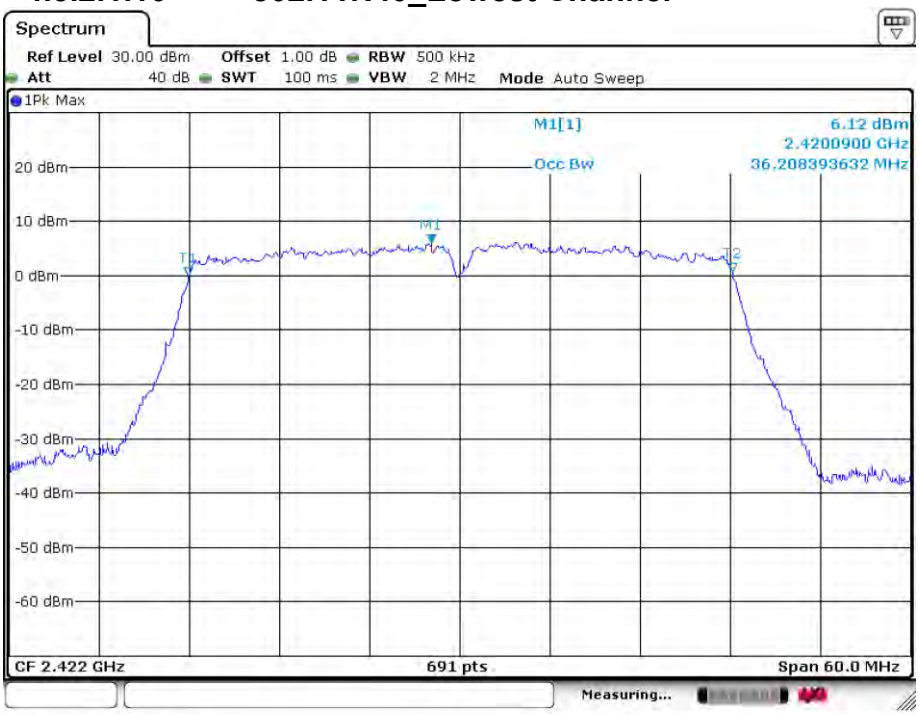
4.5.2.1.10 802.11N40_Lowest Channel



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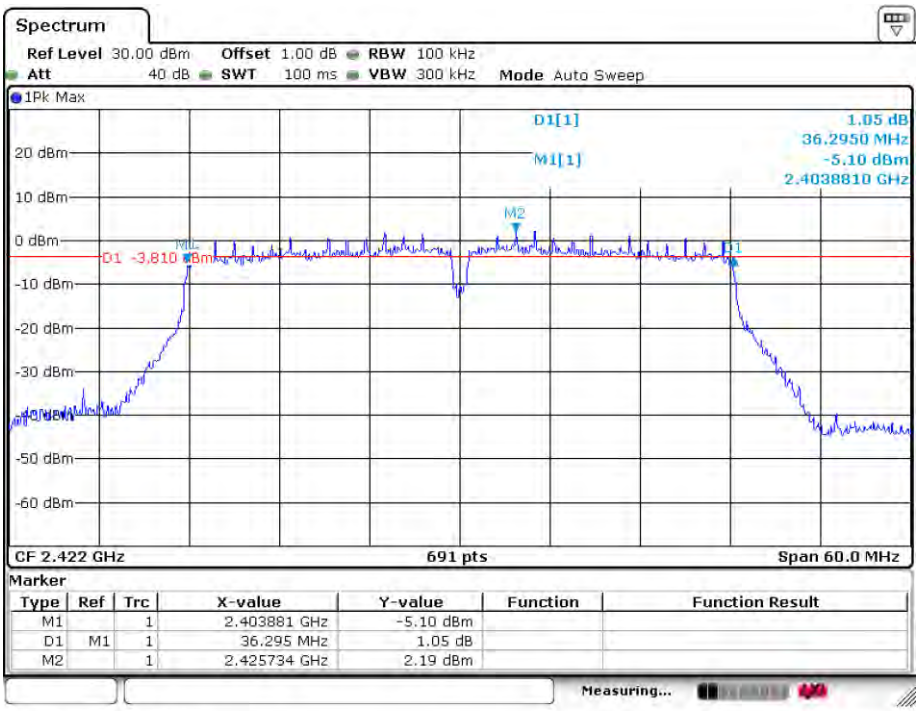

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.403881 GHz	-5.10 dBm		
D1	M1	1	36.295 MHz	1.05 dB		
M2		1	2.425734 GHz	2.19 dBm		

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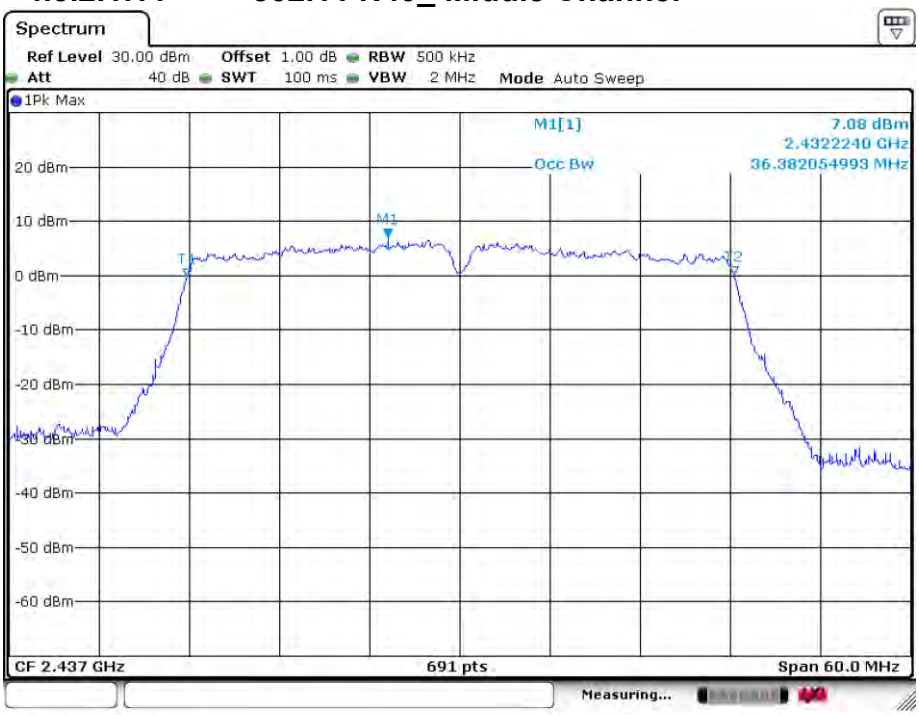
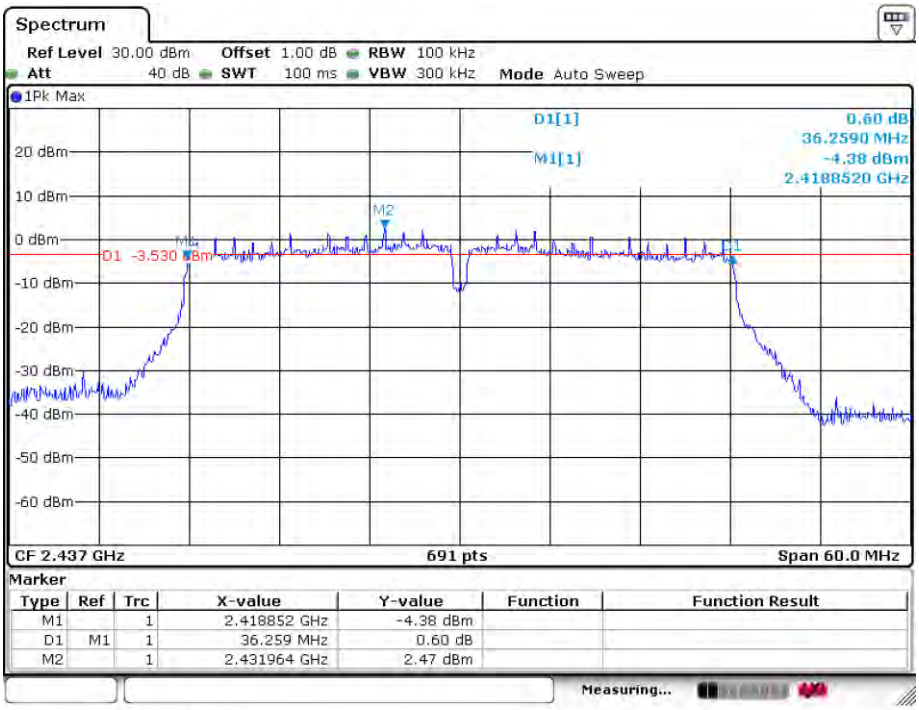
4.5.2.1.11 802.11 N40_ Middle Channel



Date: 27.SEP.2020 17:21:33



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.418852 GHz	-4.38 dBm		
D1	M1	1	36.259 MHz	0.60 dB		
M2		1	2.431964 GHz	2.47 dBm		

Date: 27.SEP.2020 17:18:11

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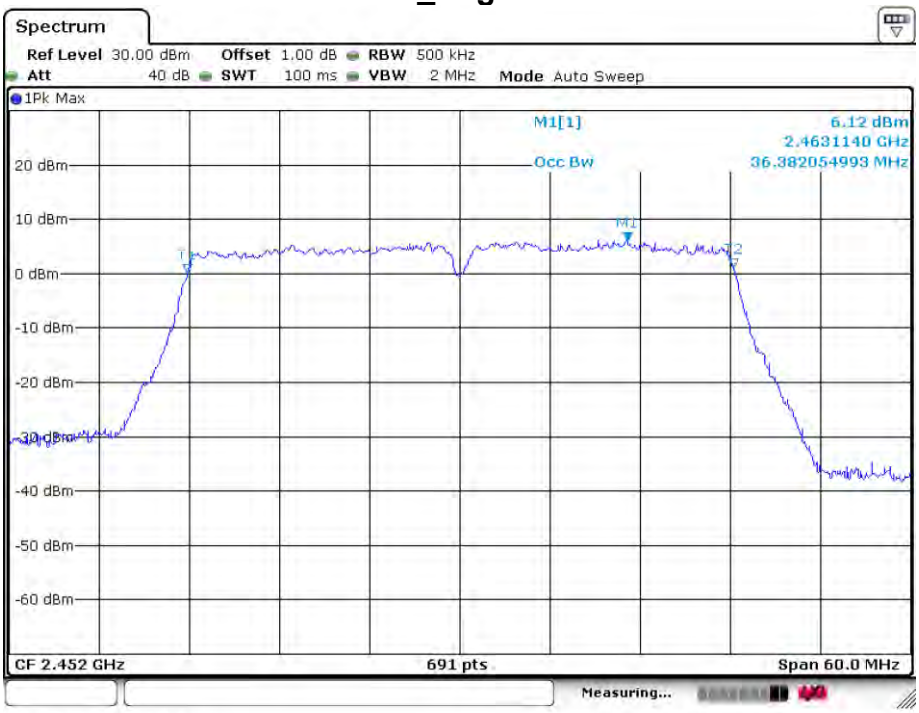
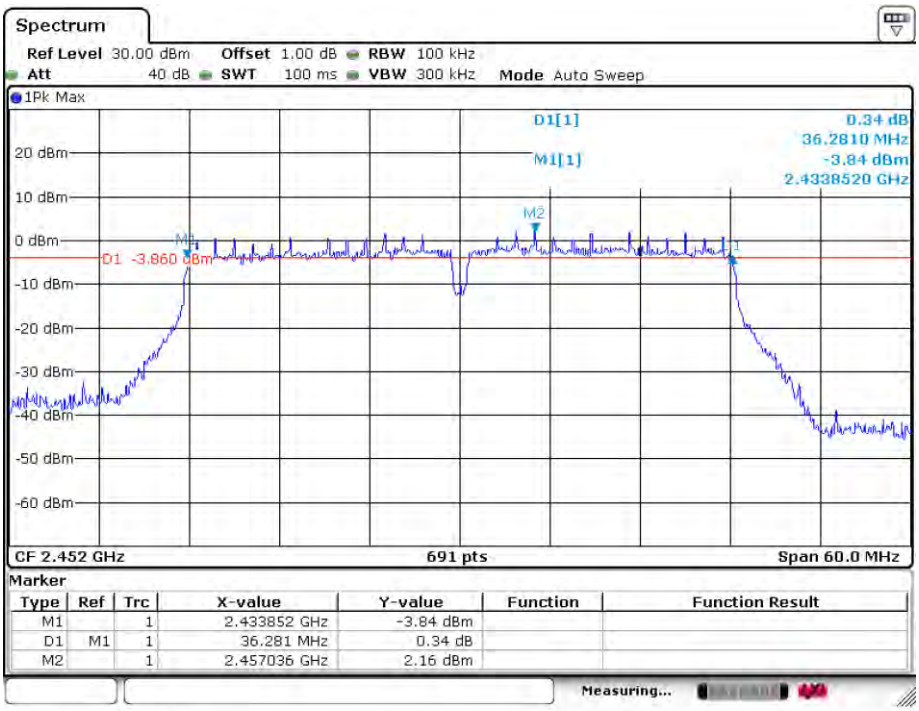
4.5.2.1.12 802.11 N40_ Highest Channel



Date: 27.SEP.2020 17:21:51



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.433852 GHz	-3.84 dBm		
D1	M1	1	36.281 MHz	0.34 dB		
M2		1	2.457036 GHz	2.16 dBm		

Date: 27.SEP.2020 17:18:49

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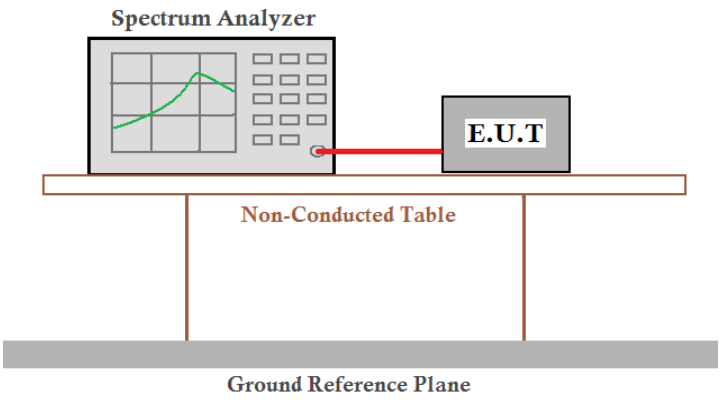
4.6 Power Spectral Density

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	-7.96	≤8.00	Pass
	Middle	-8.55	≤8.00	Pass
	Highest	-8.04	≤8.00	Pass
802.11G	Lowest	-8.62	≤8.00	Pass
	Middle	-9.71	≤8.00	Pass
	Highest	-9.10	≤8.00	Pass
802.11N20	Lowest	-10.77	≤8.00	Pass
	Middle	-9.76	≤8.00	Pass
	Highest	-10.67	≤8.00	Pass
802.11N40	Lowest	-12.59	≤8.00	Pass
	Middle	-10.93	≤8.00	Pass
	Highest	-11.97	≤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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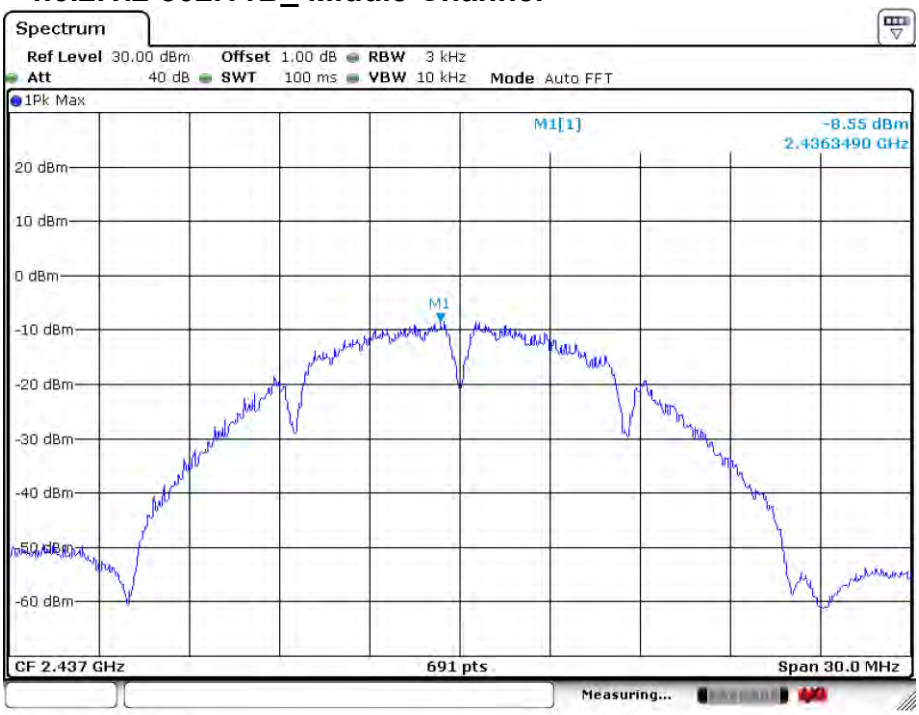
4.6.2.1.2 802.11B_ Middle Channel



Date: 27.SEP.2020 16:57:34

4.6.2.1.3 802.11B_ Highest Channel

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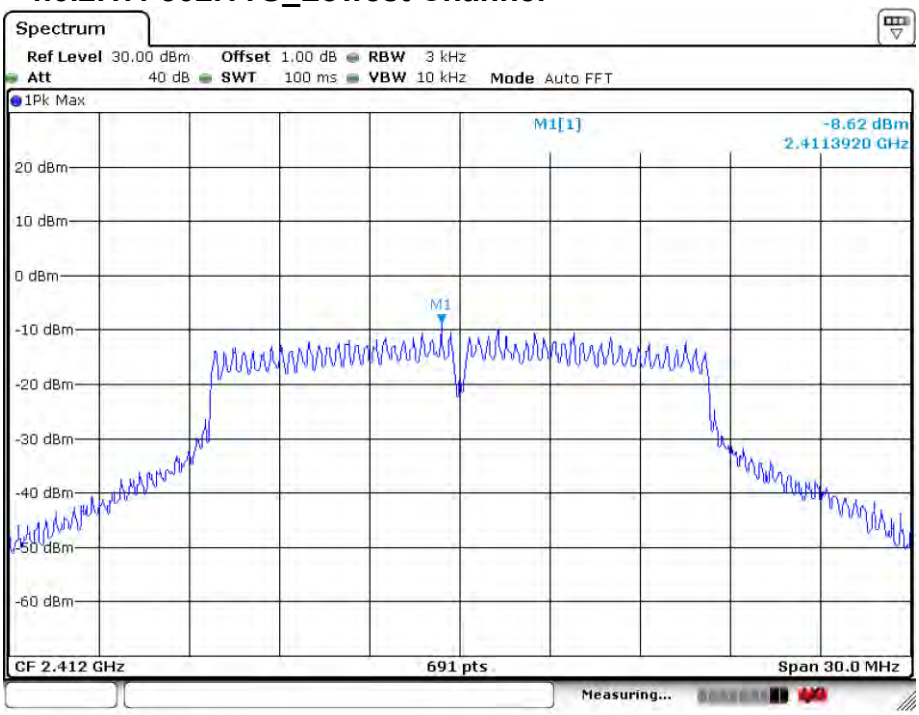
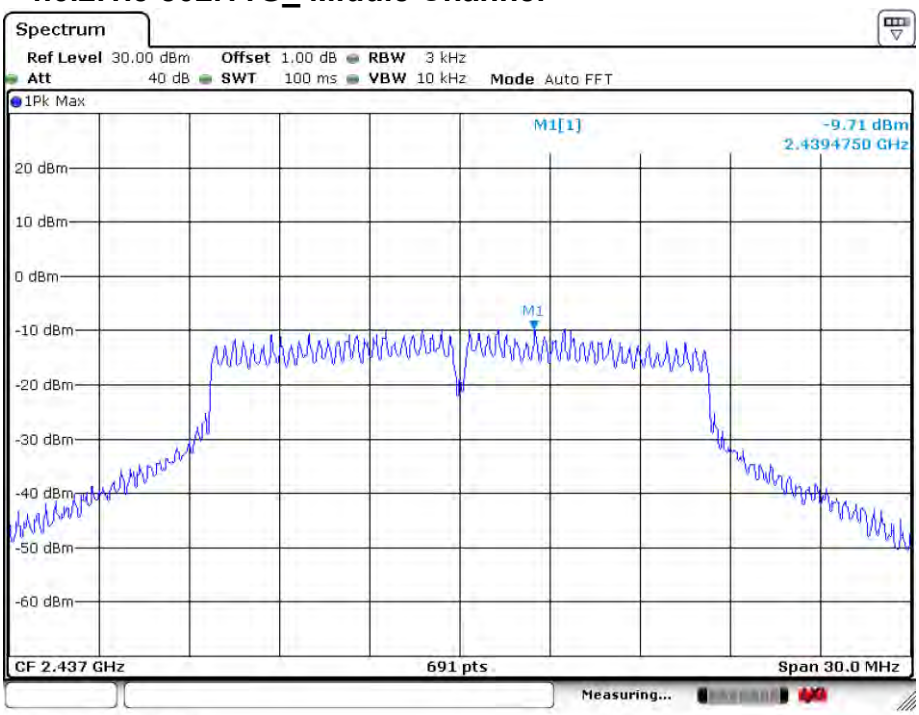
4.6.2.1.4 802.11G_Lowest Channel



Date: 27.SEP.2020 16:51:30

4.6.2.1.5 802.11G_ Middle Channel



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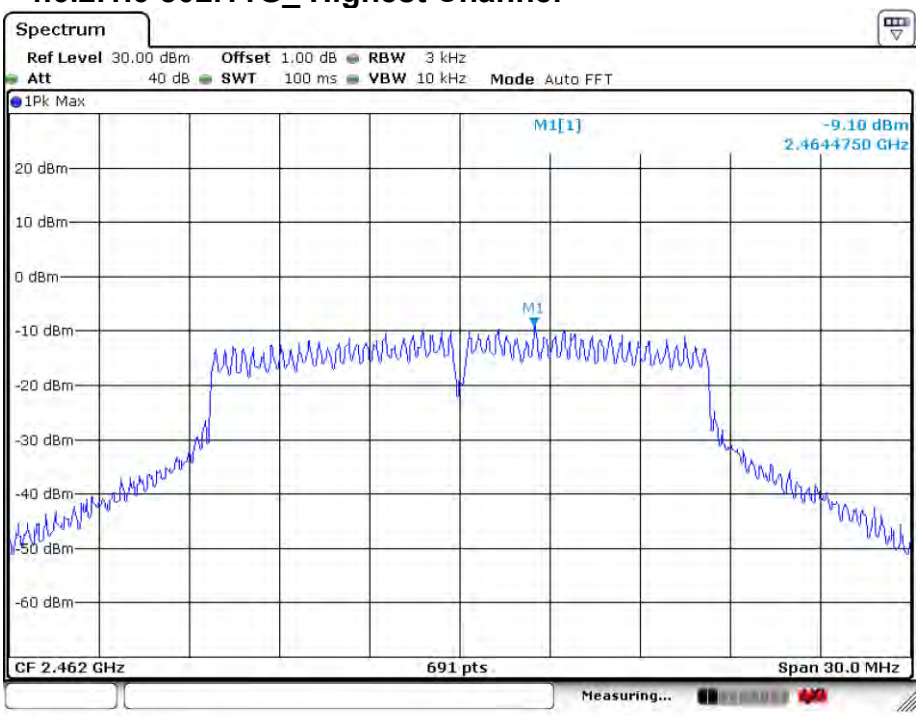
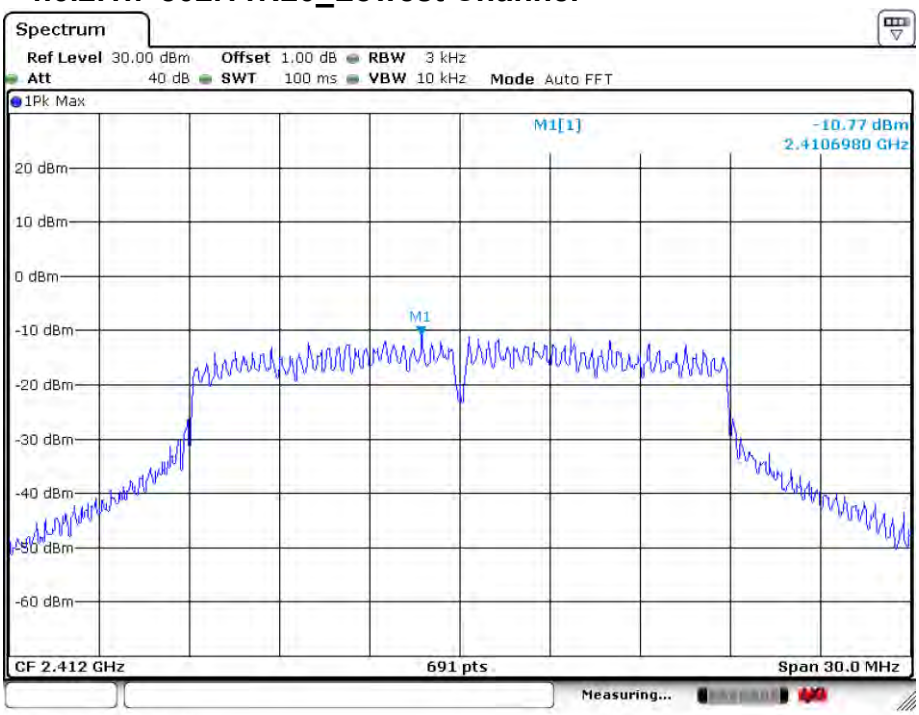
4.6.2.1.6 802.11G_ Highest Channel



Date: 27.SEP.2020 16:50:28

4.6.2.1.7 802.11N20_Lowest Channel



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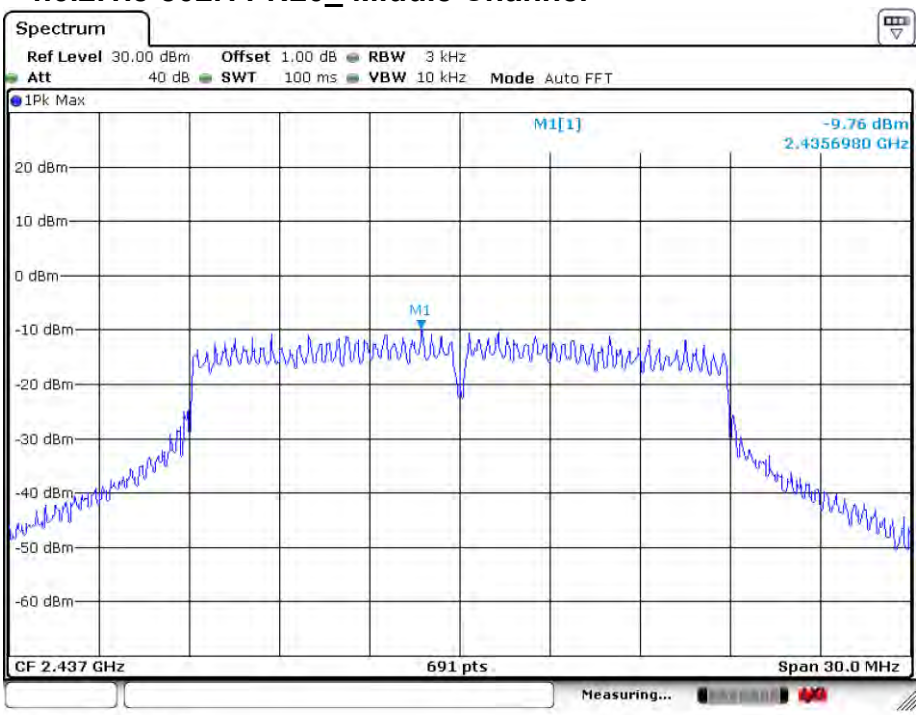
4.6.2.1.8 802.11 N20_ Middle Channel



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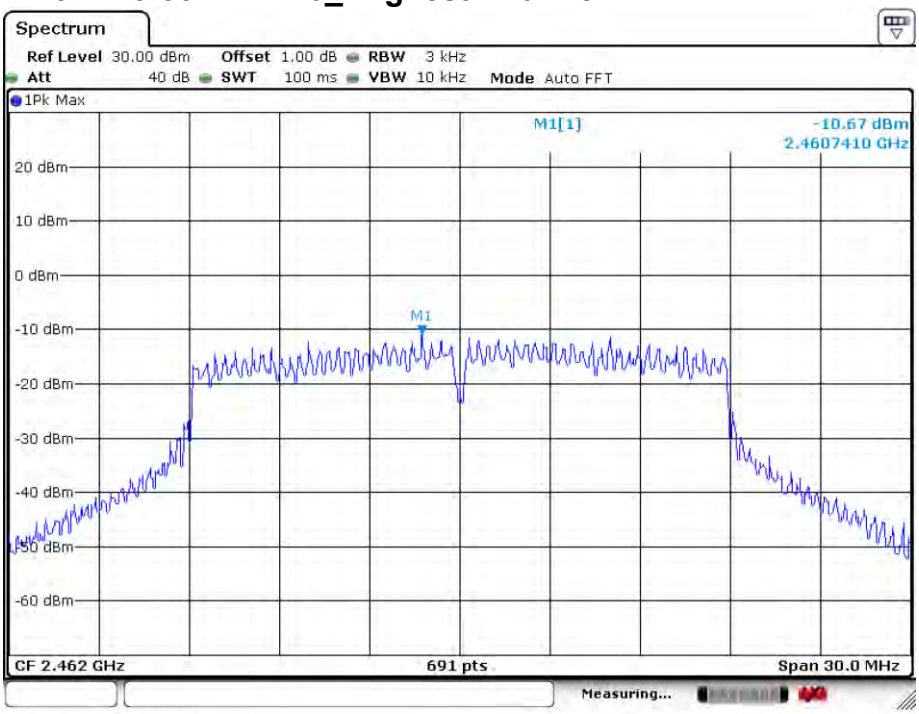
4.6.2.1.9 802.11 N20_ Highest Channel



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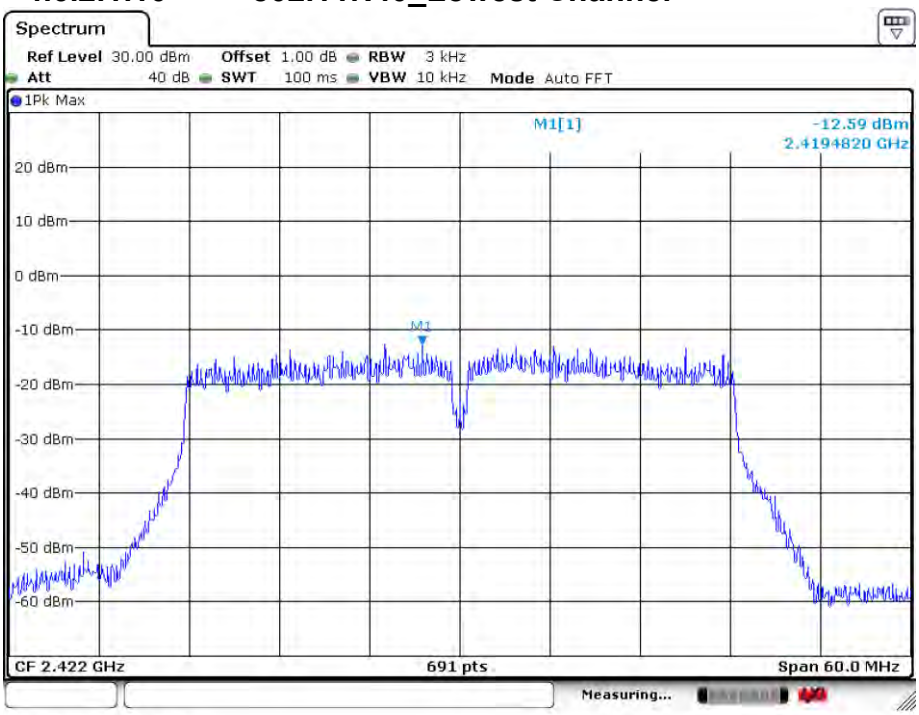
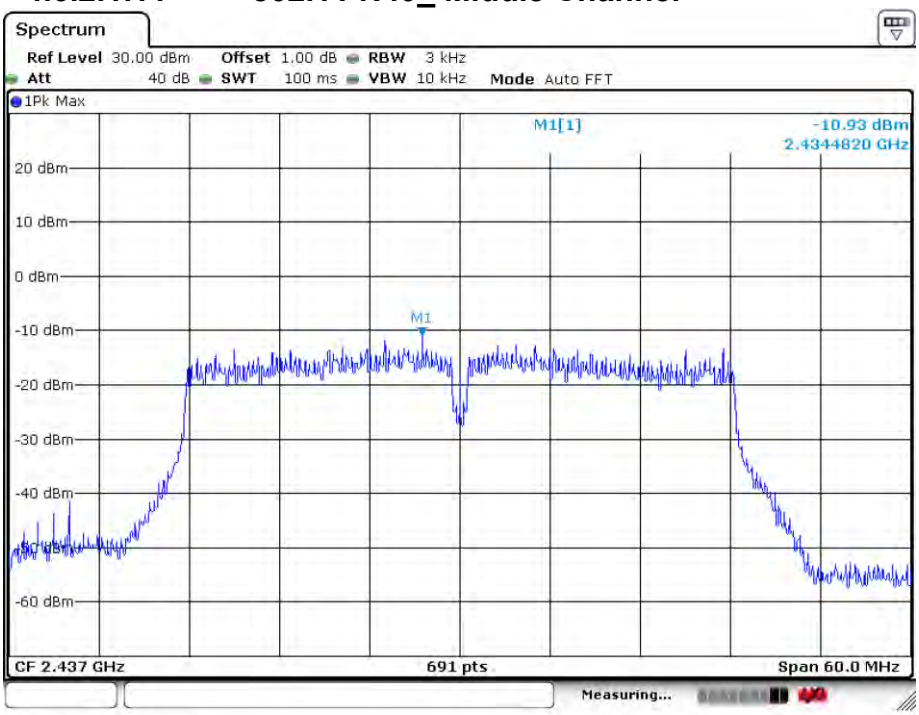
4.6.2.1.10 802.11N40_Lowest Channel



Date: 27.SEP.2020 16:47:29

4.6.2.1.11 802.11 N40_ Middle Channel



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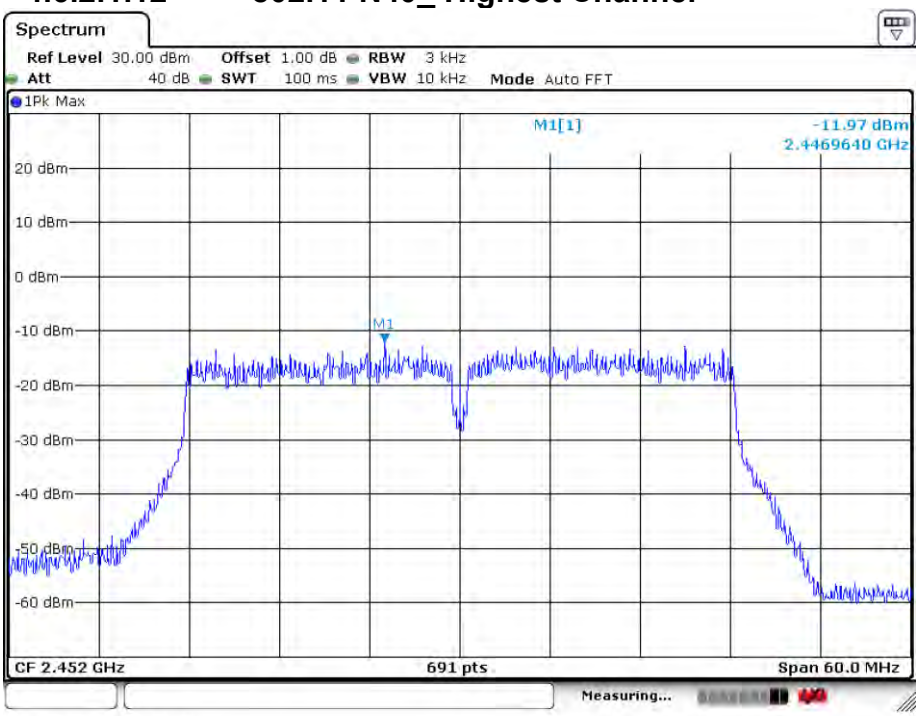
4.6.2.1.12 802.11 N40_ Highest Channel



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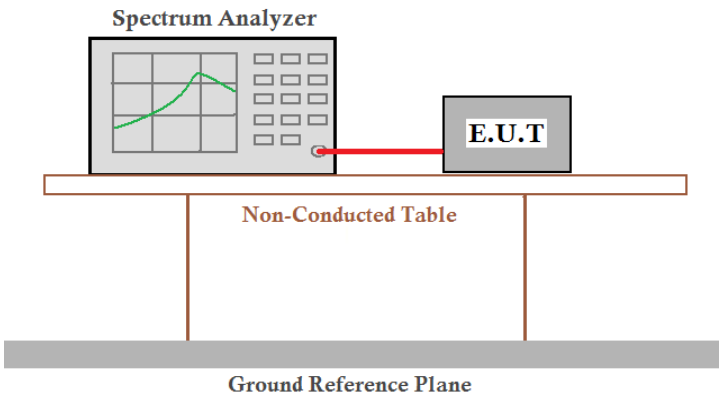
4.7 Band-edge for RF Conducted Emissions

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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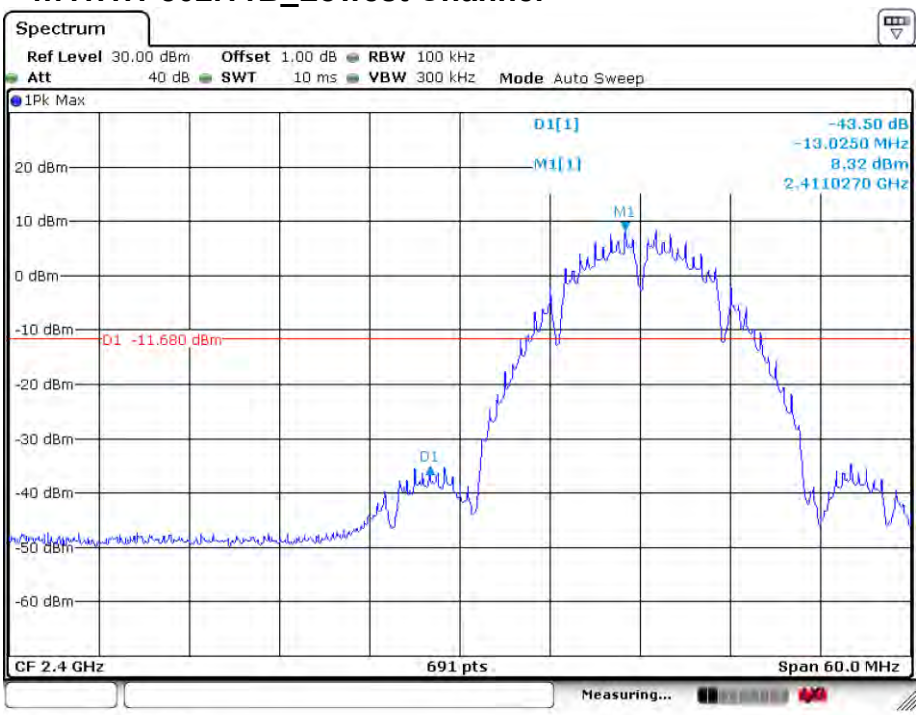
4.7.1 Test plots

4.7.1.1 ANT1

4.7.1.1.1 802.11B_Lowest Channel



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4.7.1.1.2 802.11B_ Highest Channel

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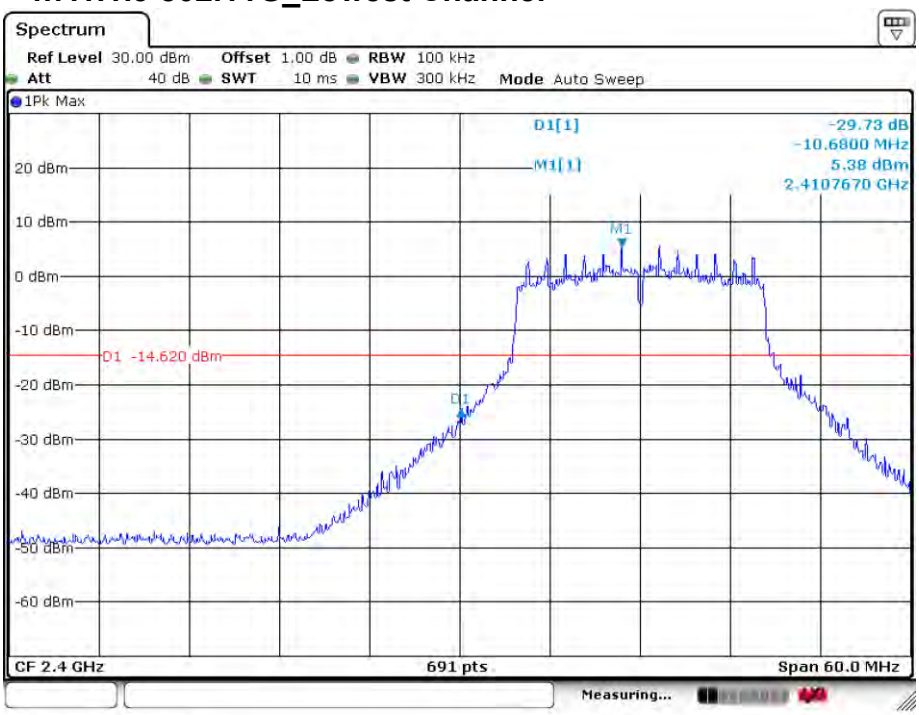
4.7.1.1.3 802.11G_Lowest Channel



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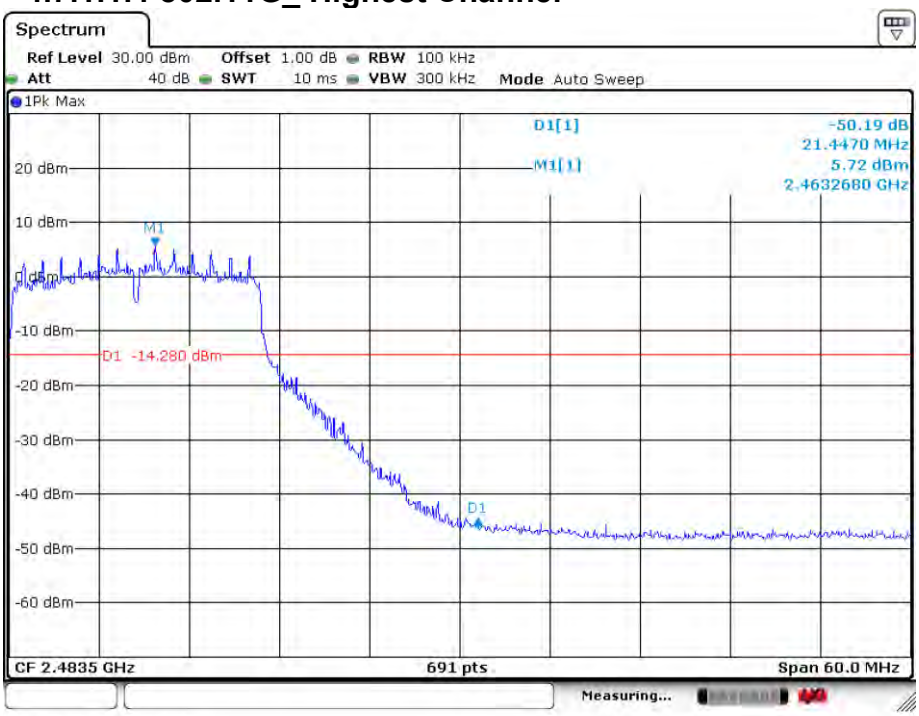
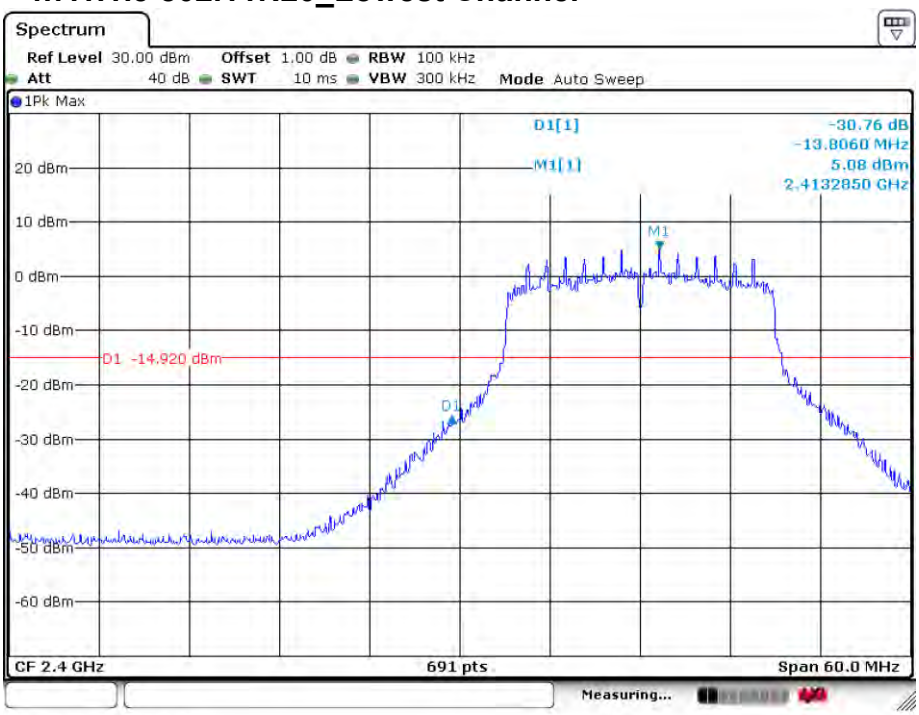
4.7.1.1.4 802.11G_ Highest Channel



Date: 27.SEP.2020 17:32:01

4.7.1.1.5 802.11N20_Lowest Channel



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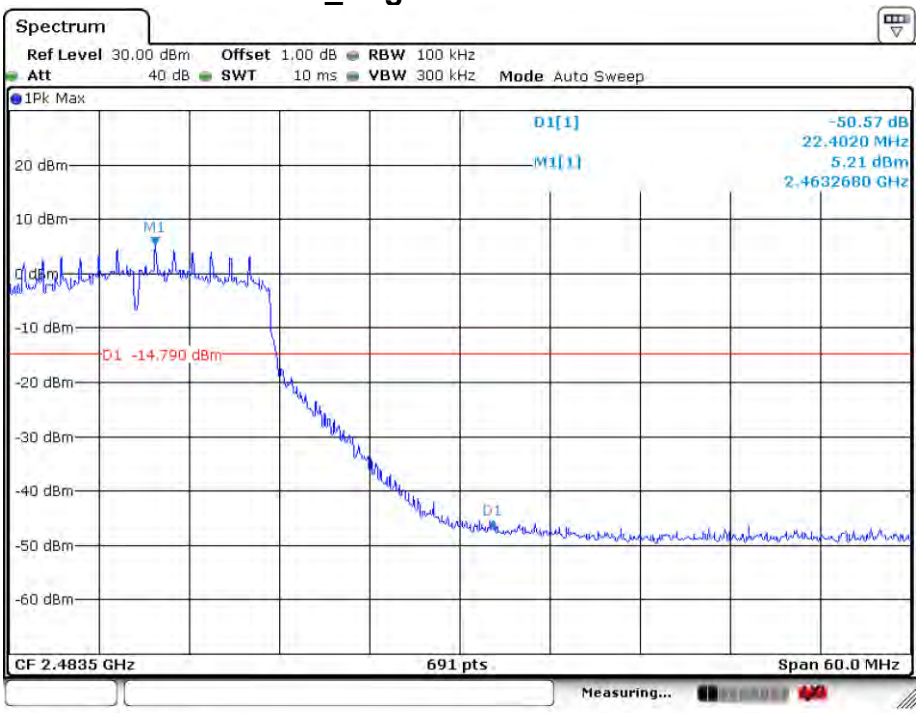
4.7.1.1.6 802.11 N20_ Highest Channel



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4.7.1.1.7 802.11N40_Lowest Channel

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4.7.1.1.8 802.11 N40_ Highest Channel

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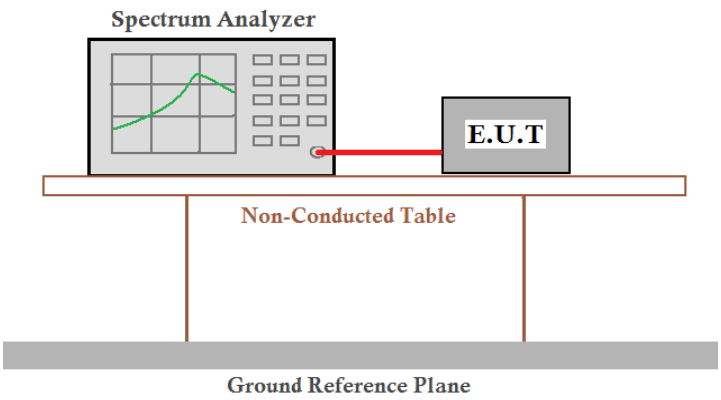
4.8 RF Conducted Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.11
Test Setup:	
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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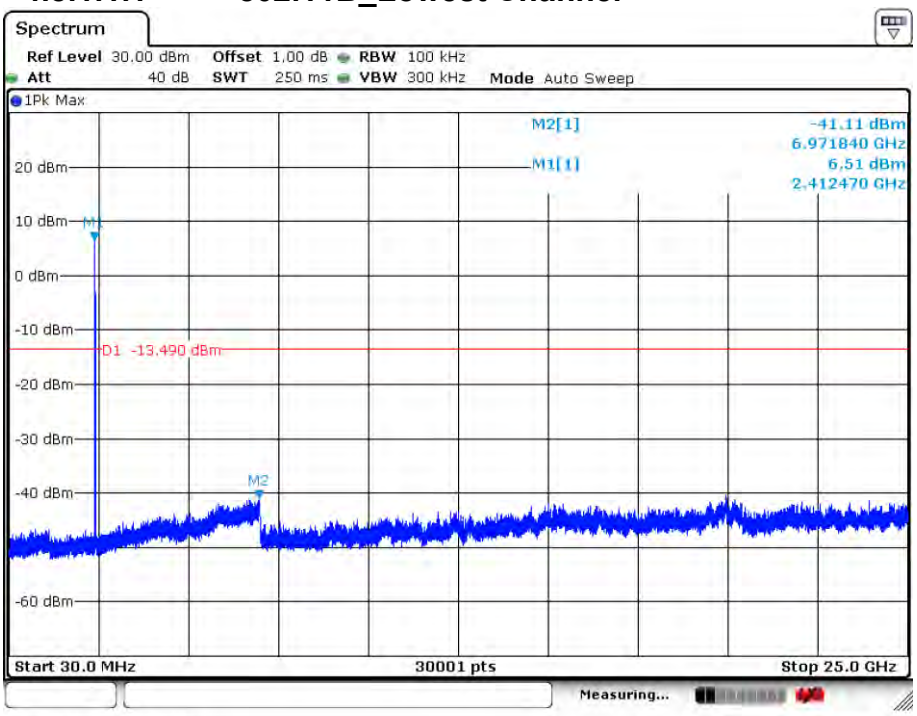
4.8.1 Test plots

4.8.1.1 ANT1

4.8.1.1.1 802.11B_Lowest Channel



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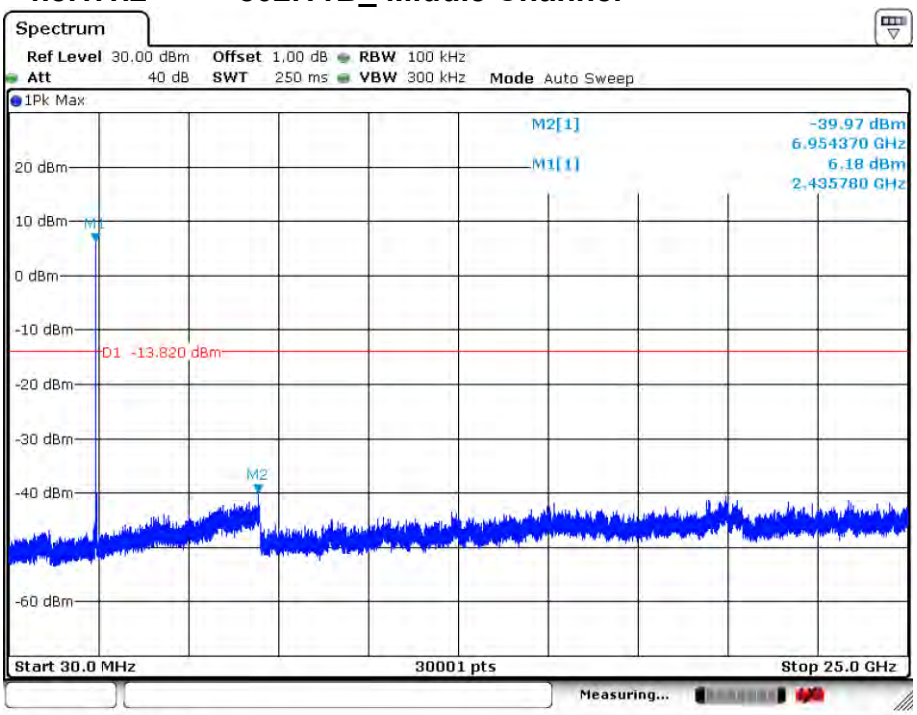
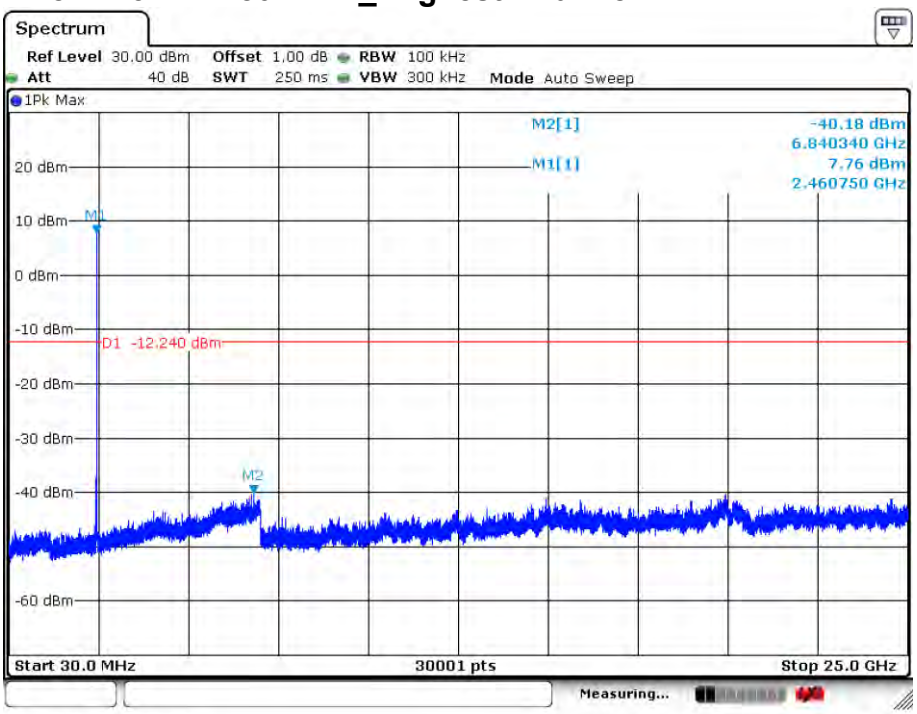
4.8.1.1.2 802.11B_ Middle Channel



Date: 27.SEP.2020 18:08:37

4.8.1.1.3 802.11B_ Highest Channel



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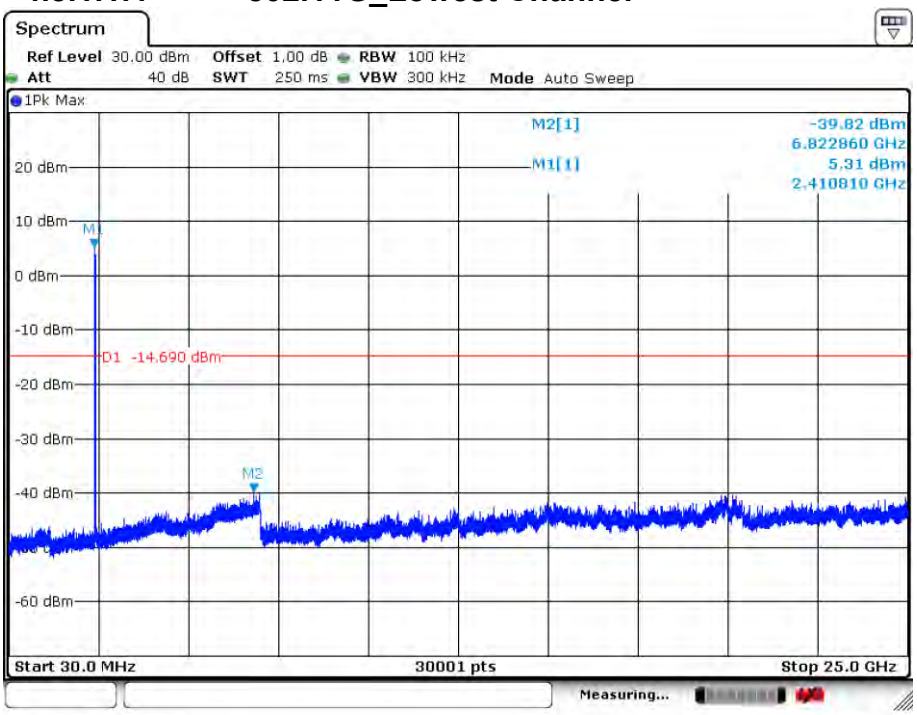
4.8.1.1.4 802.11G_Lowest Channel



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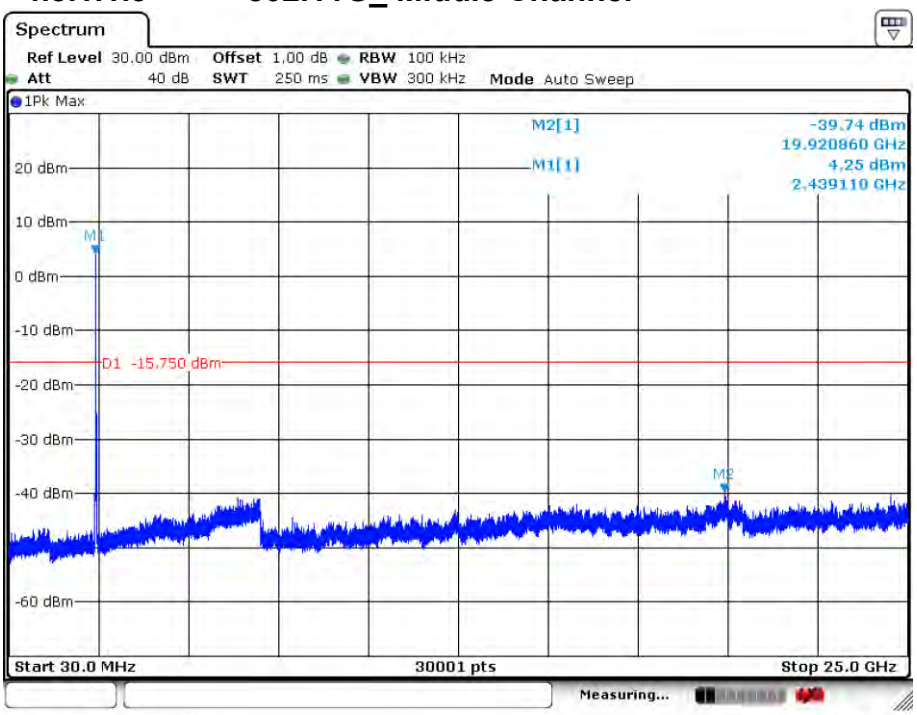
4.8.1.1.5 802.11G_ Middle Channel



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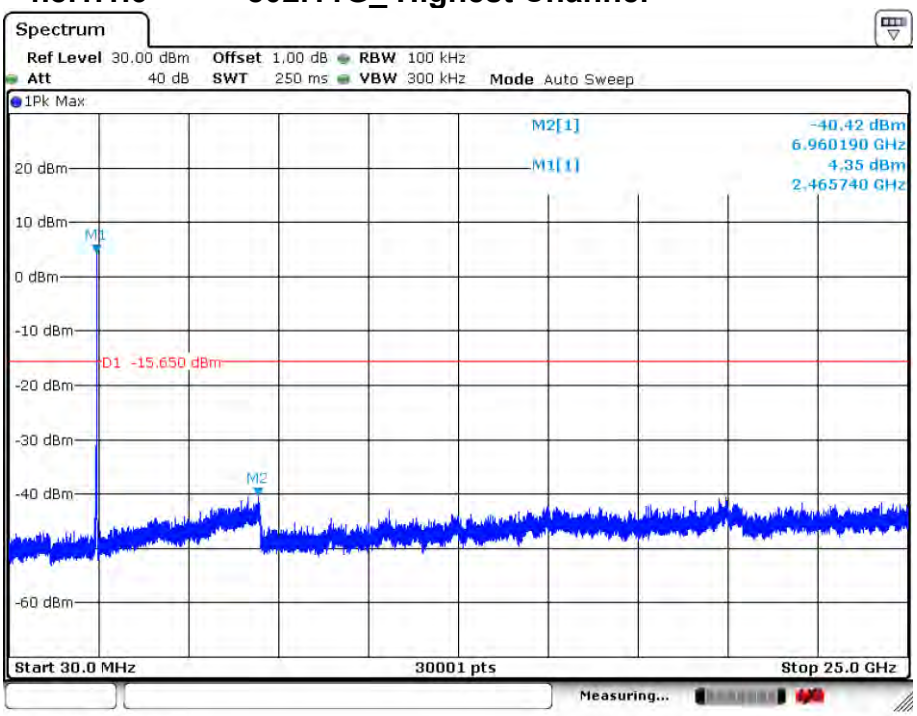
4.8.1.1.6 802.11G_ Highest Channel



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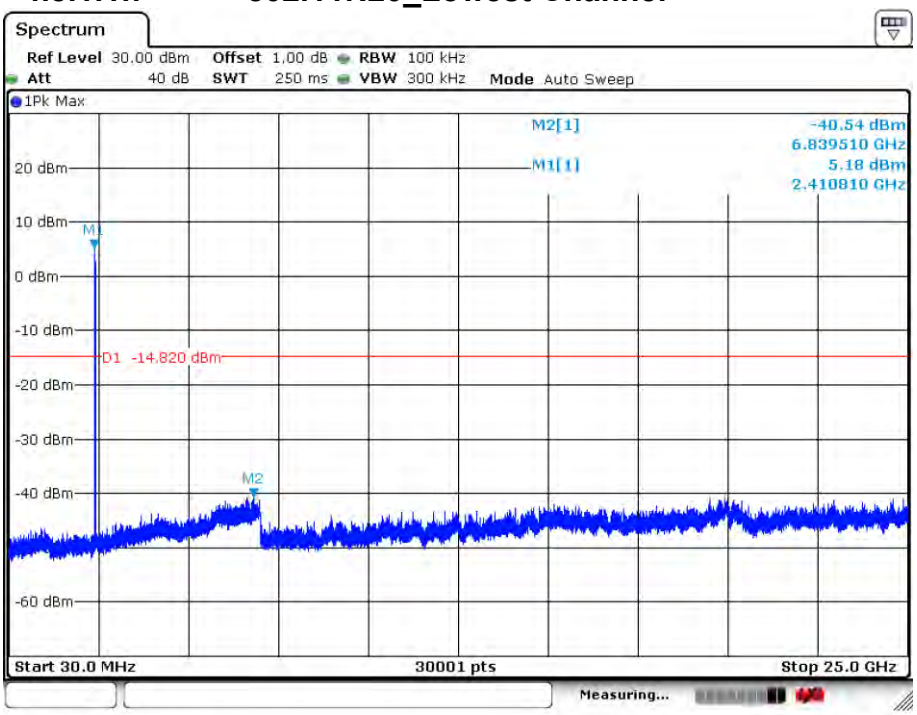
4.8.1.1.7 802.11N20_Lowest Channel



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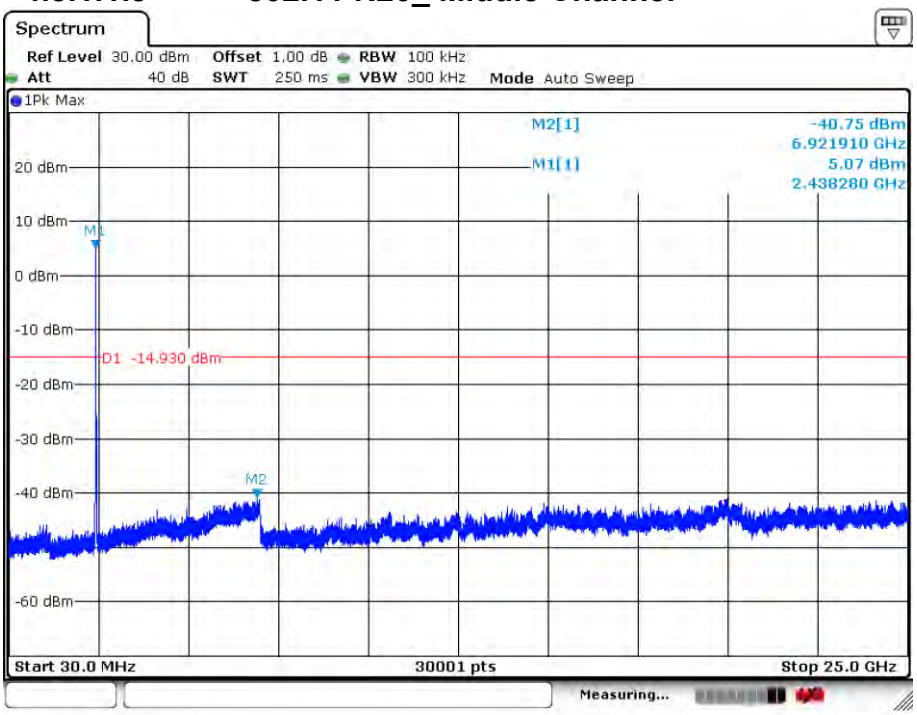
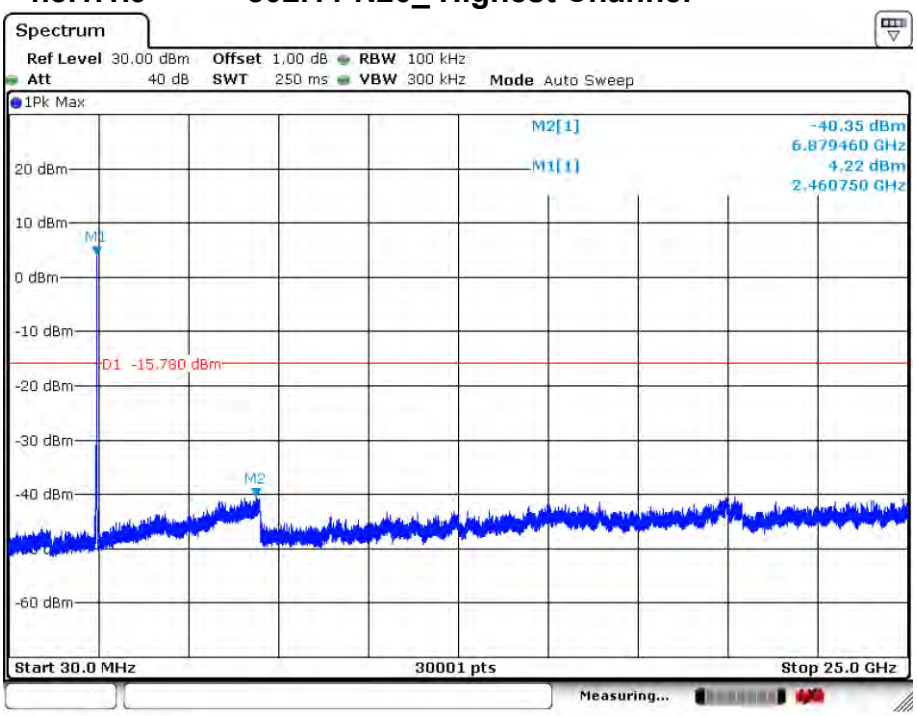
4.8.1.1.8 802.11 N20_ Middle Channel



Date: 27.SEP.2020 17:59:10

4.8.1.1.9 802.11 N20_ Highest Channel



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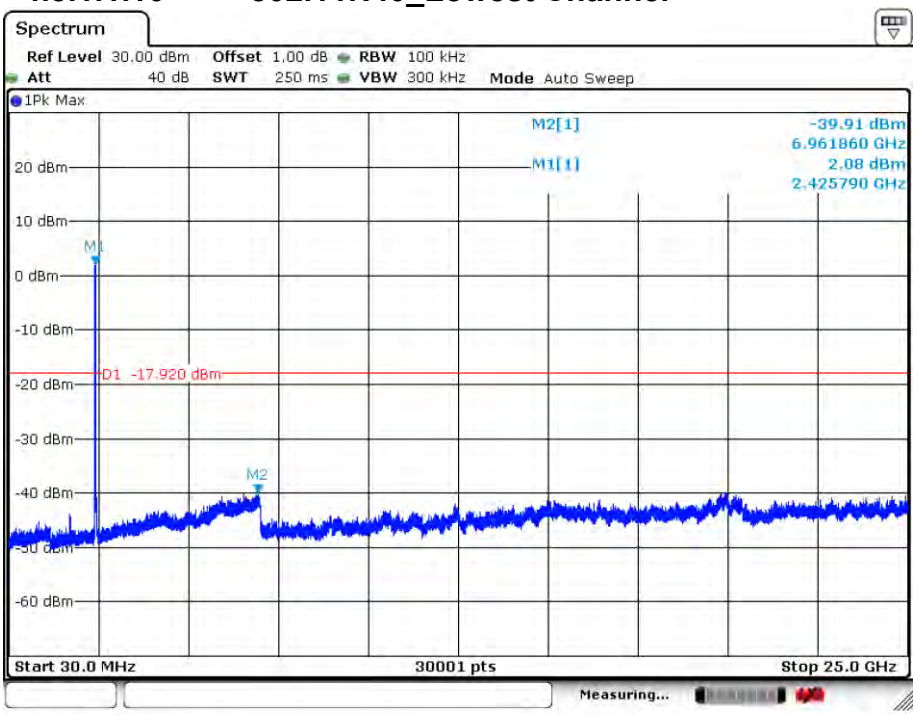
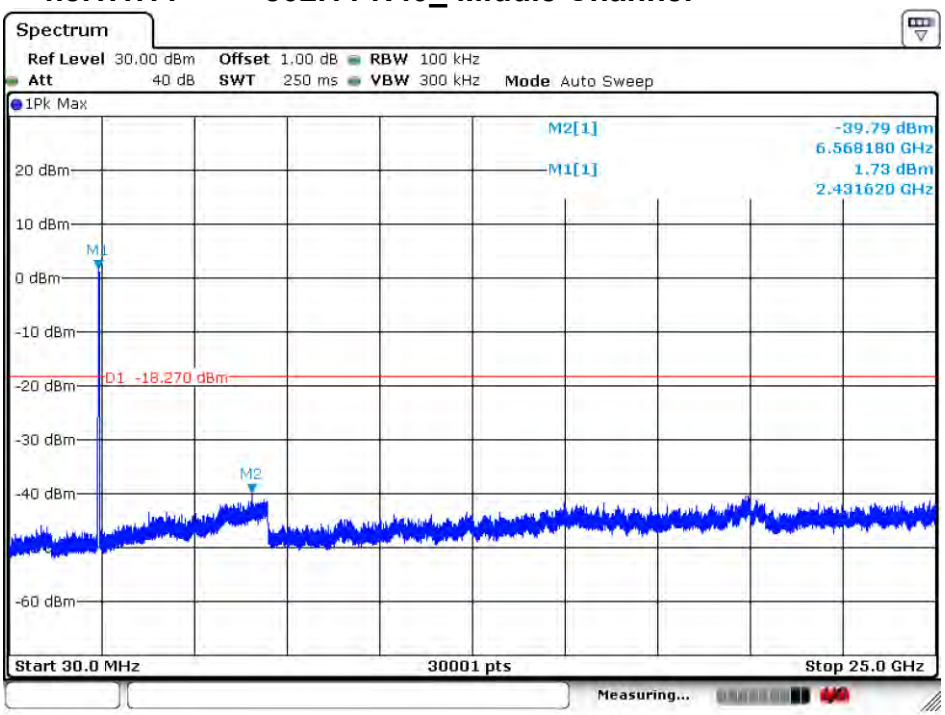
4.8.1.1.10 802.11N40_Lowest Channel



Date: 27.SEP.2020 17:55:53

4.8.1.1.11 802.11 N40_ Middle Channel



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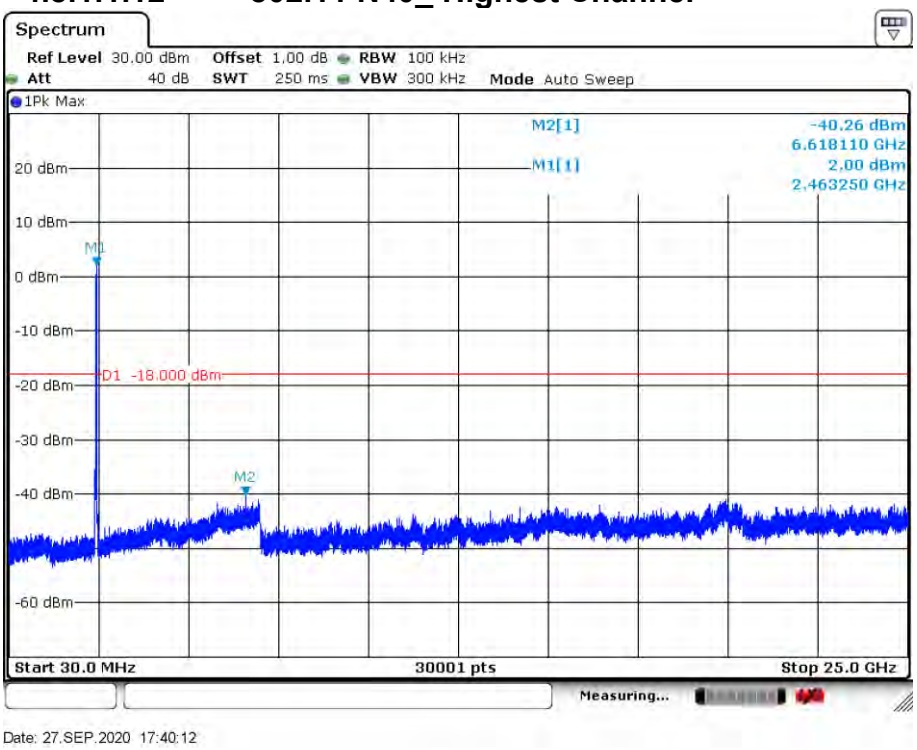
4.8.1.1.12 802.11 N40_ Highest Channel



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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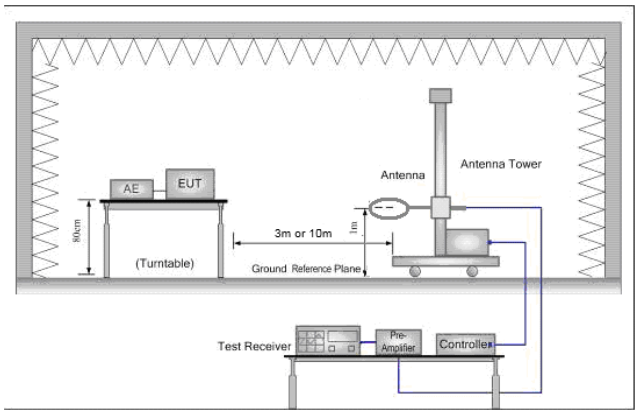

Figure 1. Below 30MHz

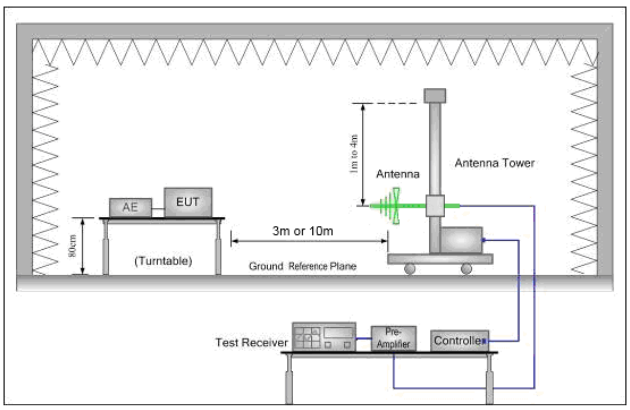

Figure 2. 30MHz to 1GHz

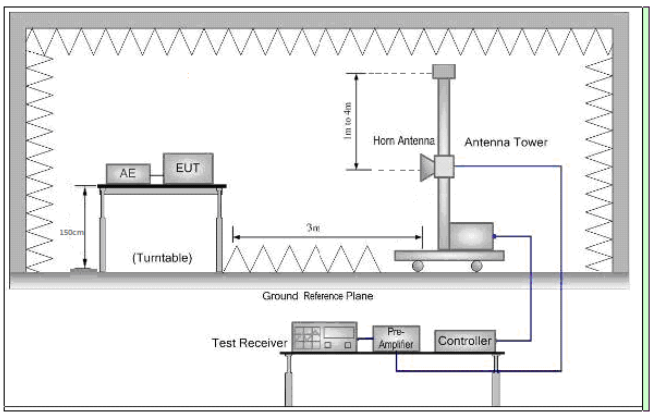

Figure 3. Above 1 GHz

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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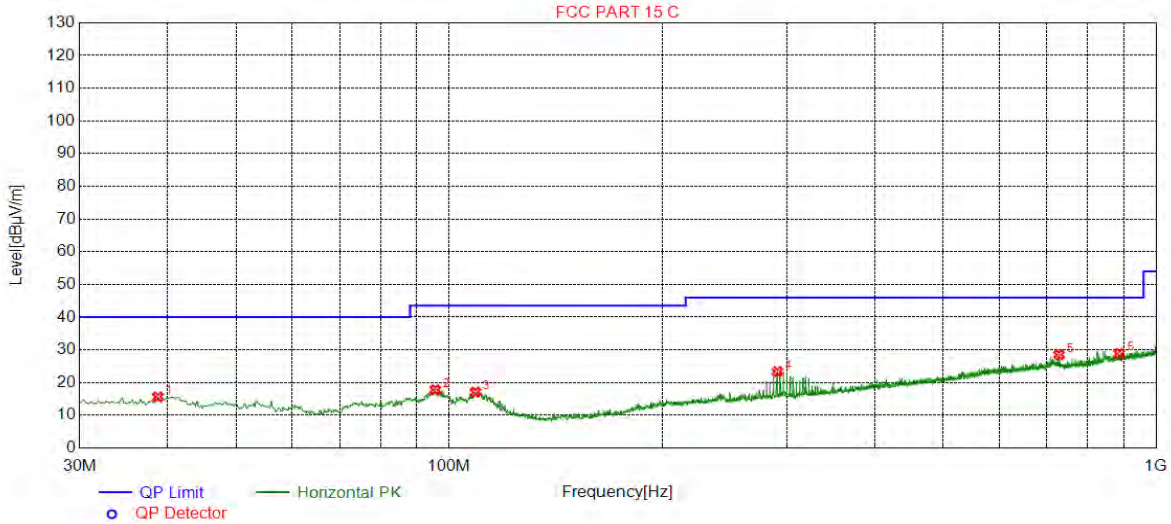
4.9.1 Radiated emission below 1GHz

4.9.1.1 Charge + Transmitting, Vertical

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	38.7317	15.64	-28.75	40.00	24.36	114	229	Horizontal
2	95.5851	17.80	-32.79	43.50	25.70	233	329	Horizontal
3	108.973	17.09	-32.00	43.50	26.41	223	346	Horizontal
4	291.176	23.37	-28.60	46.00	22.63	247	267	Horizontal
5	729.121	28.52	-18.82	46.00	17.48	218	360	Horizontal
6	887.263	28.86	-16.25	46.00	17.14	244	144	Horizontal

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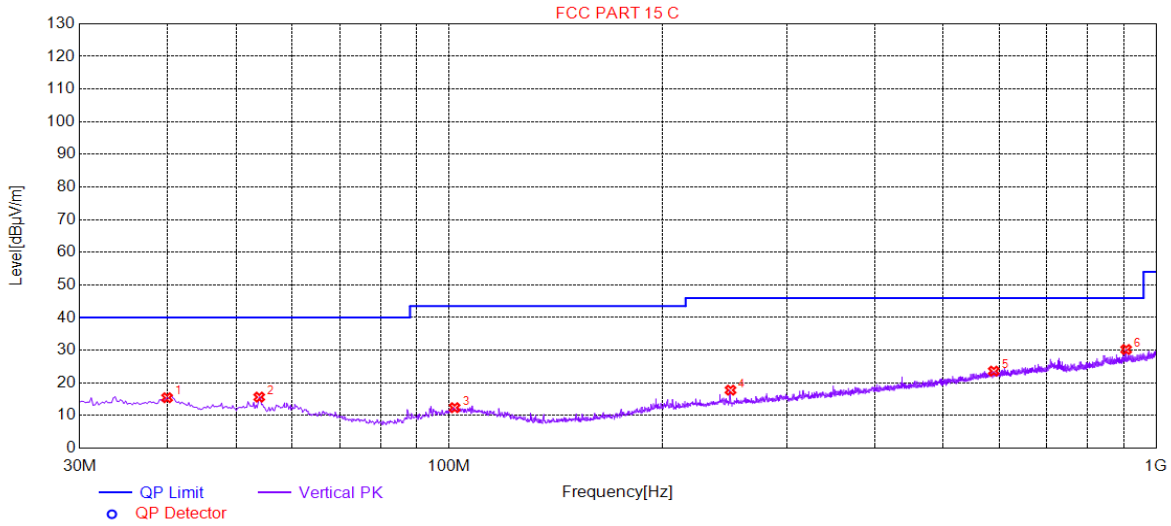
Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	39.8960	15.46	-28.37	40.00	24.54	279	72	Vertical
2	53.8668	15.65	-30.95	40.00	24.35	152	292	Vertical
3	101.794	12.40	-32.00	43.50	31.10	263	232	Vertical
4	250.040	17.78	-29.66	46.00	28.22	220	31	Vertical
5	589.413	23.61	-20.93	46.00	22.39	186	22	Vertical
6	907.055	30.23	-15.95	46.00	15.77	160	14	Vertical

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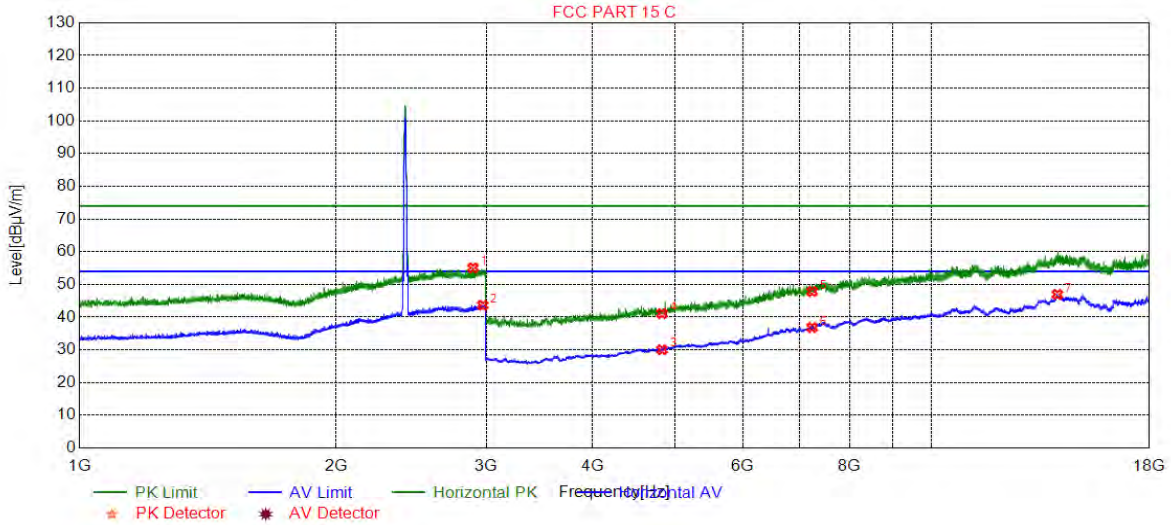
4.9.2 Transmitter emission above 1GHz

4.9.2.1 802.11B_Channel 1

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2894.97	55.12	9.15	74.00	18.88	102	137	Horizontal
2	2971.99	43.62	9.58	54.00	10.38	209	55	Horizontal
3	4824.00	30.06	-18.21	54.00	23.94	191	342	Horizontal
4	4824.00	41.09	-18.21	74.00	32.91	153	314	Horizontal
5	7236.00	47.84	-9.76	74.00	26.16	115	232	Horizontal
6	7236.00	36.85	-9.76	54.00	17.15	224	342	Horizontal
7	14035.1	46.95	2.46	54.00	7.05	179	14	Horizontal

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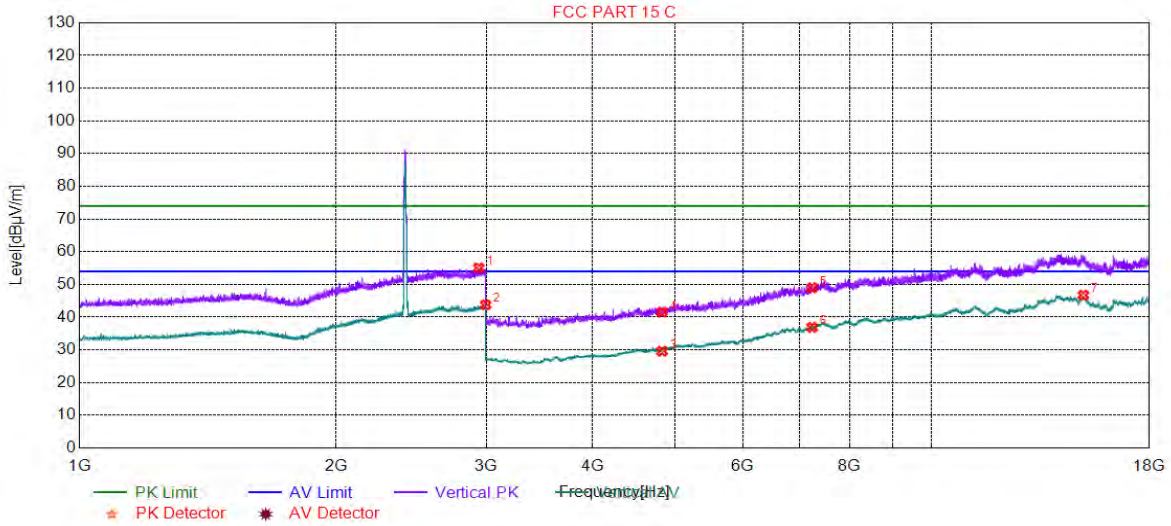
4.9.2.2 802.11B_Channel 1

Test Graph



Suspected List

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NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2939.98	55.08	9.57	74.00	18.92	252	99	Vertical
2	2995.99	43.81	9.47	54.00	10.19	184	303	Vertical
3	4824.00	29.60	-18.21	54.00	24.40	205	360	Vertical
4	4824.00	41.57	-18.21	74.00	32.43	259	317	Vertical
5	7236.00	49.02	-9.76	74.00	24.98	246	290	Vertical
6	7236.00	36.89	-9.76	54.00	17.11	174	344	Vertical
7	15053.7	46.75	2.64	54.00	7.25	201	100	Vertical

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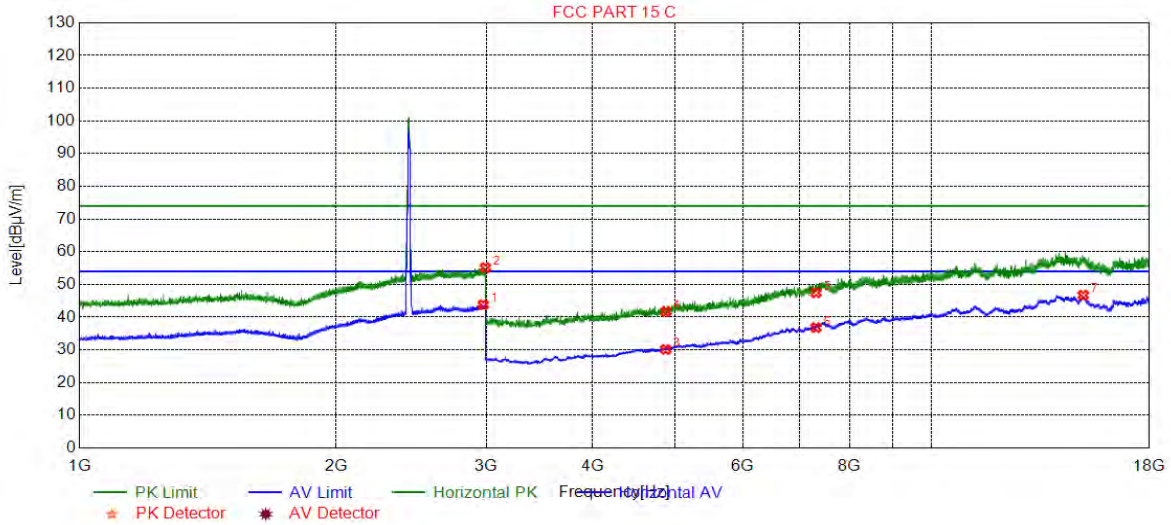
4.9.2.3 802.11B_Channel 6

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2976.49	43.83	9.56	54.00	10.17	206	31	Horizontal
2	2993.49	55.16	9.48	74.00	18.84	246	276	Horizontal
3	4874.00	30.14	-17.99	54.00	23.86	151	13	Horizontal
4	4874.00	41.73	-17.99	74.00	32.27	138	204	Horizontal
5	7311.00	47.48	-9.59	74.00	26.52	214	232	Horizontal
6	7311.00	36.81	-9.59	54.00	17.19	183	204	Horizontal
7	15050.7	46.73	2.64	54.00	7.27	209	40	Horizontal

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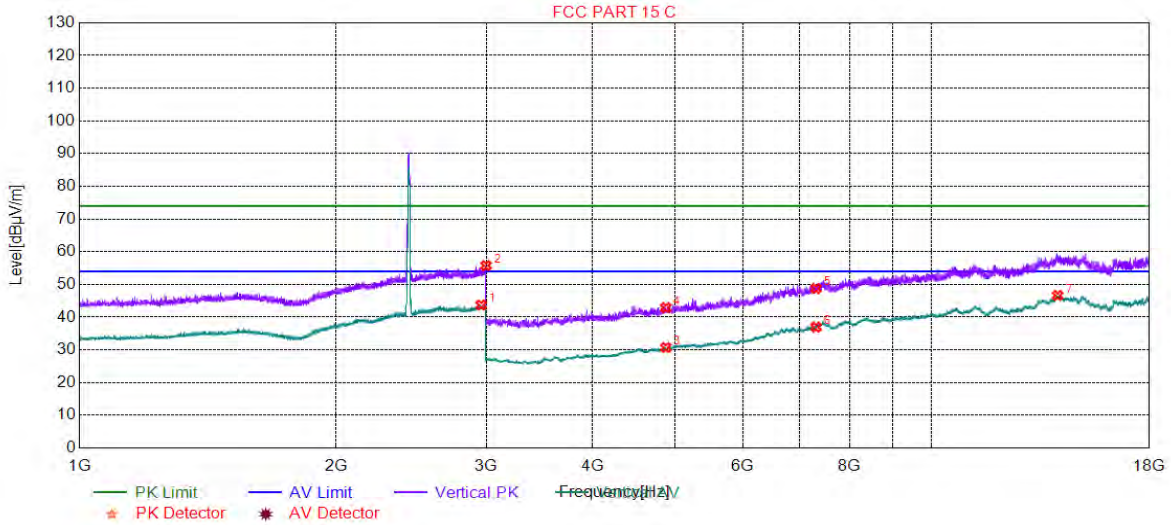
4.9.2.4 802.11B_Channel 6

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2958.98	43.74	9.64	54.00	10.26	212	302	Vertical
2	2998.49	55.77	9.46	74.00	18.23	156	71	Vertical
3	4874.00	30.73	-17.99	54.00	23.27	276	126	Vertical
4	4874.00	42.91	-17.99	74.00	31.09	169	236	Vertical
5	7311.00	48.75	-9.59	74.00	25.25	201	360	Vertical
6	7311.00	36.97	-9.59	54.00	17.03	201	263	Vertical
7	14044.1	46.62	2.48	54.00	7.38	274	317	Vertical

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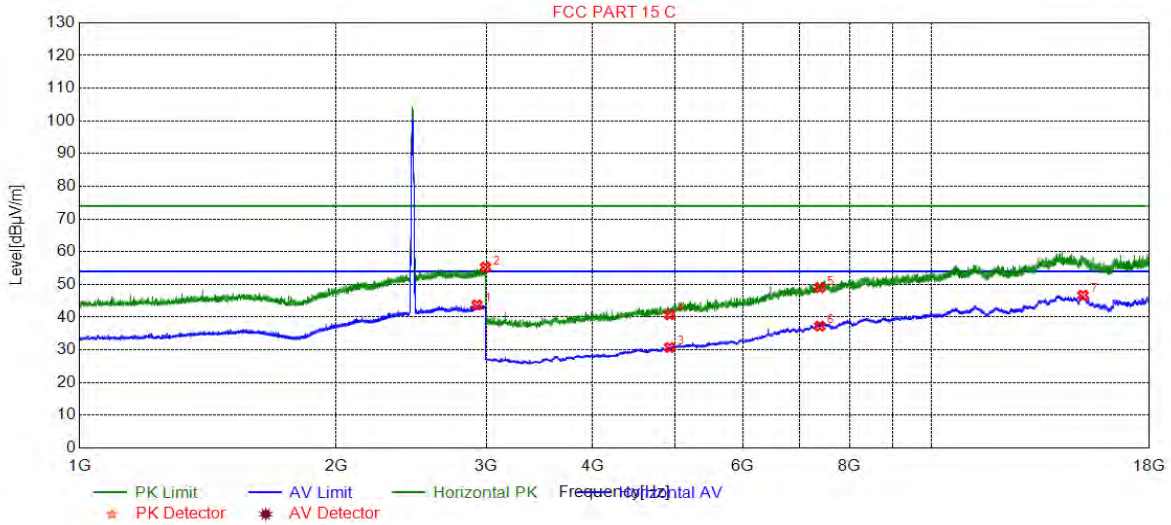
4.9.2.5 802.11B_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2926.98	43.76	9.43	54.00	10.24	141	125	Horizontal
2	2994.49	55.29	9.48	74.00	18.71	143	57	Horizontal
3	4924.00	30.76	-17.71	54.00	23.24	225	233	Horizontal
4	4924.00	40.73	-17.71	74.00	33.27	116	151	Horizontal
5	7386.00	49.04	-9.20	74.00	24.96	188	260	Horizontal
6	7386.00	37.26	-9.20	54.00	16.74	104	0	Horizontal
7	15043.2	46.73	2.62	54.00	7.27	178	287	Horizontal

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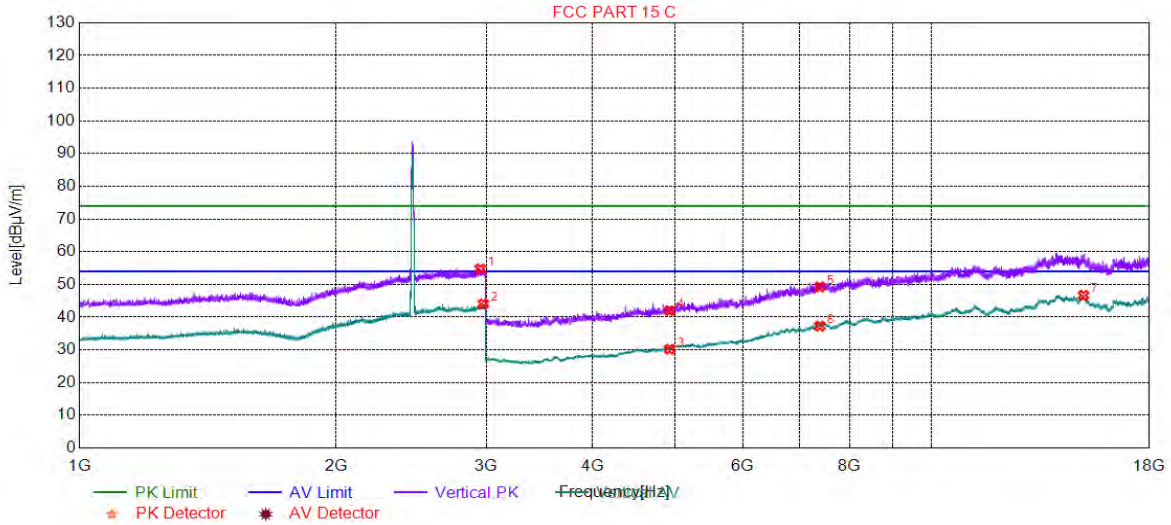
4.9.2.6 802.11B_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2952.48	54.77	9.67	74.00	19.23	244	235	Vertical
2	2976.99	44.08	9.56	54.00	9.92	181	126	Vertical
3	4924.00	30.23	-17.71	54.00	23.77	262	72	Vertical
4	4924.00	42.01	-17.71	74.00	31.99	169	18	Vertical
5	7386.00	49.27	-9.20	74.00	24.73	209	99	Vertical
6	7386.00	37.29	-9.20	54.00	16.71	168	99	Vertical
7	15059.7	46.70	2.65	54.00	7.30	221	153	Vertical

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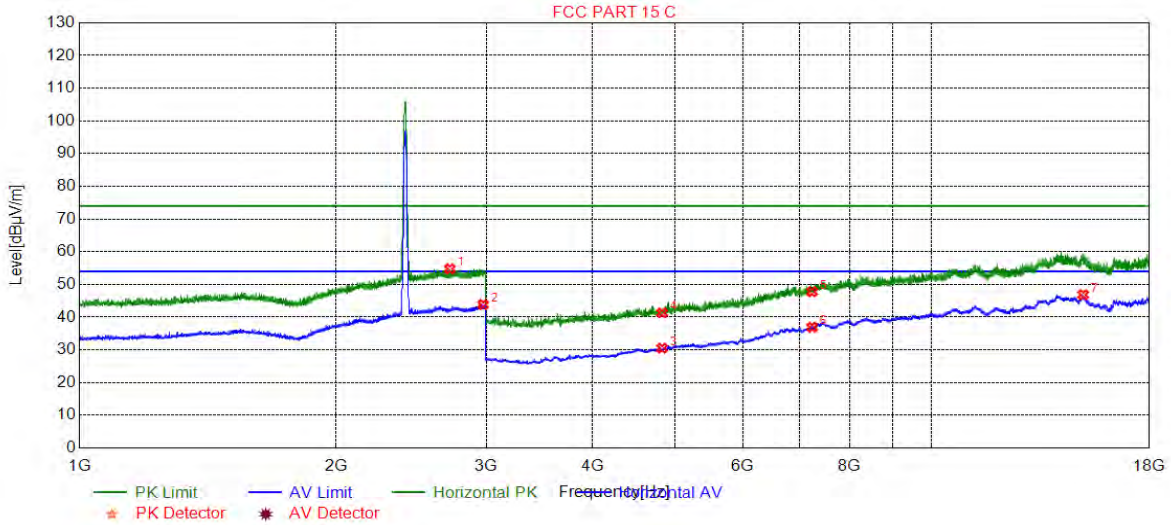
4.9.2.7 802.11G_Channel 1

Test Graph



Suspected List

Suspected List								
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1	2719.93	54.81	8.80	74.00	19.19	129	0	Horizontal
2	2975.49	43.88	9.56	54.00	10.12	174	208	Horizontal
3	4824.00	30.53	-18.21	54.00	23.47	193	0	Horizontal
4	4824.00	41.34	-18.21	74.00	32.66	194	15	Horizontal
5	7236.00	47.78	-9.76	74.00	26.22	140	233	Horizontal
6	7236.00	36.94	-9.76	54.00	17.06	128	97	Horizontal
7	15046.2	46.87	2.63	54.00	7.13	249	70	Horizontal

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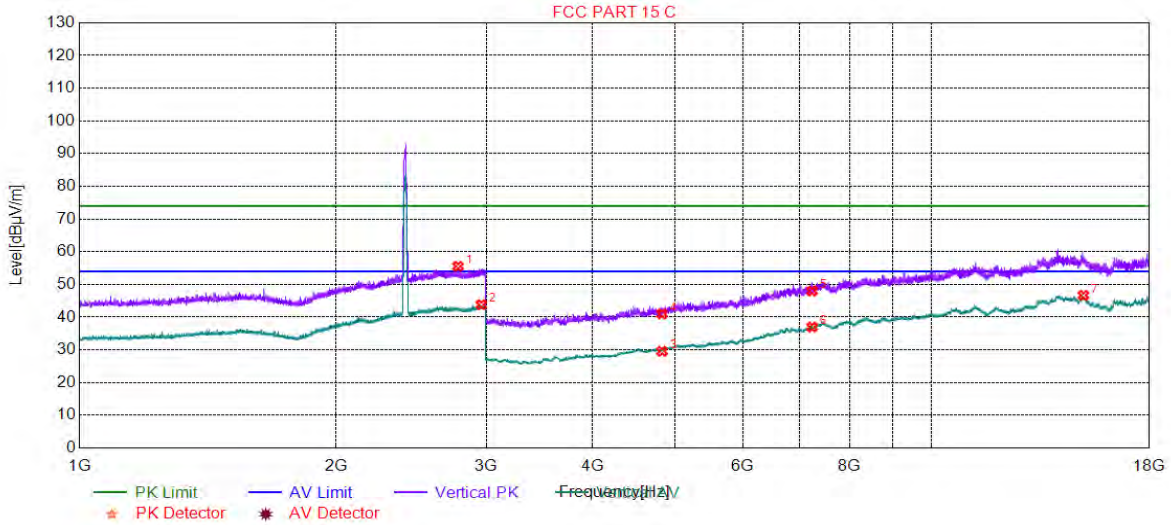
4.9.2.8 802.11G_Channel 1

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2779.94	55.55	9.03	74.00	18.45	231	222	Vertical
2	2960.49	43.83	9.63	54.00	10.17	166	112	Vertical
3	4824.00	29.58	-18.21	54.00	24.42	279	127	Vertical
4	4824.00	41.01	-18.21	74.00	32.99	286	236	Vertical
5	7236.00	48.02	-9.76	74.00	25.98	256	345	Vertical
6	7236.00	36.99	-9.76	54.00	17.01	189	264	Vertical
7	15056.7	46.66	2.65	54.00	7.34	244	155	Vertical

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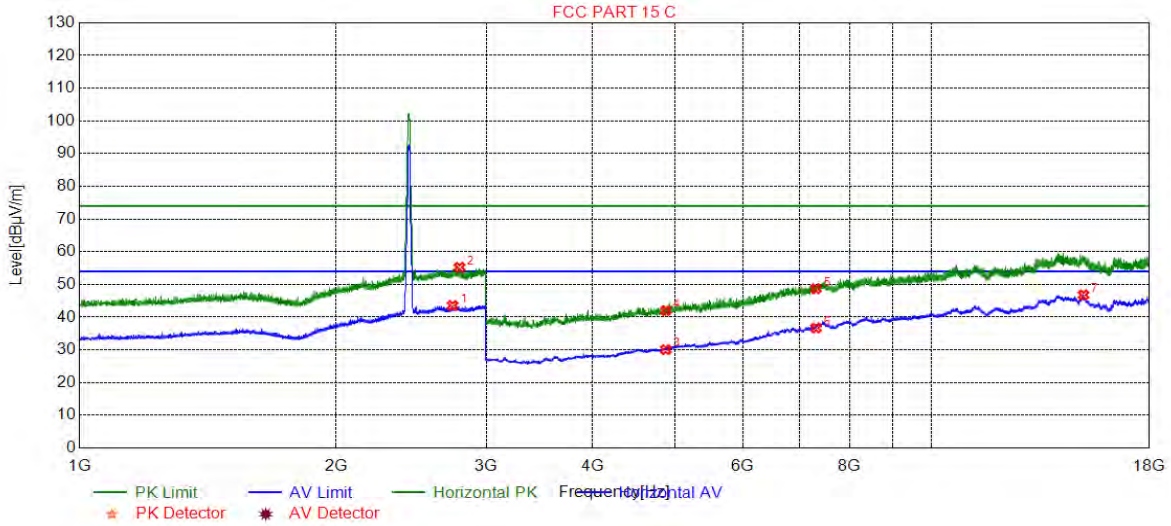
4.9.2.9 802.11G_Channel 6

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2739.43	43.55	9.00	54.00	10.45	246	177	Horizontal
2	2791.94	55.24	9.00	74.00	18.76	123	233	Horizontal
3	4874.00	30.08	-17.99	54.00	23.92	196	342	Horizontal
4	4874.00	42.03	-17.99	74.00	31.97	214	0	Horizontal
5	7311.00	48.69	-9.59	74.00	25.31	210	0	Horizontal
6	7311.00	36.71	-9.59	54.00	17.29	160	314	Horizontal
7	15059.7	46.82	2.65	54.00	7.18	129	233	Horizontal

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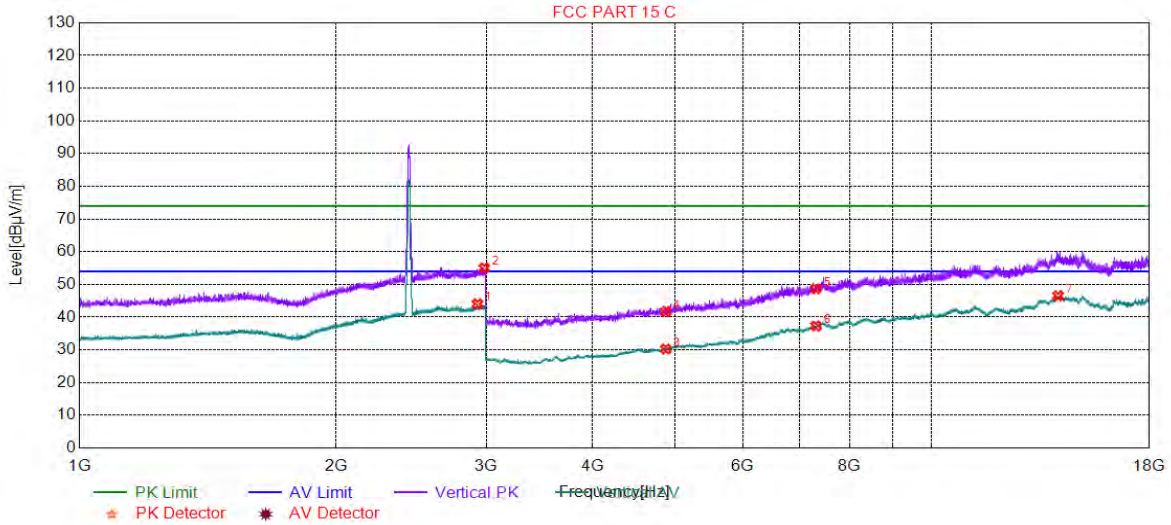
4.9.2.10 802.11G_Channel 6

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2929.98	44.05	9.46	54.00	9.95	184	113	Vertical
2	2983.99	55.05	9.52	74.00	18.95	214	236	Vertical
3	4874.00	30.27	-17.99	54.00	23.73	164	265	Vertical
4	4874.00	41.72	-17.99	74.00	32.28	240	319	Vertical
5	7311.00	48.69	-9.59	74.00	25.31	290	210	Vertical
6	7311.00	37.31	-9.59	54.00	16.69	188	18	Vertical
7	14060.6	46.54	2.52	54.00	7.46	291	292	Vertical

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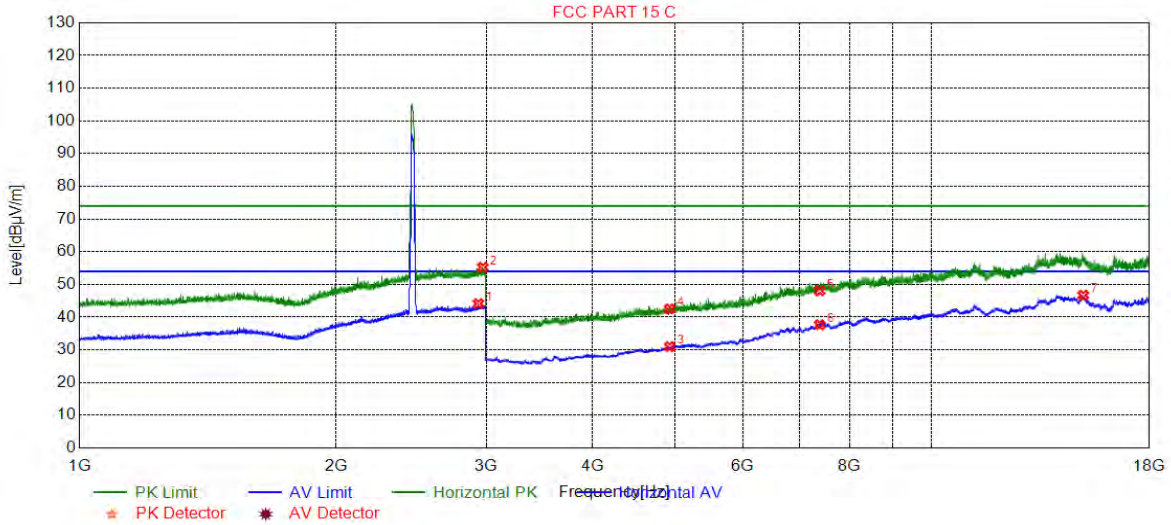
4.9.2.11 802.11G_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2936.98	44.13	9.54	54.00	9.87	188	261	Horizontal
2	2972.49	55.25	9.58	74.00	18.75	195	41	Horizontal
3	4924.00	31.02	-17.71	54.00	22.98	240	16	Horizontal
4	4924.00	42.55	-17.71	74.00	31.45	226	16	Horizontal
5	7386.00	48.07	-9.20	74.00	25.93	234	342	Horizontal
6	7386.00	37.68	-9.20	54.00	16.32	215	234	Horizontal
7	15052.2	46.72	2.64	54.00	7.28	172	288	Horizontal

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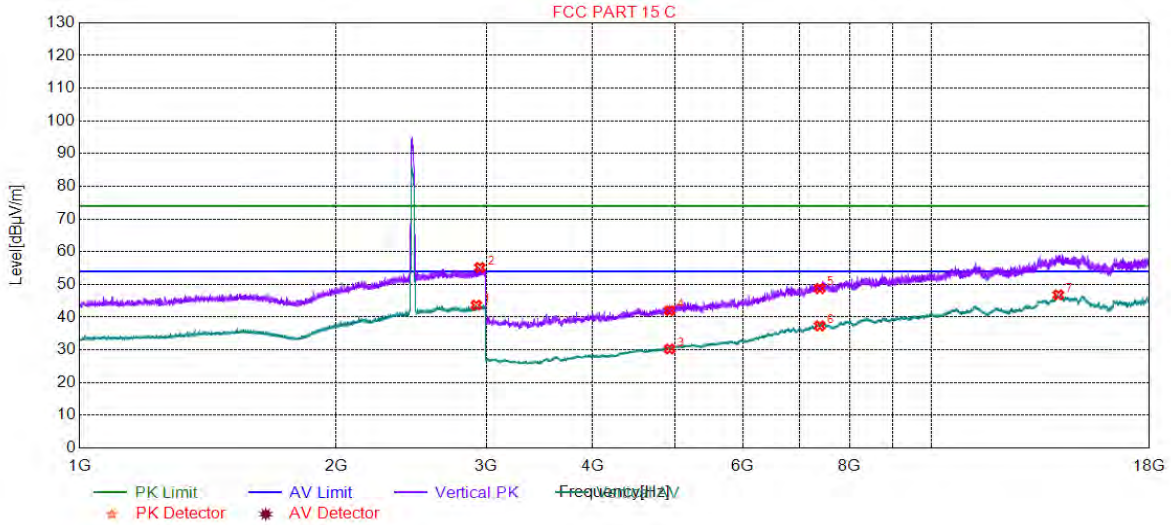
4.9.2.12 802.11G_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2921.48	43.68	9.37	54.00	10.32	228	263	Vertical
2	2948.98	55.20	9.67	74.00	18.80	209	360	Vertical
3	4924.00	30.29	-17.71	54.00	23.71	170	181	Vertical
4	4924.00	42.00	-17.71	74.00	32.00	209	18	Vertical
5	7386.00	48.75	-9.20	74.00	25.25	294	18	Vertical
6	7386.00	37.36	-9.20	54.00	16.64	166	126	Vertical
7	14069.6	46.84	2.54	54.00	7.16	278	262	Vertical

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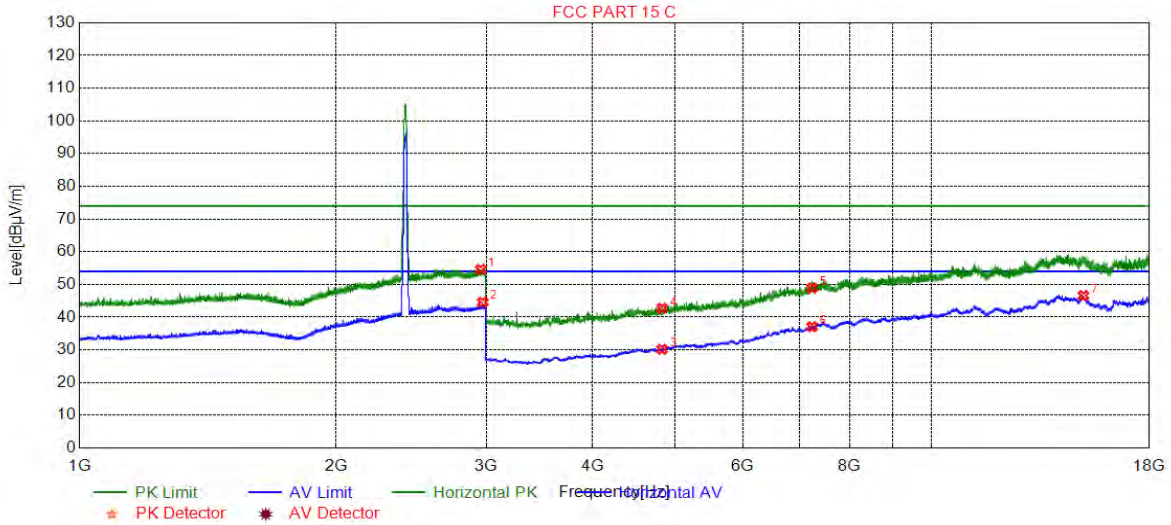
4.9.2.13 802.11N20_Channel 1

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2955.48	54.64	9.65	74.00	19.36	116	85	Horizontal
2	2972.49	44.59	9.58	54.00	9.41	137	165	Horizontal
3	4824.00	30.17	-18.21	54.00	23.83	221	205	Horizontal
4	4824.00	42.76	-18.21	74.00	31.24	143	96	Horizontal
5	7236.00	48.93	-9.76	74.00	25.07	160	150	Horizontal
6	7236.00	37.07	-9.76	54.00	16.93	155	41	Horizontal
7	15056.7	46.62	2.65	54.00	7.38	228	342	Horizontal

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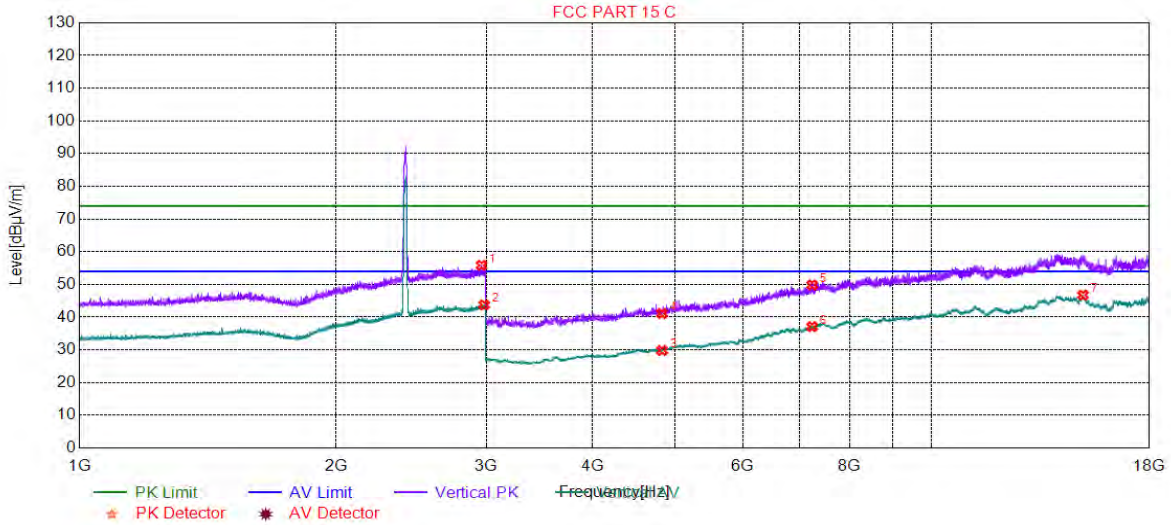
4.9.2.14 802.11N20_Channel 1

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2962.49	55.87	9.62	74.00	18.13	284	169	Vertical
2	2983.99	43.77	9.52	54.00	10.23	271	169	Vertical
3	4824.00	29.80	-18.21	54.00	24.20	173	237	Vertical
4	4824.00	41.11	-18.21	74.00	32.89	160	264	Vertical
5	7236.00	49.86	-9.76	74.00	24.14	219	45	Vertical
6	7236.00	37.12	-9.76	54.00	16.88	226	18	Vertical
7	15041.7	46.77	2.62	54.00	7.23	186	264	Vertical

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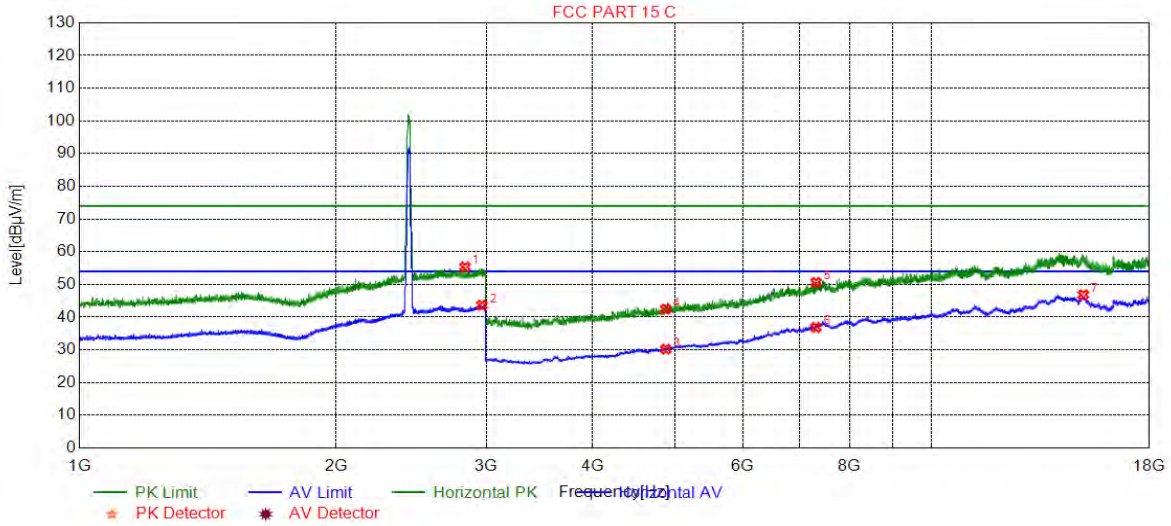
4.9.2.15 802.11N20_Channel 6

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2833.45	55.36	9.15	74.00	18.64	144	82	Horizontal
2	2965.49	43.66	9.61	54.00	10.34	128	274	Horizontal
3	4874.00	30.21	-17.99	54.00	23.79	185	260	Horizontal
4	4874.00	42.49	-17.99	74.00	31.51	170	0	Horizontal
5	7311.00	50.64	-9.59	74.00	23.36	192	232	Horizontal
6	7311.00	36.87	-9.59	54.00	17.13	191	314	Horizontal
7	15053.7	46.85	2.64	54.00	7.15	219	342	Horizontal

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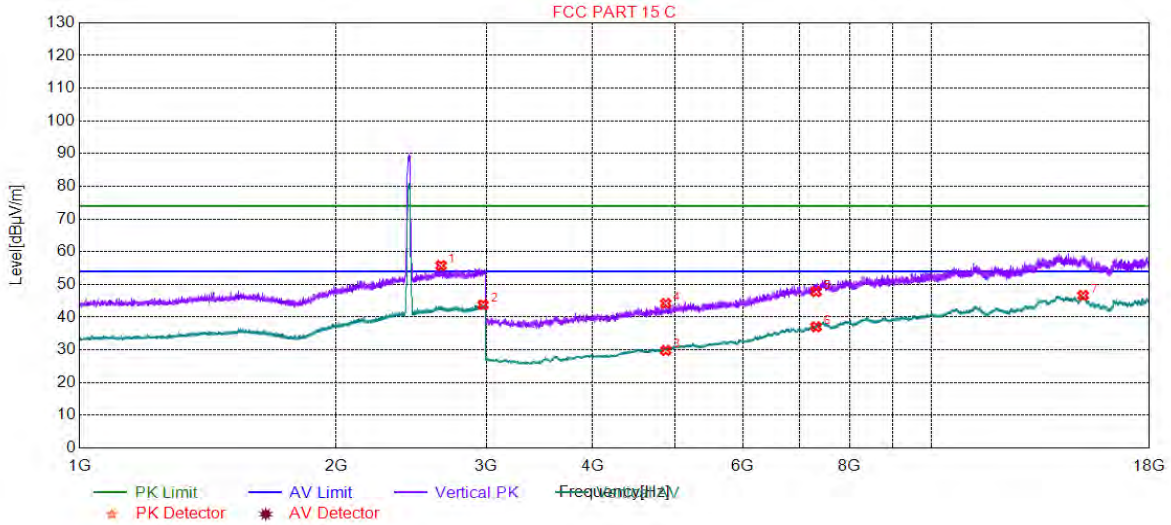
4.9.2.16 802.11N20_Channel 6

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2654.41	55.81	8.70	74.00	18.19	256	32	Vertical
2	2973.99	43.78	9.57	54.00	10.22	198	222	Vertical
3	4874.00	29.83	-17.99	54.00	24.17	168	44	Vertical
4	4874.00	44.19	-17.99	74.00	29.81	227	181	Vertical
5	7311.00	47.79	-9.59	74.00	26.21	180	262	Vertical
6	7311.00	37.06	-9.59	54.00	16.94	252	181	Vertical
7	15047.7	46.63	2.63	54.00	7.37	246	99	Vertical

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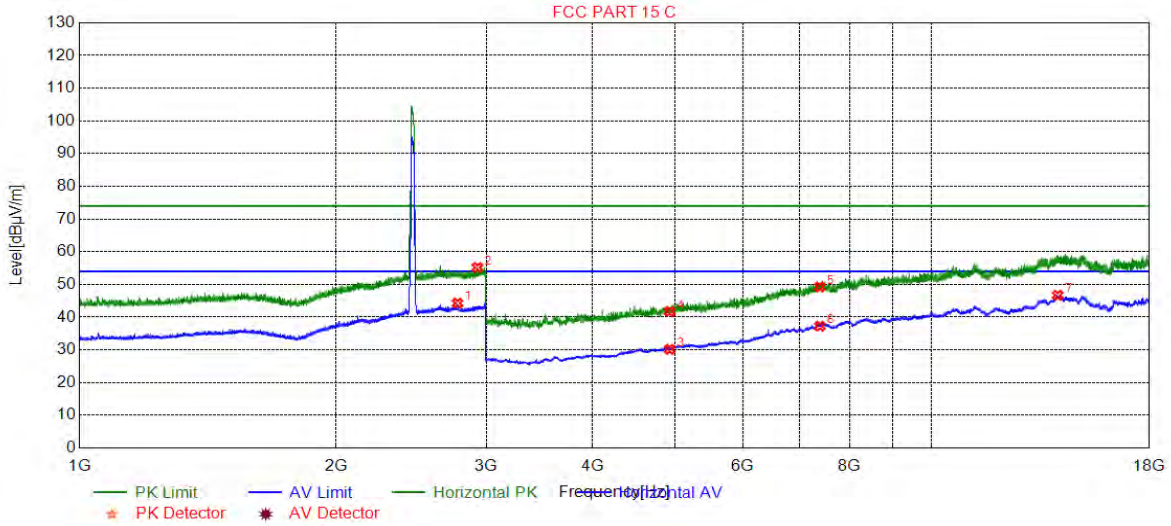
4.9.2.17 802.11N20_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2776.44	44.30	9.04	54.00	9.70	108	262	Horizontal
2	2929.98	55.20	9.46	74.00	18.80	246	56	Horizontal
3	4924.00	30.19	-17.71	54.00	23.81	184	178	Horizontal
4	4924.00	41.72	-17.71	74.00	32.28	237	41	Horizontal
5	7386.00	49.28	-9.20	74.00	24.72	232	260	Horizontal
6	7386.00	37.26	-9.20	54.00	16.74	125	232	Horizontal
7	14045.6	46.72	2.48	54.00	7.28	192	96	Horizontal

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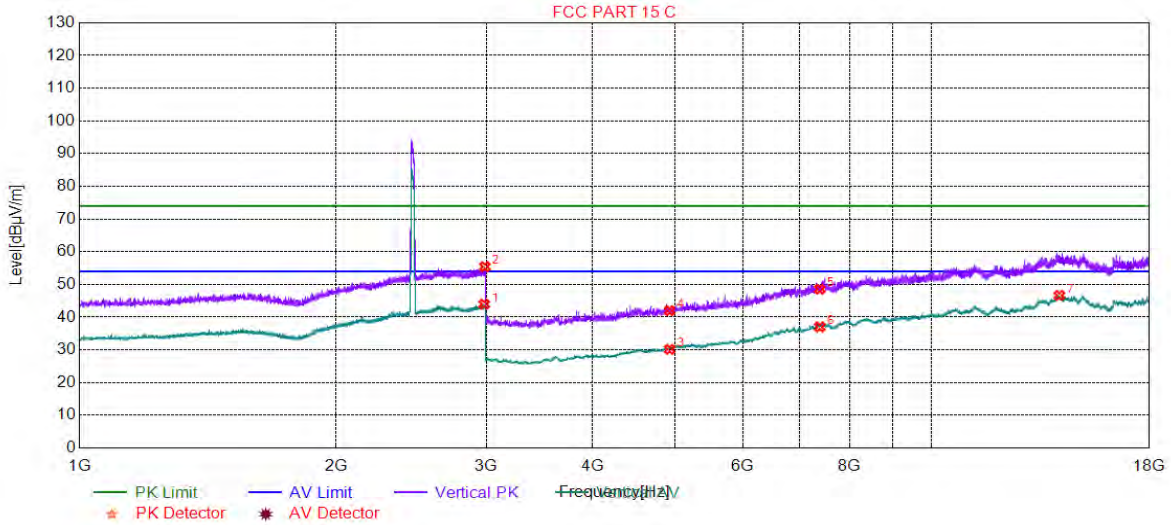
4.9.2.18 802.11N20_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2983.49	43.98	9.53	54.00	10.02	161	208	Vertical
2	2989.49	55.44	9.50	74.00	18.56	224	154	Vertical
3	4924.00	30.19	-17.71	54.00	23.81	170	236	Vertical
4	4924.00	41.99	-17.71	74.00	32.01	160	182	Vertical
5	7386.00	48.57	-9.20	74.00	25.43	270	345	Vertical
6	7386.00	37.02	-9.20	54.00	16.98	256	291	Vertical
7	14113.1	46.63	2.58	54.00	7.37	286	154	Vertical

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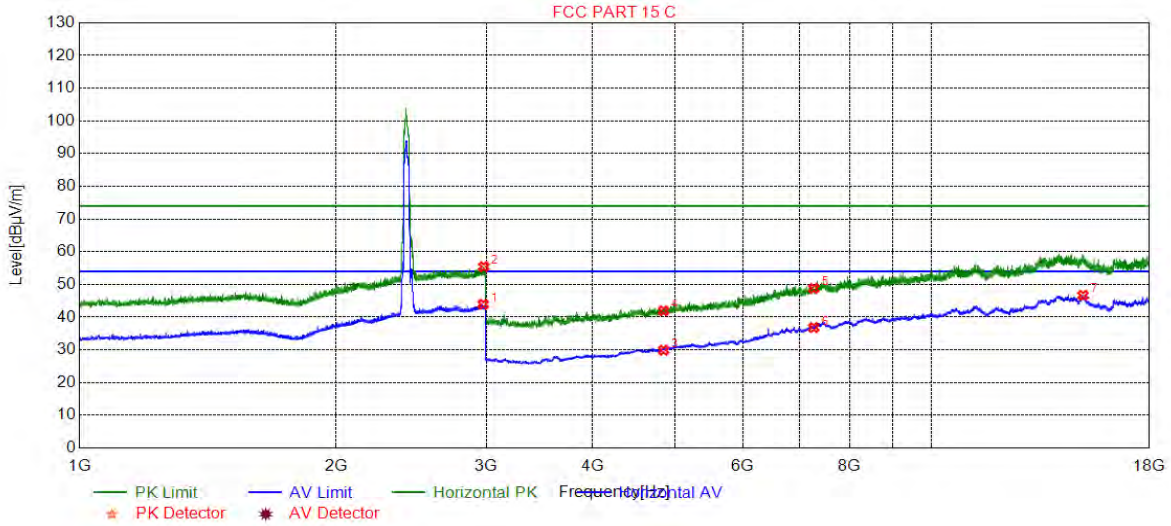
4.9.2.19 802.11N40_Channel 3

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2975.99	43.95	9.56	54.00	10.05	125	13	Horizontal
2	2980.99	55.44	9.54	74.00	18.56	141	219	Horizontal
3	4844.00	29.91	-18.12	54.00	24.09	173	206	Horizontal
4	4844.00	41.98	-18.12	74.00	32.02	213	233	Horizontal
5	7266.00	48.79	-9.71	74.00	25.21	183	15	Horizontal
6	7266.00	36.83	-9.71	54.00	17.17	145	260	Horizontal
7	15043.2	46.69	2.62	54.00	7.31	176	15	Horizontal

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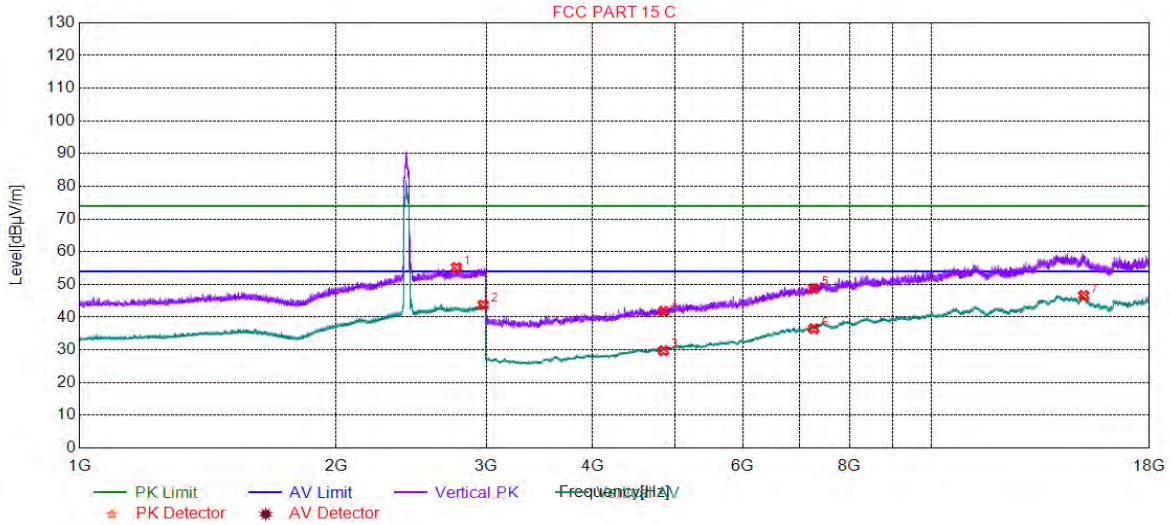
4.9.2.20 802.11N40_Channel 3

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2768.94	55.18	9.06	74.00	18.82	154	140	Vertical
2	2975.49	43.77	9.56	54.00	10.23	268	360	Vertical
3	4844.00	29.76	-18.12	54.00	24.24	187	360	Vertical
4	4844.00	41.81	-18.12	74.00	32.19	155	45	Vertical
5	7266.00	48.78	-9.71	74.00	25.22	265	209	Vertical
6	7266.00	36.46	-9.71	54.00	17.54	288	128	Vertical
7	15067.2	46.64	2.66	54.00	7.36	163	100	Vertical

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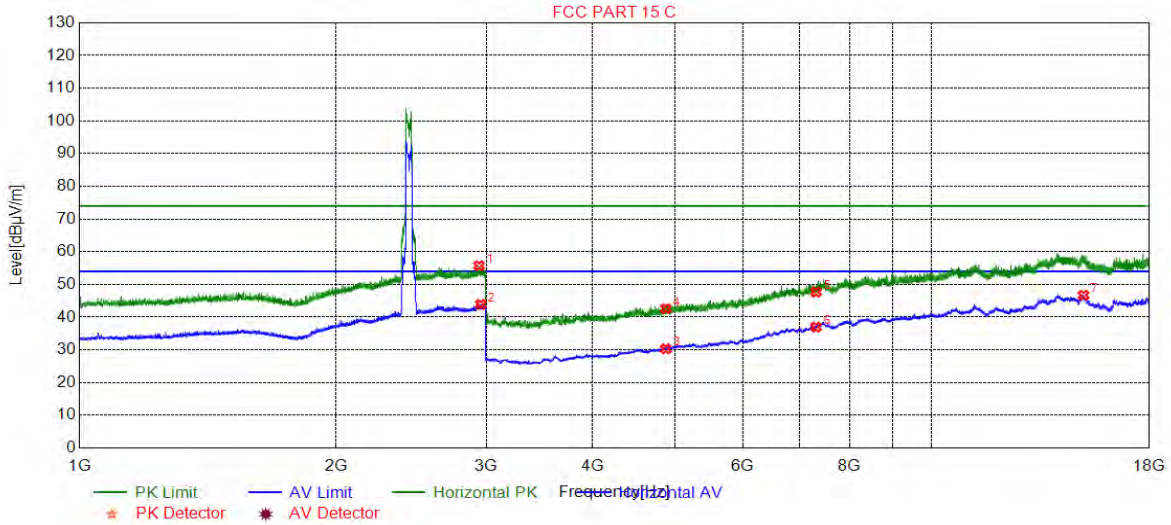
4.9.2.21 802.11N40_Channel 6

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2942.48	55.77	9.60	74.00	18.23	124	247	Horizontal
2	2955.48	43.95	9.65	54.00	10.05	232	178	Horizontal
3	4874.00	30.33	-17.99	54.00	23.67	129	314	Horizontal
4	4874.00	42.61	-17.99	74.00	31.39	239	124	Horizontal
5	7311.00	47.69	-9.59	74.00	26.31	154	260	Horizontal
6	7311.00	36.98	-9.59	54.00	17.02	211	69	Horizontal
7	15061.2	46.74	2.65	54.00	7.26	181	0	Horizontal

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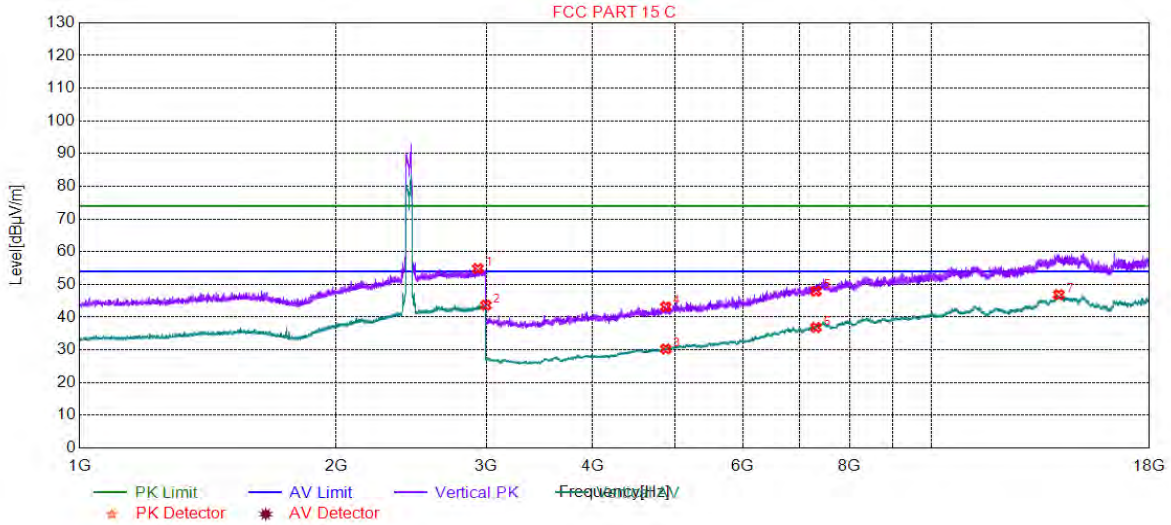
4.9.2.22 802.11N40_Channel 6

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2932.48	54.86	9.49	74.00	19.14	192	332	Vertical
2	2996.99	43.65	9.46	54.00	10.35	178	304	Vertical
3	4874.00	30.28	-17.99	54.00	23.72	290	317	Vertical
4	4874.00	43.22	-17.99	74.00	30.78	170	180	Vertical
5	7311.00	47.92	-9.59	74.00	26.08	272	207	Vertical
6	7311.00	36.85	-9.59	54.00	17.15	243	235	Vertical
7	14087.6	46.89	2.58	54.00	7.11	271	317	Vertical

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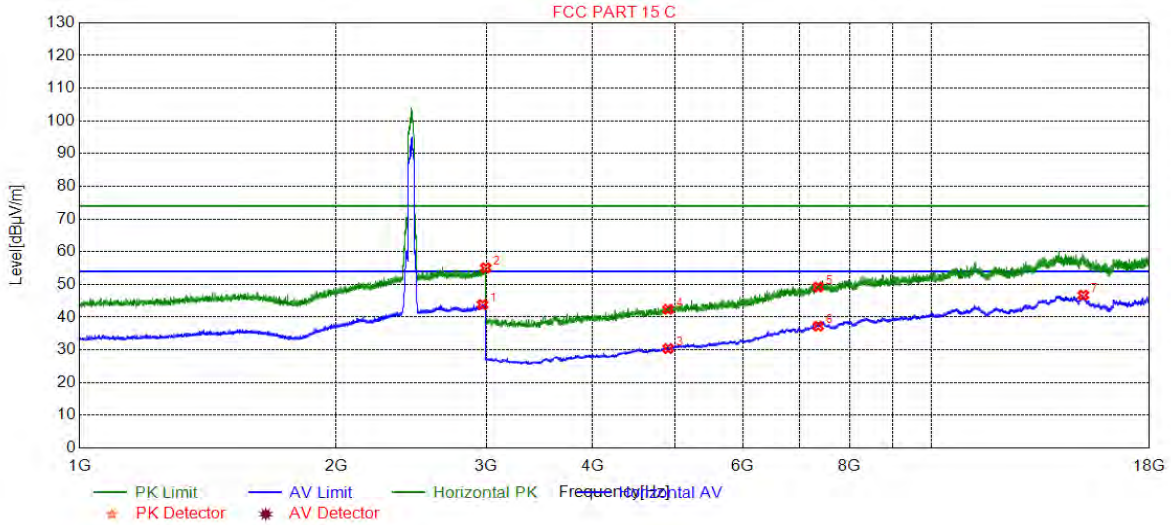
4.9.2.23 802.11N40_Channel 9

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2969.99	43.87	9.59	54.00	10.13	247	98	Horizontal
2	2996.49	55.07	9.47	74.00	18.93	224	56	Horizontal
3	4904.00	30.41	-17.84	54.00	23.59	112	342	Horizontal
4	4904.00	42.40	-17.84	74.00	31.60	112	260	Horizontal
5	7356.00	49.23	-9.36	74.00	24.77	122	152	Horizontal
6	7356.00	37.25	-9.36	54.00	16.75	243	206	Horizontal
7	15052.2	46.75	2.64	54.00	7.25	181	342	Horizontal

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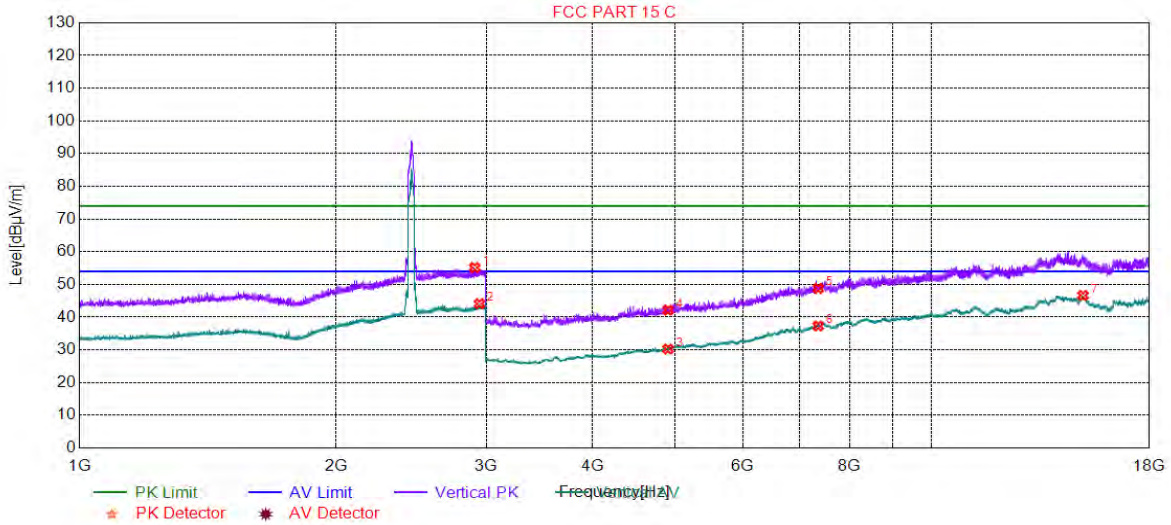
4.9.2.24 802.11N40_Channel 9

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2908.47	55.17	9.23	74.00	18.83	241	31	Vertical
2	2945.98	44.12	9.64	54.00	9.88	212	181	Vertical
3	4904.00	30.26	-17.84	54.00	23.74	238	73	Vertical
4	4904.00	42.16	-17.84	74.00	31.84	177	154	Vertical
5	7356.00	48.78	-9.36	74.00	25.22	275	208	Vertical
6	7356.00	37.31	-9.36	54.00	16.69	221	73	Vertical
7	15040.2	46.63	2.62	54.00	7.37	297	316	Vertical

Final Data List

Remark:

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

   Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

2) Scan from 9kHz to 25GHz, the disturbance between 9KHz to 30MHz and 18GHz to 25GHz was very low, and the above harmonics were the highest point could be found when testing, The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

3）As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.

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

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4.10 Restricted bands around fundamental frequency

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

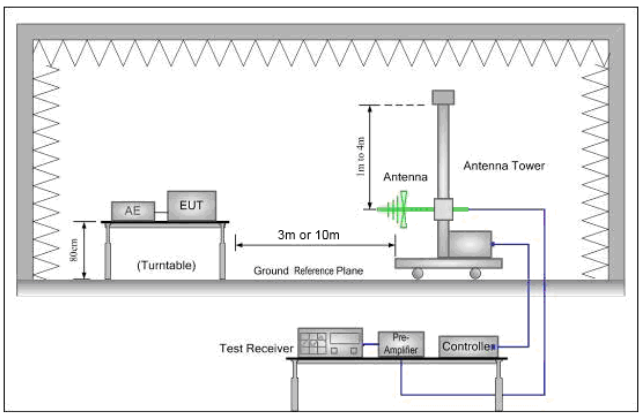

Figure 1. 30MHz to 1GHz

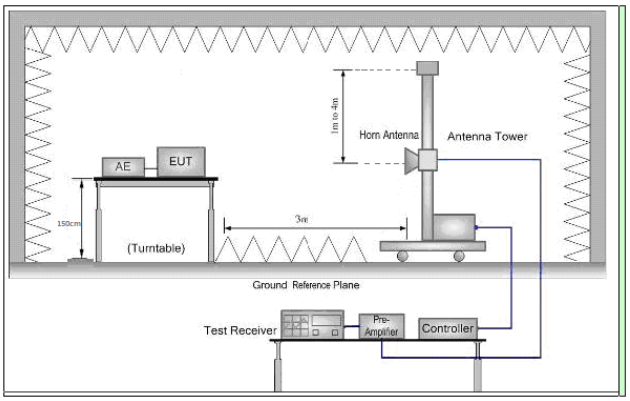

Figure 2. Above 1 GHz

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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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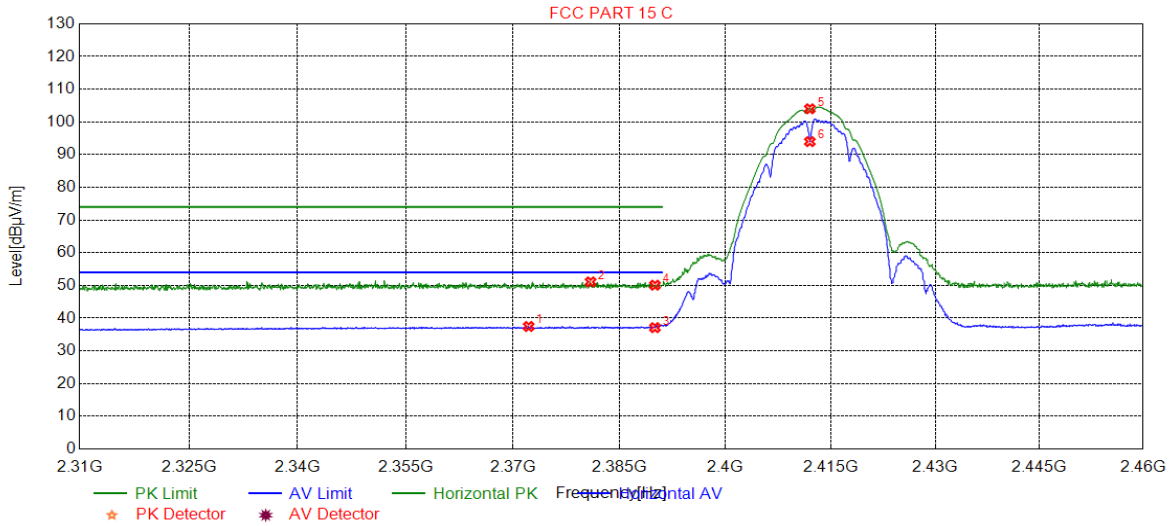
Test plot as follows:

4.10.1 Test plots

4.10.1.1 802.11B_Channel 1

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2372.20	37.47	7.79	54.00	16.53	230	227	Horizontal
2	2380.91	51.10	7.78	74.00	22.90	227	45	Horizontal
3	2390.00	37.11	7.77	54.00	16.89	228	346	Horizontal
4	2390.00	50.10	7.77	74.00	23.90	104	346	Horizontal
5	2412.00	104.02	7.81	0.00	-104.02	124	101	Horizontal
6	2412.00	93.98	7.81	0.00	-93.98	215	101	Horizontal

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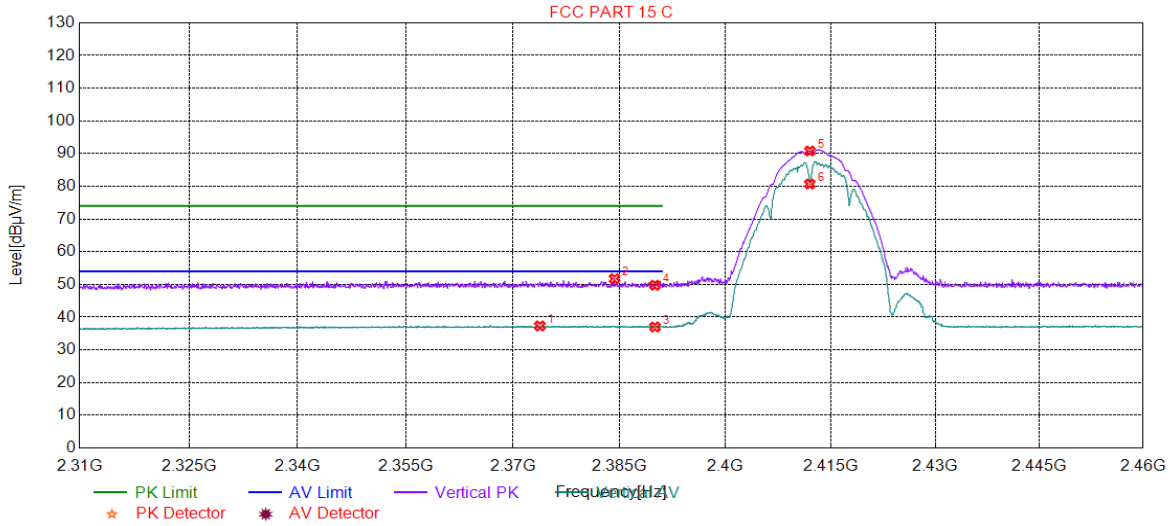
4.10.1.2 802.11B_Channel 1

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2373.78	37.32	7.79	54.00	16.68	194	266	Vertical
2	2384.28	51.77	7.78	74.00	22.23	181	199	Vertical
3	2390.00	37.02	7.77	54.00	16.98	234	282	Vertical
4	2390.00	49.78	7.77	74.00	24.22	189	129	Vertical
5	2412.00	90.82	7.81	0.00	-90.82	216	343	Vertical
6	2412.00	80.71	7.81	0.00	-80.71	251	337	Vertical

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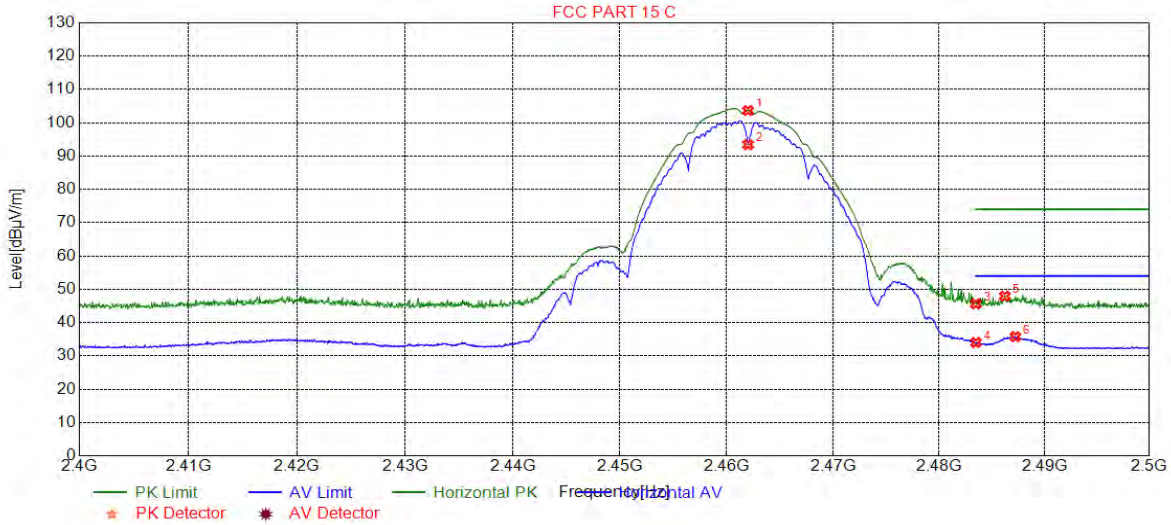
4.10.1.3 802.11B_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	103.66	7.98	0.00	-103.66	136	264	Horizontal
2	2462.00	93.46	7.98	0.00	-93.46	205	264	Horizontal
3	2483.50	45.66	8.01	74.00	28.34	102	264	Horizontal
4	2483.50	34.05	8.01	54.00	19.95	219	264	Horizontal
5	2486.24	47.97	8.01	74.00	26.03	184	216	Horizontal
6	2487.24	35.79	8.01	54.00	18.21	222	216	Horizontal

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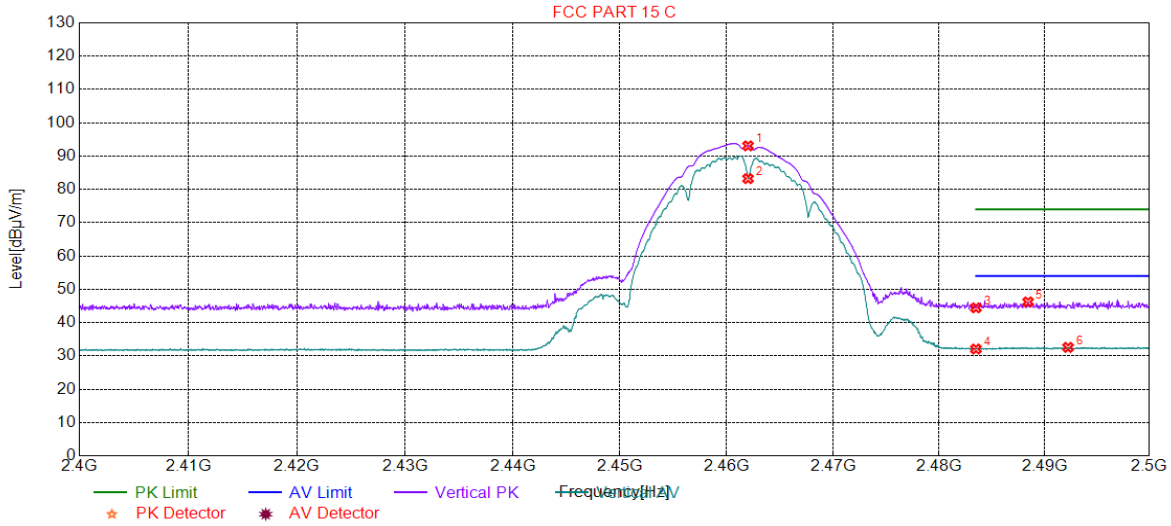
4.10.1.4 802.11B_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	93.07	7.98	0.00	-93.07	260	354	Vertical
2	2462.00	83.24	7.98	0.00	-83.24	281	349	Vertical
3	2483.50	44.46	8.01	74.00	29.54	271	310	Vertical
4	2483.50	32.10	8.01	54.00	21.90	174	239	Vertical
5	2488.44	46.24	8.02	74.00	27.76	192	90	Vertical
6	2492.24	32.59	8.02	54.00	21.41	173	228	Vertical

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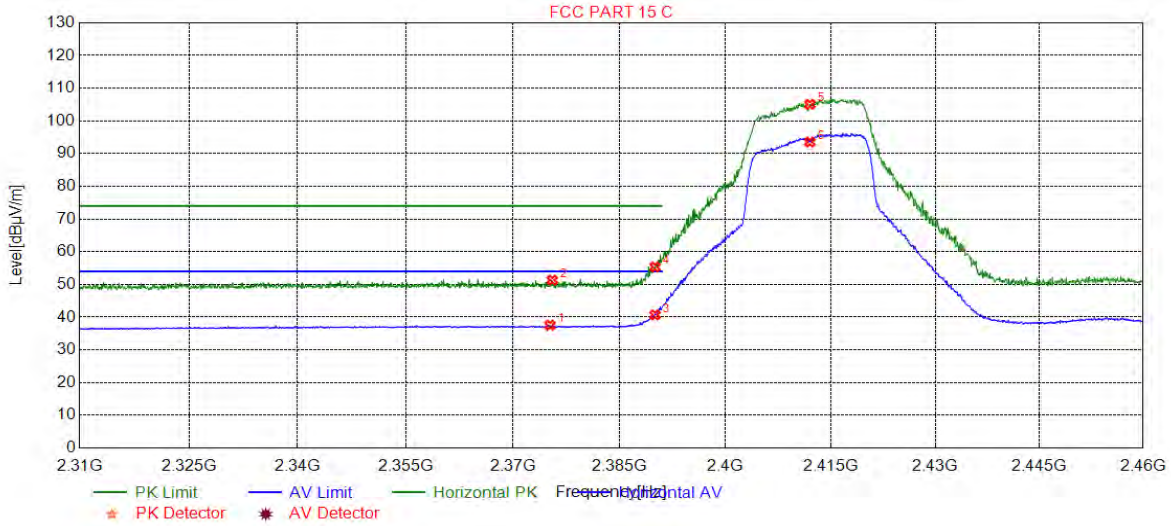
4.10.1.5 802.11G_Channel 1

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2375.20	37.54	7.78	54.00	16.46	169	105	Horizontal
2	2375.50	51.33	7.78	74.00	22.67	108	56	Horizontal
3	2390.00	40.70	7.77	54.00	13.30	230	221	Horizontal
4	2390.00	55.36	7.77	74.00	18.64	179	221	Horizontal
5	2412.00	105.08	7.81	0.00	-105.08	150	100	Horizontal
6	2412.00	93.53	7.81	0.00	-93.53	171	105	Horizontal

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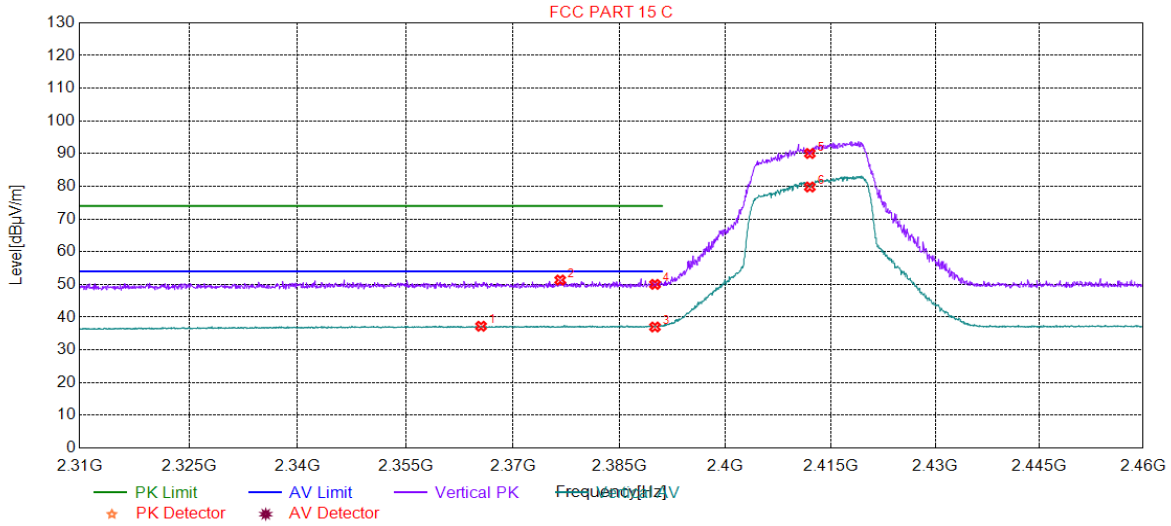
4.10.1.6 802.11G_Channel 1

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2365.52	37.24	7.79	54.00	16.76	294	316	Vertical
2	2376.63	51.36	7.78	74.00	22.64	199	266	Vertical
3	2390.00	37.01	7.77	54.00	16.99	292	95	Vertical
4	2390.00	50.04	7.77	74.00	23.96	175	294	Vertical
5	2412.00	90.05	7.81	0.00	-90.05	234	343	Vertical
6	2412.00	79.81	7.81	0.00	-79.81	194	95	Vertical

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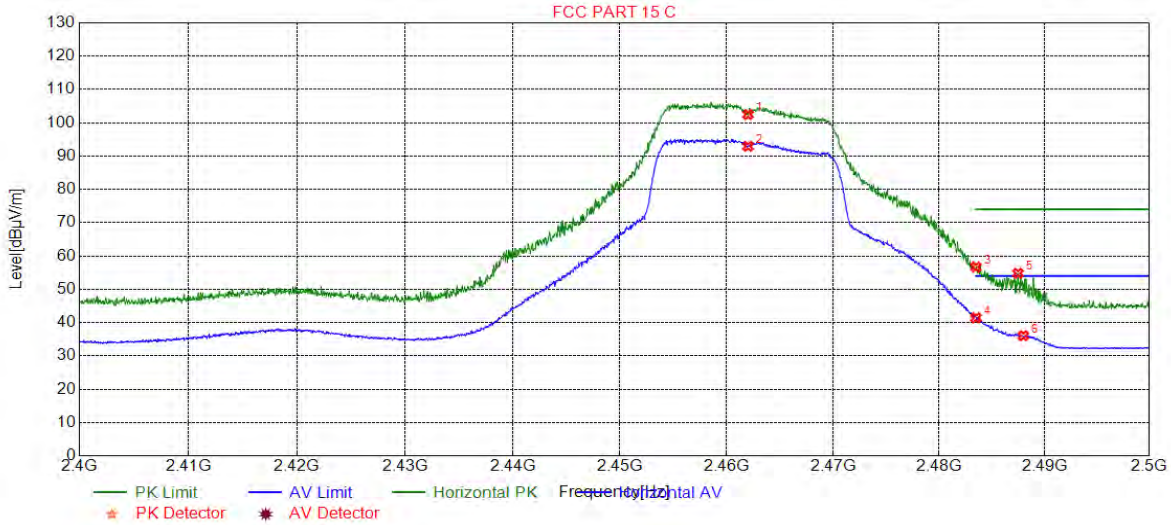
4.10.1.7 802.11G_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	102.47	7.98	0.00	-102.47	141	259	Horizontal
2	2462.00	92.93	7.98	0.00	-92.93	232	264	Horizontal
3	2483.50	56.72	8.01	74.00	17.28	115	259	Horizontal
4	2483.50	41.46	8.01	54.00	12.54	235	215	Horizontal
5	2487.49	54.82	8.01	74.00	19.18	216	215	Horizontal
6	2487.99	36.09	8.02	54.00	17.91	241	264	Horizontal

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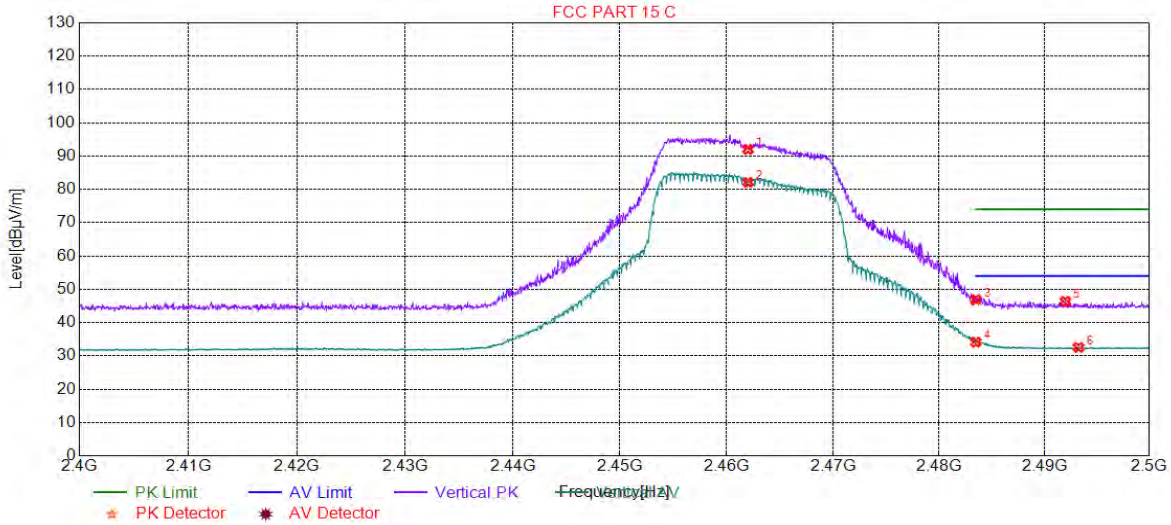
4.10.1.8 802.11G_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	92.00	7.98	0.00	-92.00	222	355	Vertical
2	2462.00	82.11	7.98	0.00	-82.11	264	350	Vertical
3	2483.50	46.89	8.01	74.00	27.11	267	355	Vertical
4	2483.50	34.16	8.01	54.00	19.84	291	350	Vertical
5	2491.99	46.39	8.02	74.00	27.61	252	46	Vertical
6	2493.24	32.58	8.02	54.00	21.42	286	67	Vertical

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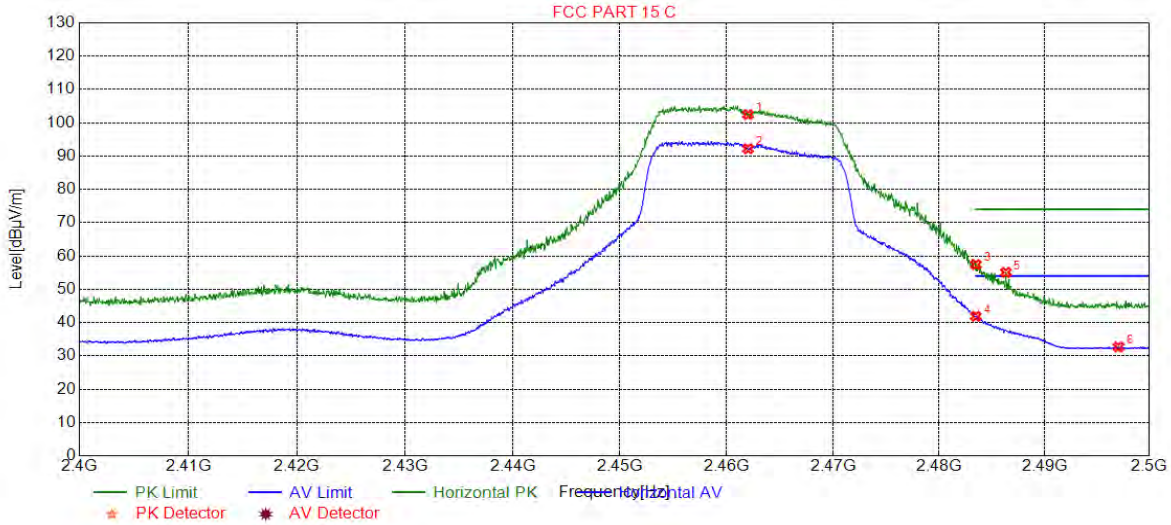
4.10.1.9 802.11N20_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	102.49	7.98	0.00	-102.49	129	264	Horizontal
2	2462.00	92.20	7.98	0.00	-92.20	146	264	Horizontal
3	2483.50	57.46	8.01	74.00	16.54	164	270	Horizontal
4	2483.50	41.91	8.01	54.00	12.09	185	264	Horizontal
5	2486.34	55.10	8.01	74.00	18.90	227	264	Horizontal
6	2497.04	32.74	8.03	54.00	21.26	137	34	Horizontal

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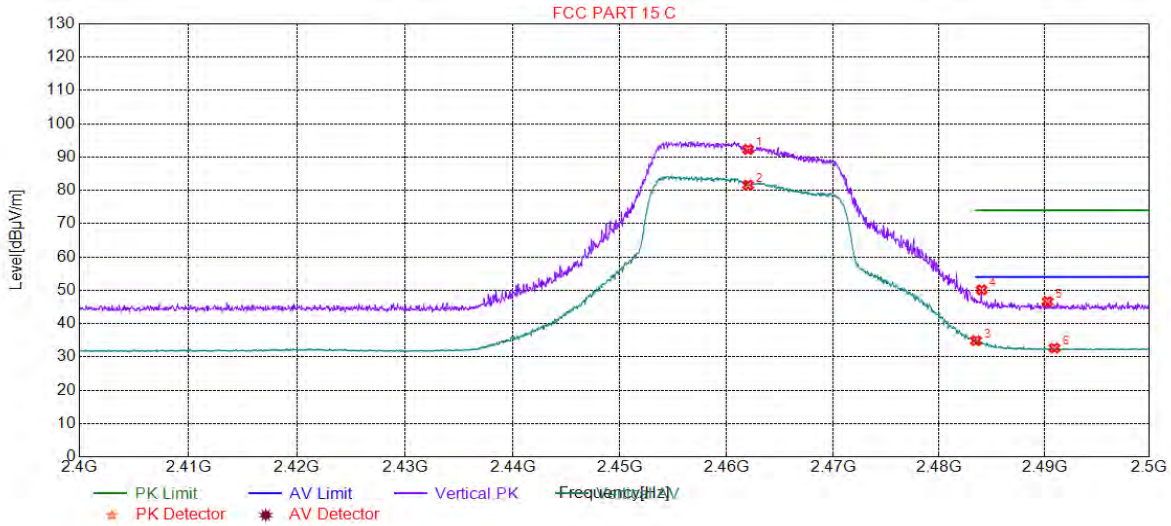
4.10.1.10 802.11N20_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	92.31	7.98	0.00	-92.31	197	353	Vertical
2	2462.00	81.61	7.98	0.00	-81.61	249	353	Vertical
3	2483.50	34.89	8.01	54.00	19.11	285	348	Vertical
4	2484.04	50.17	8.01	74.00	23.83	187	348	Vertical
5	2490.29	46.65	8.02	74.00	27.35	188	129	Vertical
6	2490.94	32.67	8.02	54.00	21.33	161	358	Vertical

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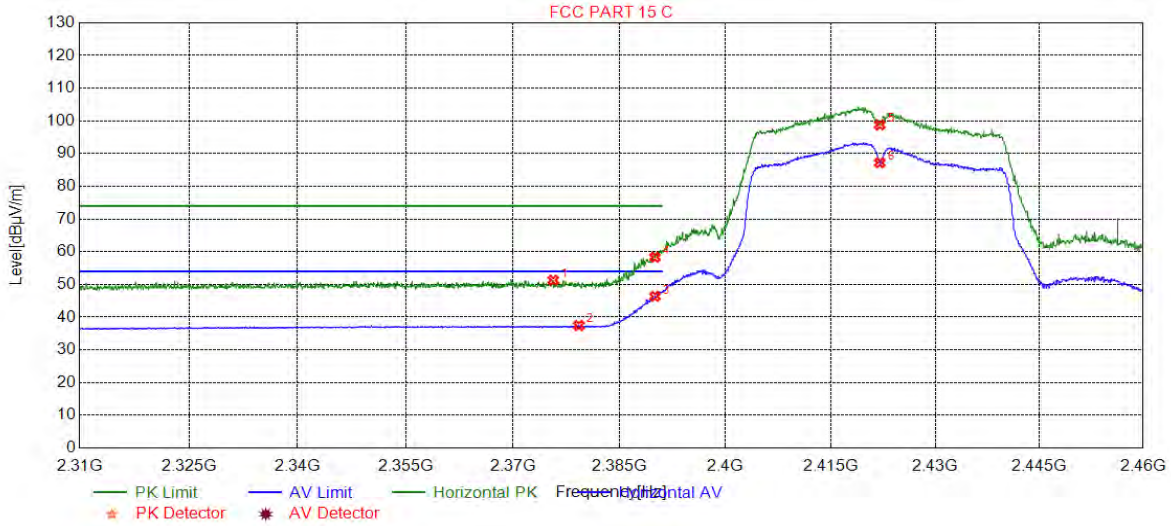
4.10.1.11 802.11N40_Channel 3

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2375.65	51.32	7.78	74.00	22.68	186	216	Horizontal
2	2379.25	37.45	7.78	54.00	16.55	103	18	Horizontal
3	2390.00	46.37	7.77	54.00	7.63	223	101	Horizontal
4	2390.00	58.33	7.77	74.00	15.67	130	216	Horizontal
5	2422.00	98.79	7.85	0.00	-98.79	243	79	Horizontal
6	2422.00	87.22	7.85	0.00	-87.22	176	106	Horizontal

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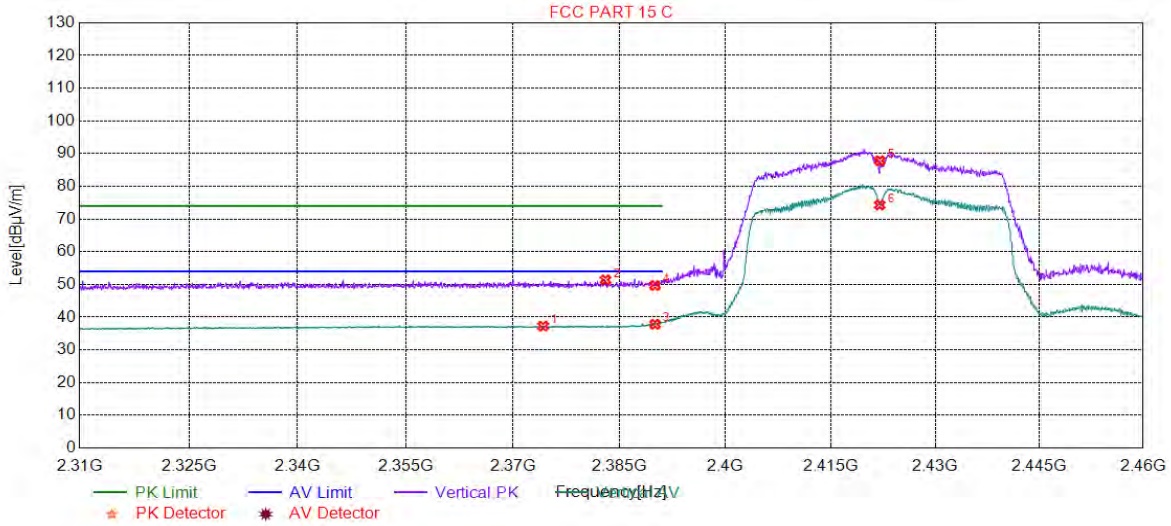
4.10.1.12 802.11N40_Channel 3

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2374.23	37.26	7.79	54.00	16.74	259	220	Vertical
2	2383.01	51.40	7.78	74.00	22.60	271	14	Vertical
3	2390.00	37.84	7.77	54.00	16.16	274	313	Vertical
4	2390.00	49.69	7.77	74.00	24.31	211	78	Vertical
5	2422.00	87.83	7.85	0.00	-87.83	253	324	Vertical
6	2422.00	74.30	7.85	0.00	-74.30	274	329	Vertical

Final Data List

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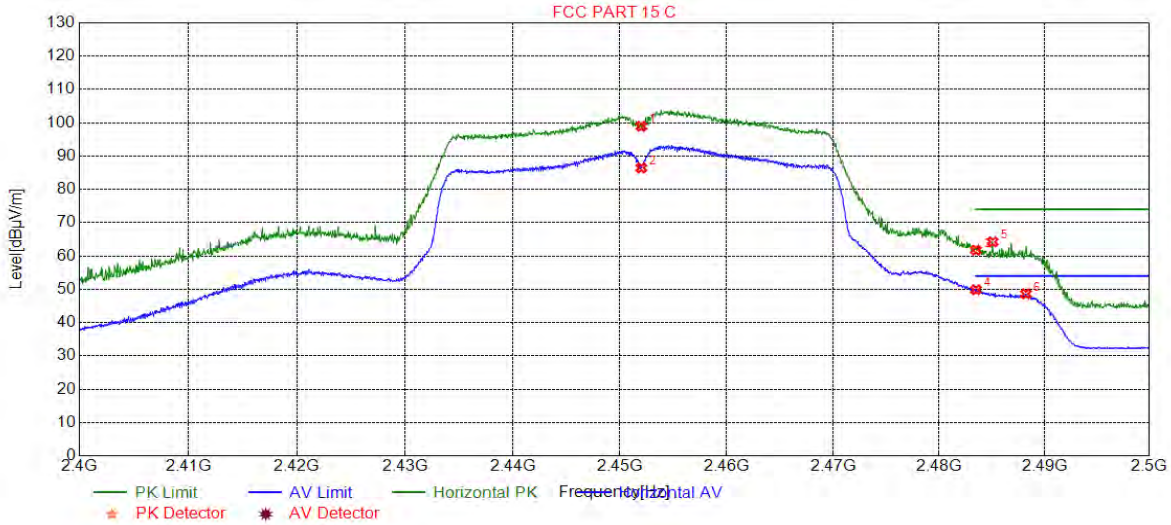
4.10.1.13 802.11N40_Channel 9

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2452.00	98.93	7.97	0.00	-98.93	243	265	Horizontal
2	2452.00	86.46	7.97	0.00	-86.46	179	265	Horizontal
3	2483.50	61.77	8.01	74.00	12.23	231	270	Horizontal
4	2483.50	49.87	8.01	54.00	4.13	159	265	Horizontal
5	2485.09	64.25	8.01	74.00	9.75	172	216	Horizontal
6	2488.24	48.66	8.02	54.00	5.34	198	216	Horizontal

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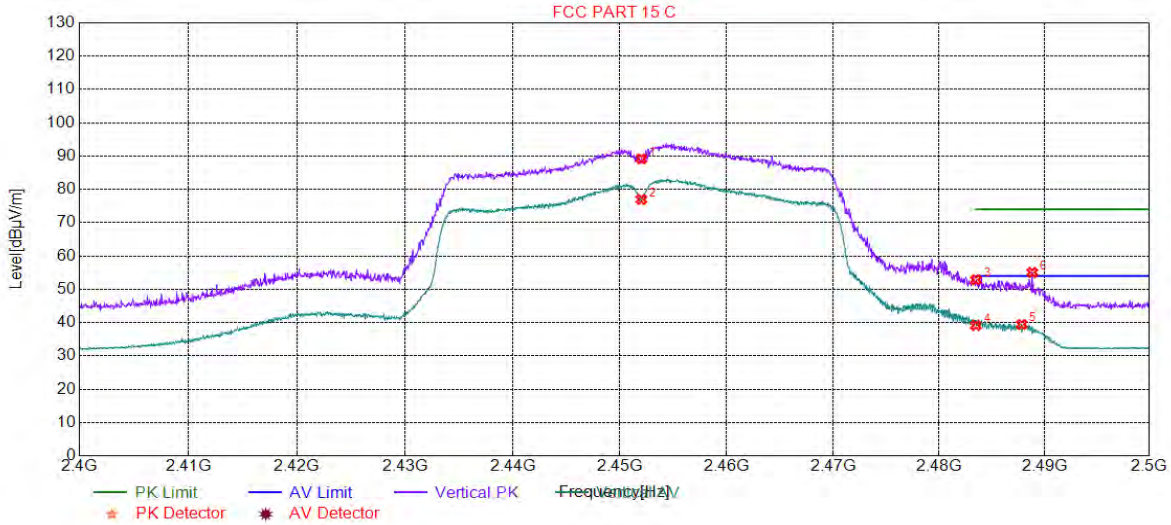
4.10.1.14 802.11N40_Channel 9

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2452.00	89.19	7.97	0.00	-89.19	222	352	Vertical
2	2452.00	76.99	7.97	0.00	-76.99	276	352	Vertical
3	2483.50	52.87	8.01	74.00	21.13	151	352	Vertical
4	2483.50	39.21	8.01	54.00	14.79	167	347	Vertical
5	2487.84	39.48	8.02	54.00	14.52	253	347	Vertical
6	2488.84	55.08	8.02	74.00	18.92	191	274	Vertical

Final Data List

Remark:
The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor
All Modes have been tested, but only the worst case data displayed in this report.

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

Lab A:

No.	Item	Measurement Uncertainty
1	Total RF power, conducted	±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	2020/7/15	2021/7/15
Signal Analyzer	Rohde & Schwarz	FSV	W025-05	2020/1/3	2021/1/2
Coaxial Cable	SGS	N/A	SEM031-01	2020/6/12	2021/6/11
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2020/7/14	2021/7/14
Temperature Chamber	GIANT FORCE	ICT-150-40-CP-AR	W027-03	2019/10/27	2020/10/27
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2020/7/14	2021/7/14

CE Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Shielding Room	Brilliant-emc	N/A	XAW03-35-01	2019-09-11	2022-09-10
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2020-09-11	2021-09-10
Artificial network	ROHDE&SCHWARZ	ENV216	XAW01-04-01	2020-08-04	2021-08-03
Temperature and humidity meter	MingGao	TH101B	XAW01-01-01	2019-12-06	2020-12-05
Measurement Software	Tonscend	TS+ CE V2.5	XAW02-05-02	NCR	NCR

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RSE Test System					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
Semi-Anechoic Chamber	Brilliant-emc	N/A	XAW03-35-01	2019-09-11	2022-09-10
MXA signal analyzer	Keysight	N9020A	XAW01-06-01	2020-04-02	2021-04-01
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2020-09-11	2021-09-10
Receiving antenna (30MHz-3GHz)	Schwarzbeck	VULB 9163	XAW01-09-01	2019-10-13	2021-10-12
Receiving antenna (1GHz~18GHz)	Schwarzbeck	BBHA 9120D	XAW01-09-02	2019-10-13	2021-10-12
Receiving antenna (15GHz~40GHz)	Schwarzbeck	BBHA 9170	XAW01-09-03	2019-10-13	2021-10-12
Directional antenna rack controller	Max-Full	MF-7802BS	XAW03-03-01	NCR	NCR
High-speed antenna rack controller	Max-Full	MF-7802	XAW03-04-01	NCR	NCR
Filter bank	Tonscend	JS0806-F	XAW03-05-01	NCR	NCR
Filter bank	Tonscend	JS0806s	XAW03-05-02	NCR	NCR
Amplifier	Tonscend	TAP00903040	XAW01-41-01	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/2020/90041.

The End

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