FCC TEST REPORT

Application No:	ZR/2020/90037
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-1340
Trade Mark:	NOKIA
FCC ID:	2AJOTTA-1340
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(for original report ZR/2020/9003702)
Date of Test:	2020/9/22 to 2020/9/29(for original report ZR/2020/9003702)
Date of Issue:	2020/9/30(for original report ZR/2020/9003702) 2020/11/9(for new report ZR/2020/9003714)
Test Result:	**PASS ***

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

Remark: TA-1333 support Double SIM, while TA-1340 can support Double SIM and Single SIM.

Authorized Signature:

Derek Yang

Derek Yang
Wireless Laboratory Manager

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1 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		2020/11/9		Original

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

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检验检测专用章
Inspection & Testing Services
SGS-CSTC Standards Technical Services Co.,Ltd. Shenzhen Branch Technical Services Co., Ltd. Shenzhen Branch Technical Services LLC Laboratory

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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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Remark:
This test report (Report No.: ZR/2020/9003714) is base on the original test report (Report No.: ZR/2020/9003702) issued on 2020-09-30.
Review this report and original report, this report just changing the parts according to the declaration letter from client.
According to the declaration from the applicant, the models: TA-1333 and TA-1340 are identical in specifications, only different according to the declaration letter from client.
Considering to the difference, pre-scan were performed on the sample in this report to find the items which can be influential to the result in the original test report for fully retest.
Therefore in this report all items do not need to retest and all test data in this report are base on the previous report with report number ZR/2020/9003702.

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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

Company:	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
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Telephone:	+86 (0) 755 2601 2053
Fax:	+86 (0) 755 2671 0594
E-mail:	ee.shenzhen@sgs.com

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::	Mobile Phone
Model No.:	TA-1340
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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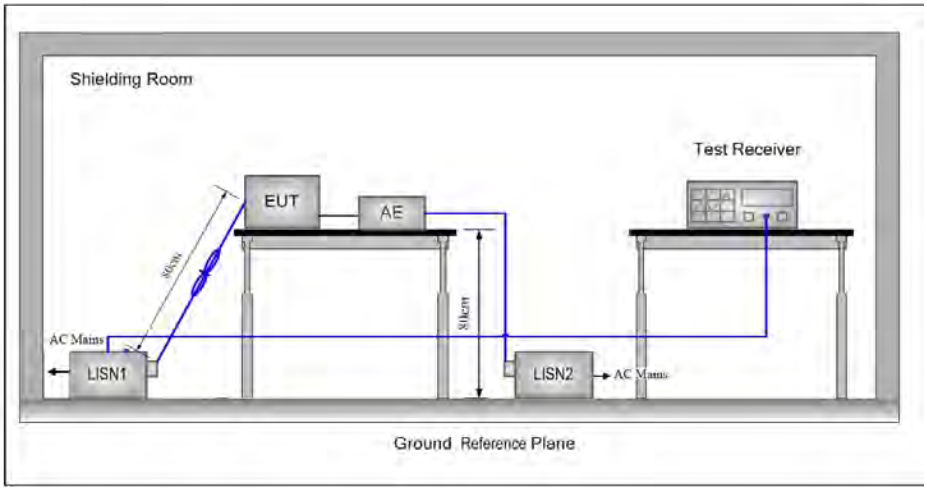
Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates at lowest, middle and highest channel. Charge + Transmitting mode.
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate of 802.11B at lowest channel is the worst case. Charge + Transmitting mode. Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

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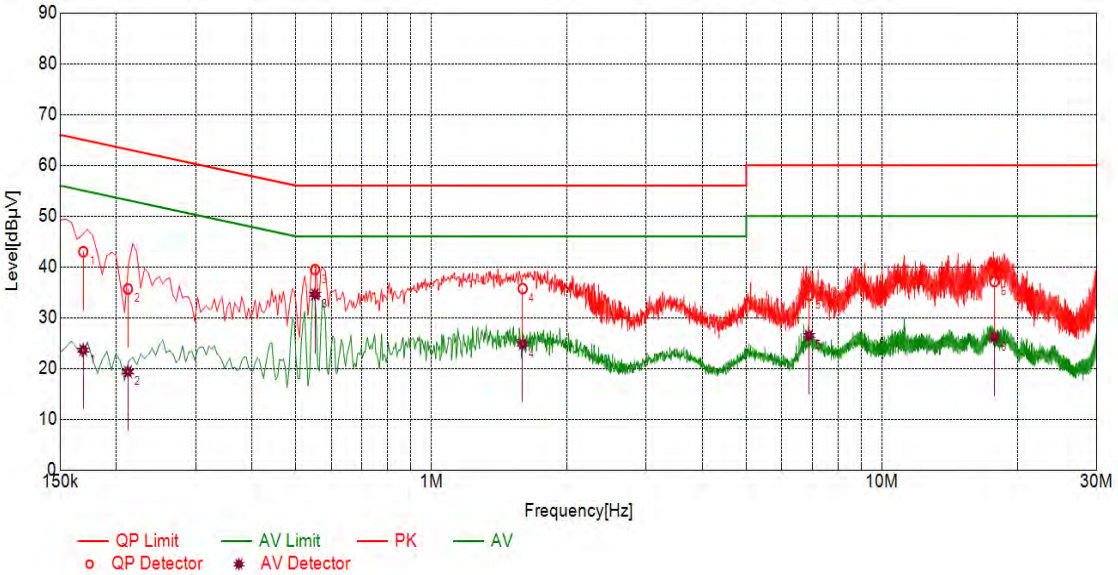
Measurement Data

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	QP Limit	QP Margin	AV Value	AV Limit	AV Margin	Type
1	0.1688	10.10	42.99	65.02	22.03	23.61	55.02	31.41	L
2	0.2121	10.10	35.65	63.12	27.47	19.36	53.12	33.76	L
3	0.5519	10.10	39.47	56.00	16.53	34.58	46.00	11.42	L
4	1.5950	10.10	35.72	56.00	20.28	24.82	46.00	21.18	L
5	6.8922	10.10	34.38	60.00	25.62	26.47	50.00	23.53	L
6	17.7654	10.11	37.10	60.00	22.90	26.10	50.00	23.90	L

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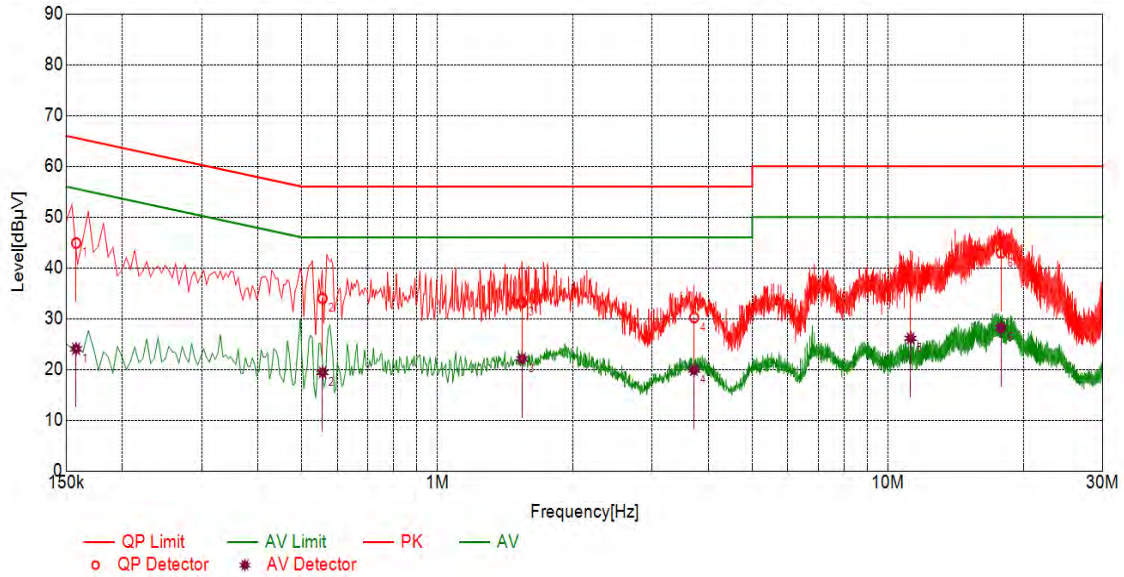
Neutral Line:



Test Graph

Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Value	QP Limit	QP Margin	AV Value	AV Limit	AV Margin	Type
1	0.1579	10.10	44.89	65.57	20.68	24.05	55.57	31.52	N
2	0.5564	10.10	33.99	56.00	22.01	19.41	46.00	26.59	N
3	1.5421	10.10	33.21	56.00	22.79	22.10	46.00	23.90	N
4	3.7153	10.10	30.22	56.00	25.78	19.89	46.00	26.11	N
5	11.2376	10.10	37.74	60.00	22.26	26.13	50.00	23.87	N
6	17.8275	10.11	42.92	60.00	17.08	28.19	50.00	21.81	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

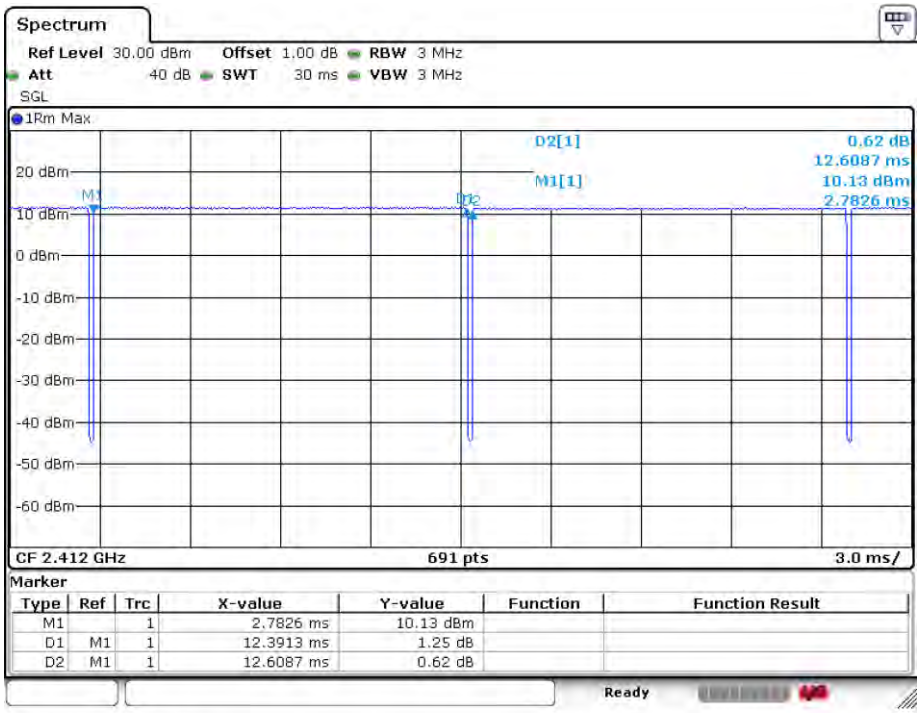
4.3.1 Test Results

Test Mode	TX Freq. [MHz]	Duty cycle [%]
11B	Ant 1: CH1,CH6,CH11	98.28
11G	Ant 1: CH1,CH6,CH11	97.52
11N20	Ant 1: CH1,CH6,CH11	97.78
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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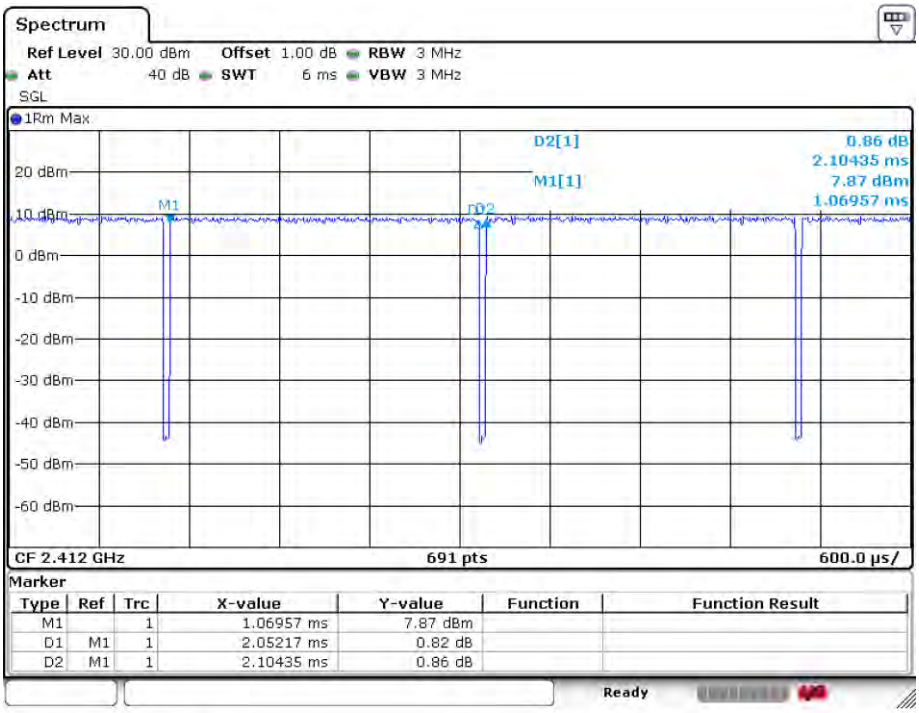
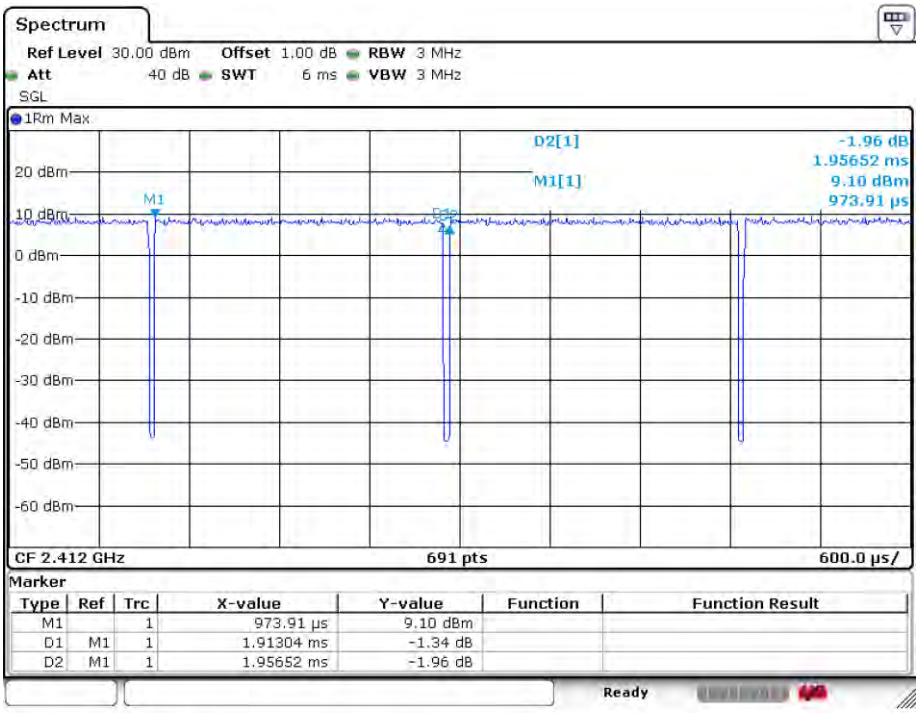
4.3.1.1.2 11G



Date: 28.SEP.2020 09:40:58

4.3.1.1.3 11N20



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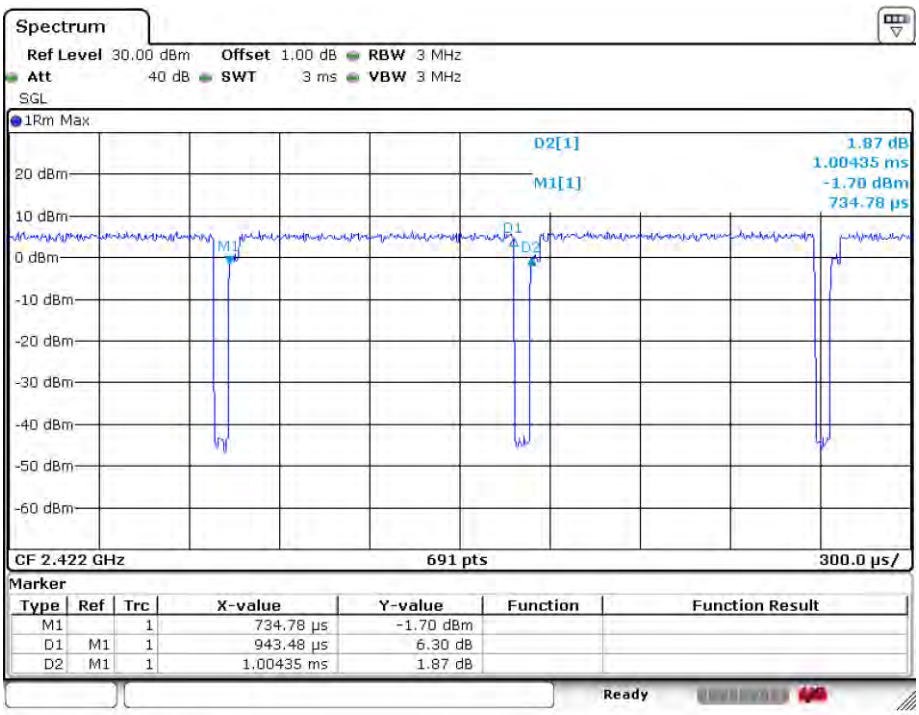
4.3.1.1.4 11N40



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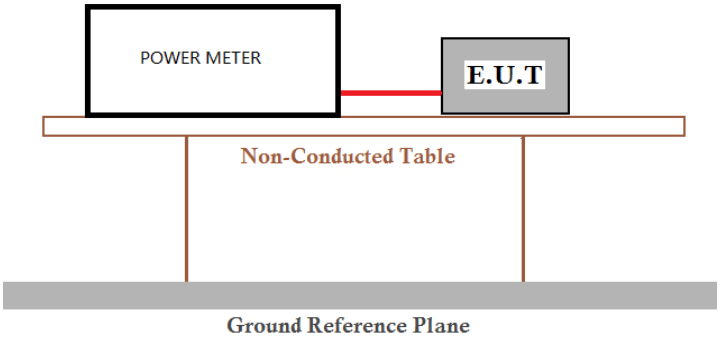
4.4 Conducted Output Power

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	16.86	30.00	Pass
	Middle	17.39	30.00	Pass
	Highest	17.10	30.00	Pass
802.11G	Lowest	15.79	30.00	Pass
	Middle	16.19	30.00	Pass
	Highest	16.10	30.00	Pass
802.11N20	Lowest	15.63	30.00	Pass
	Middle	15.33	30.00	Pass
	Highest	15.17	30.00	Pass
802.11N40	Lowest	16.08	30.00	Pass
	Middle	16.14	30.00	Pass
	Highest	16.25	30.00	Pass

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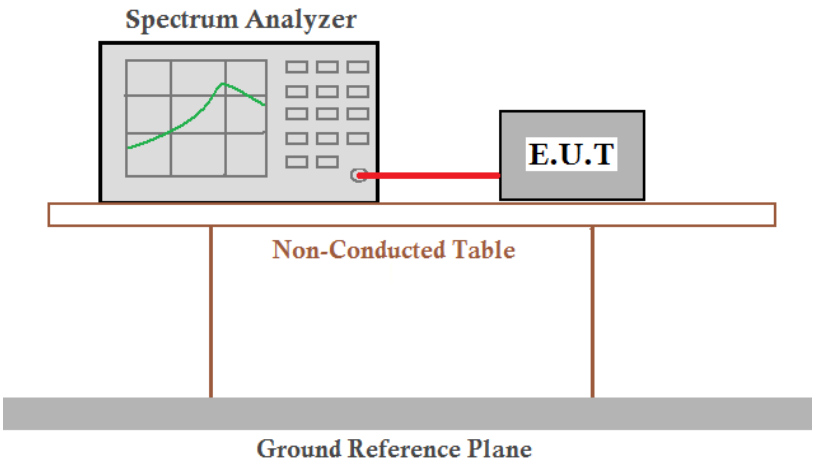
4.5 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth

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	14.02	8.08	≥500	Pass
	Middle	13.81	9.07	≥500	Pass
	Highest	13.63	8.08	≥500	Pass
802.11G	Lowest	16.71	15.89	≥500	Pass
	Middle	16.76	15.72	≥500	Pass
	Highest	16.58	15.41	≥500	Pass
802.11N20	Lowest	17.93	16.90	≥500	Pass
	Middle	17.84	16.32	≥500	Pass
	Highest	17.76	15.93	≥500	Pass
802.11N40	Lowest	36.21	35.47	≥500	Pass
	Middle	36.21	35.71	≥500	Pass
	Highest	36.38	36.30	≥500	Pass

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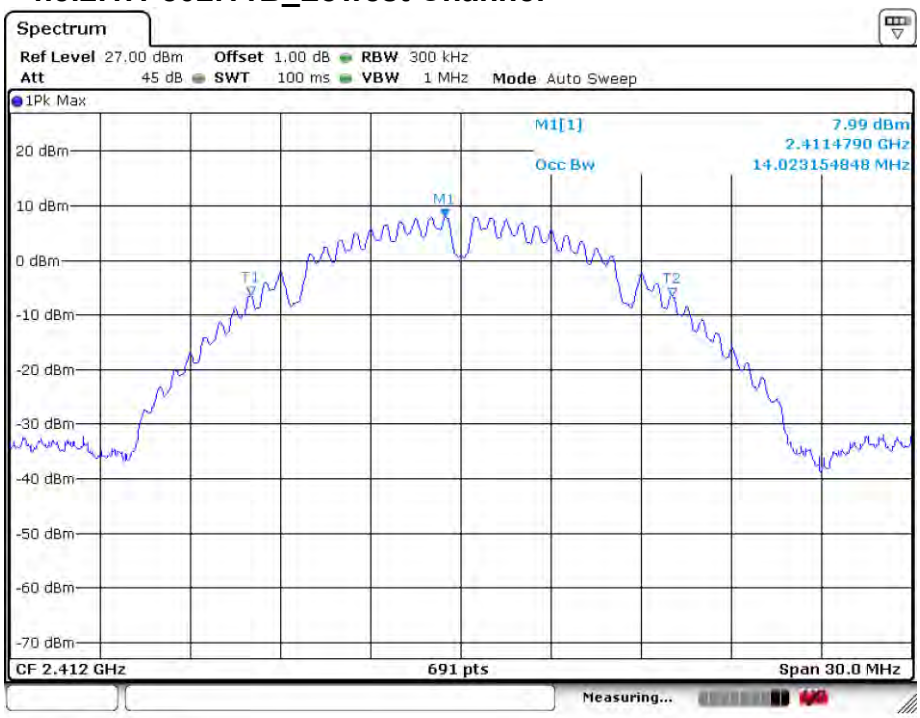
4.5.2 Test plots

4.5.2.1 ANT1

4.5.2.1.1 802.11B_Lowest Channel



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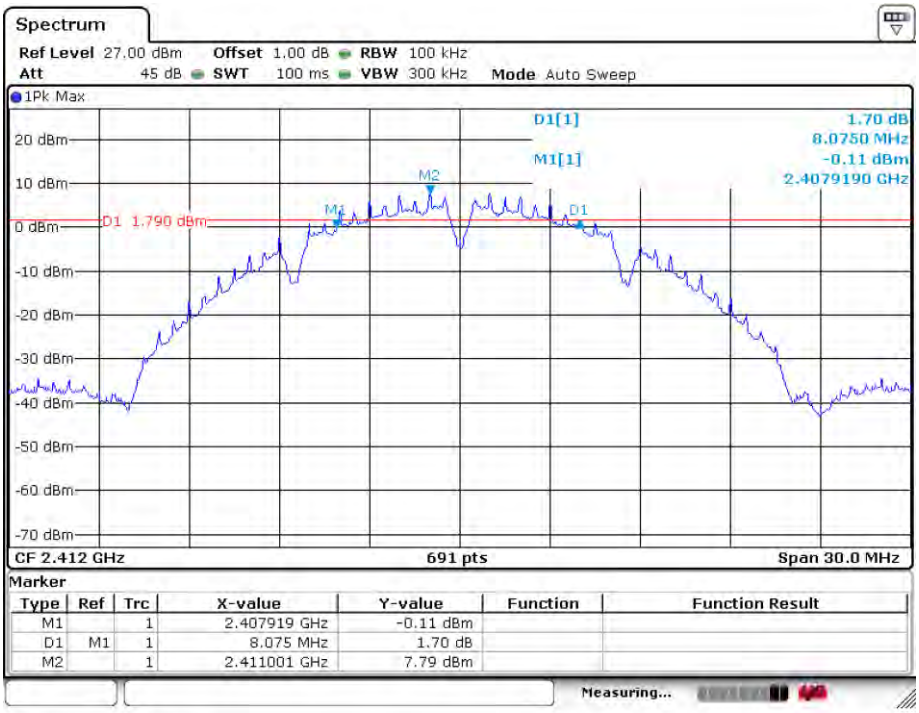

Date: 27.SEP.2020 20:21:17

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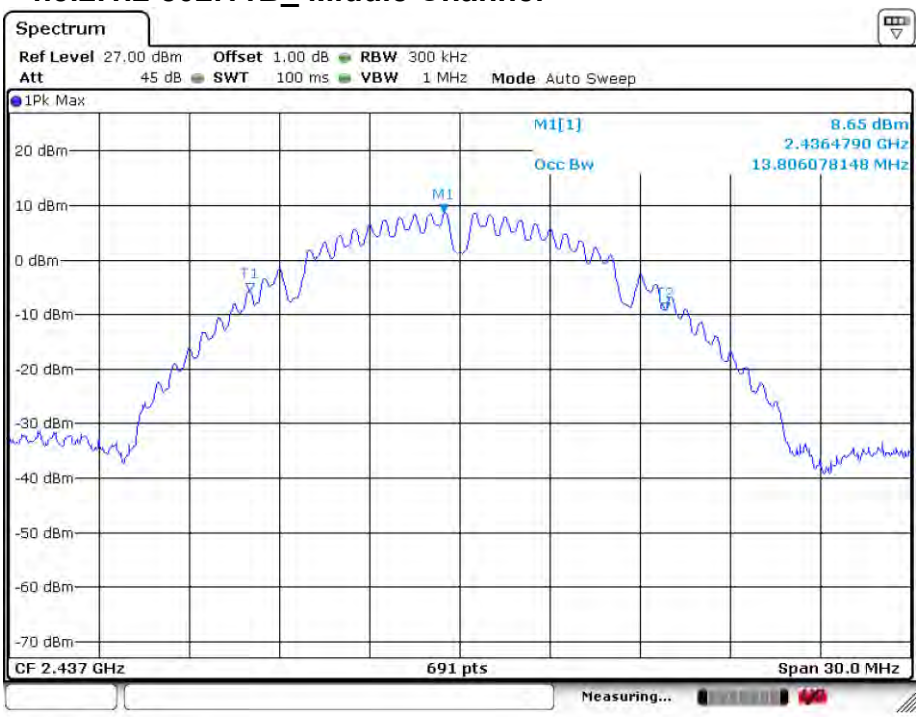
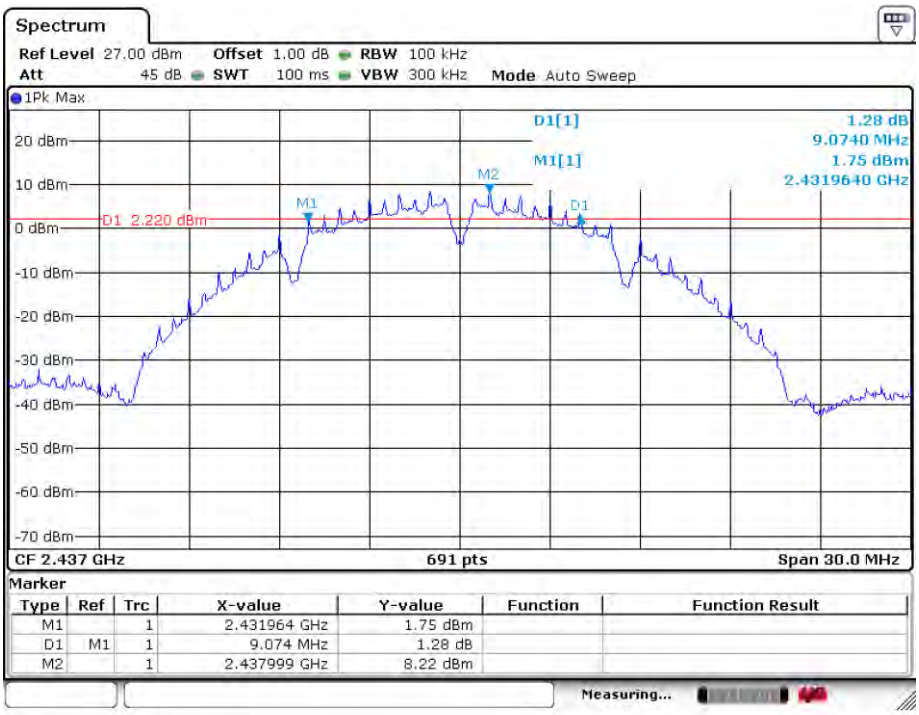
4.5.2.1.2 802.11B_ Middle Channel



Date: 28.SEP.2020 08:54:08



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.431964 GHz	1.75 dBm		
D1	M1	1	9.074 MHz	1.28 dB		
M2		1	2.437999 GHz	8.22 dBm		

Date: 27.SEP.2020 20:22:13

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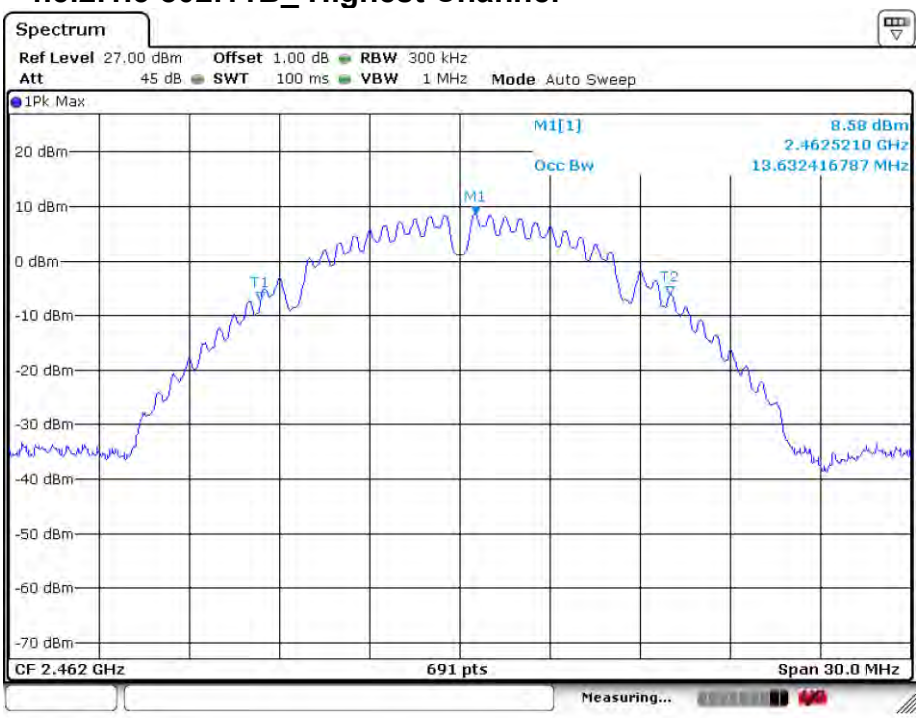
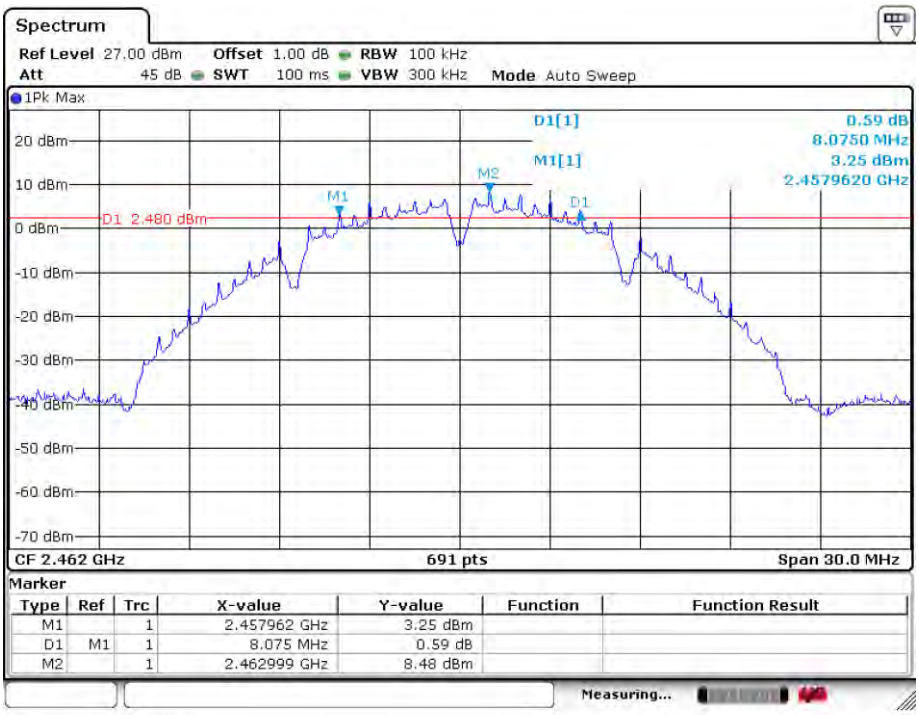
4.5.2.1.3 802.11B_ Highest Channel



Date: 28.SEP.2020 08:54:31



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.457962 GHz	3.25 dBm		
D1	M1	1	8.075 MHz	0.59 dB		
M2		1	2.462999 GHz	8.48 dBm		

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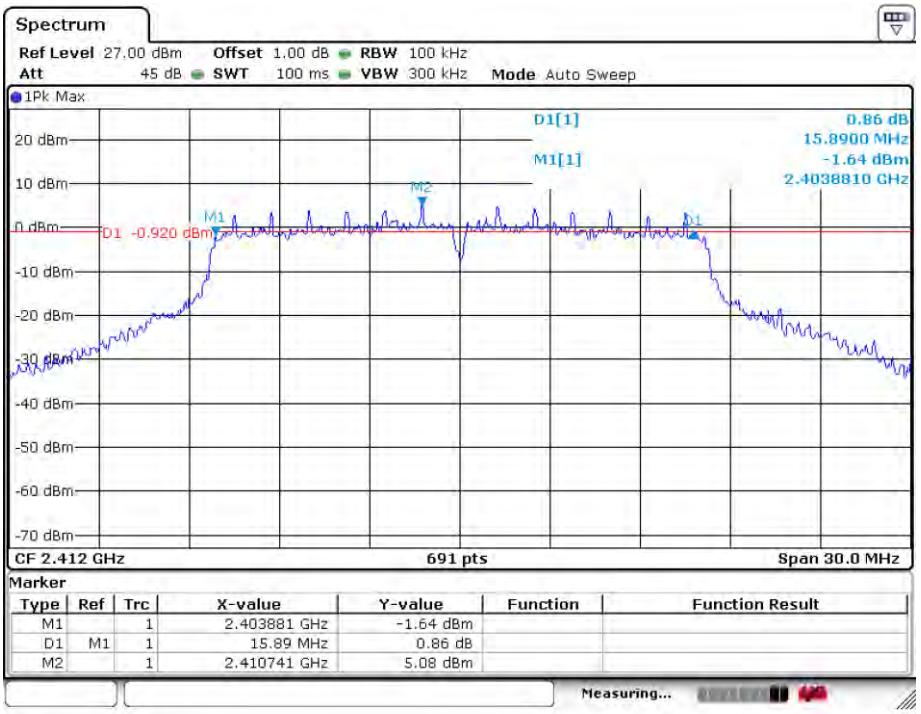
4.5.2.1.4 802.11G_Lowest Channel

Date: 28.SEP.2020 08:53:30



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.403881 GHz	-1.64 dBm		
D1	M1	1	15.89 MHz	0.86 dB		
M2		1	2.410741 GHz	5.08 dBm		

Date: 27.SEP.2020 20:20:05

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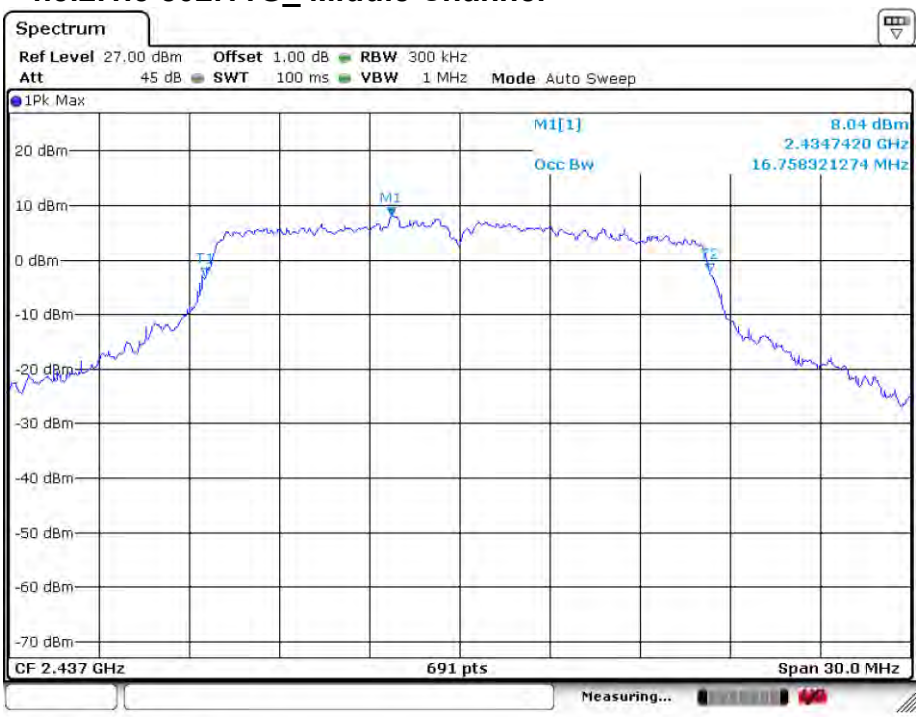
4.5.2.1.5 802.11G_ Middle Channel



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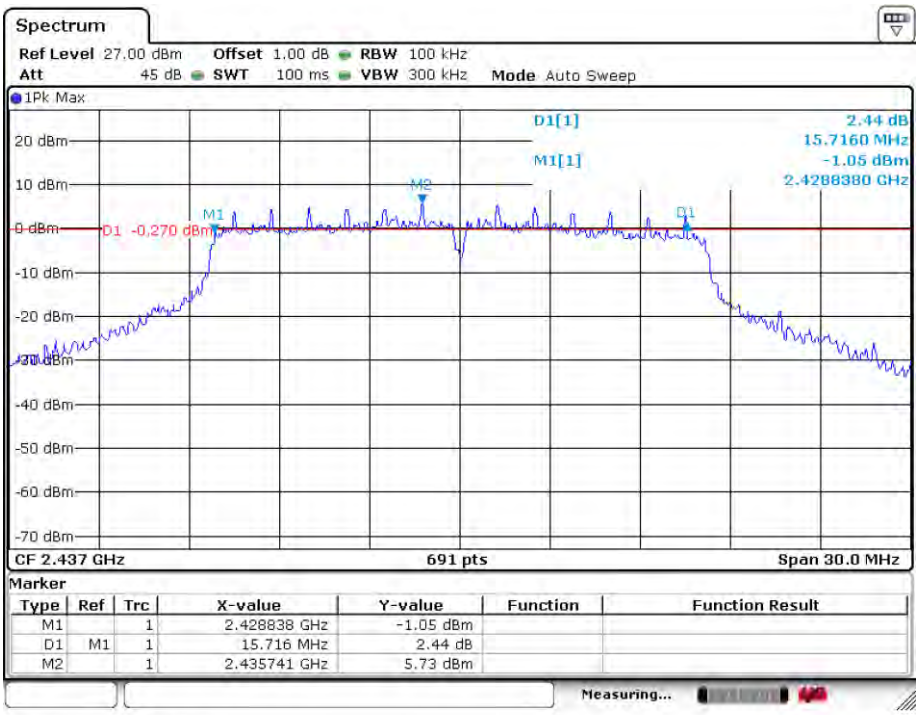

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.428838 GHz	-1.05 dBm		
D1	M1	1	15.716 MHz	2.44 dB		
M2		1	2.435741 GHz	5.73 dBm		

Date: 27.SEP.2020 20:19:20

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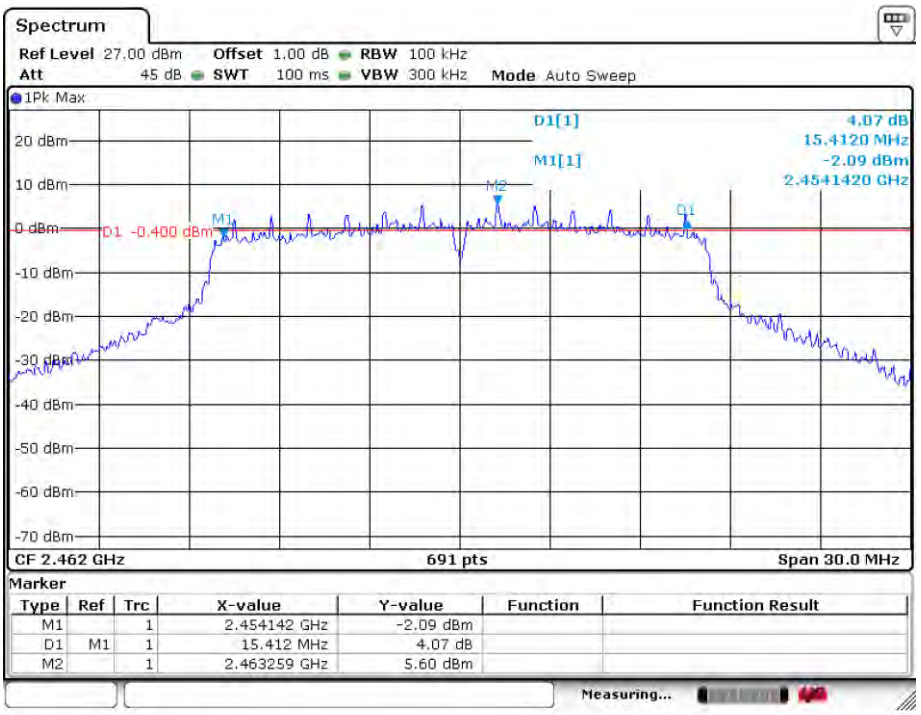
4.5.2.1.6 802.11G_ Highest Channel

Date: 28.SEP.2020 08:53:07



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.454142 GHz	-2.09 dBm		
D1	M1	1	15.412 MHz	4.07 dB		
M2		1	2.463259 GHz	5.60 dBm		

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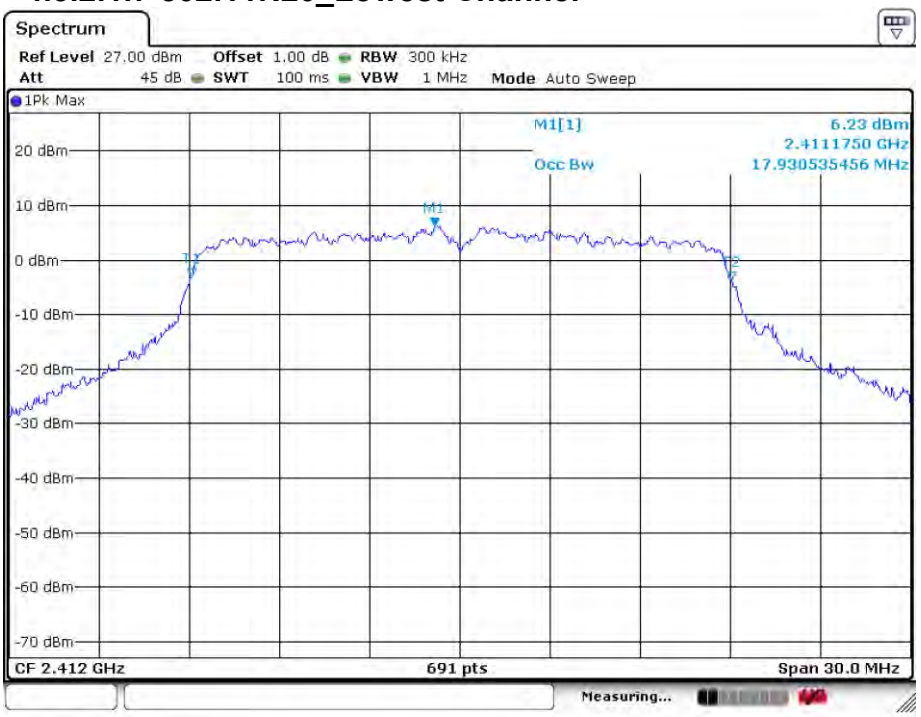
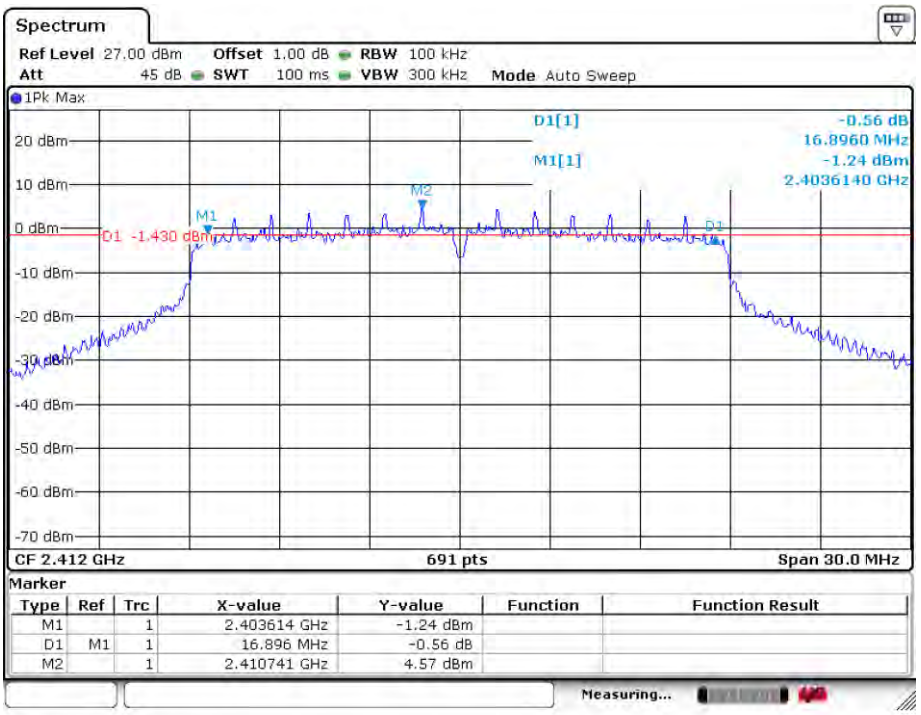
4.5.2.1.7 802.11N20_Lowest Channel



Date: 28.SEP.2020 08:56:19



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Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.403614 GHz	-1.24 dBm		
D1	M1	1	16.896 MHz	-0.56 dB		
M2		1	2.410741 GHz	4.57 dBm		

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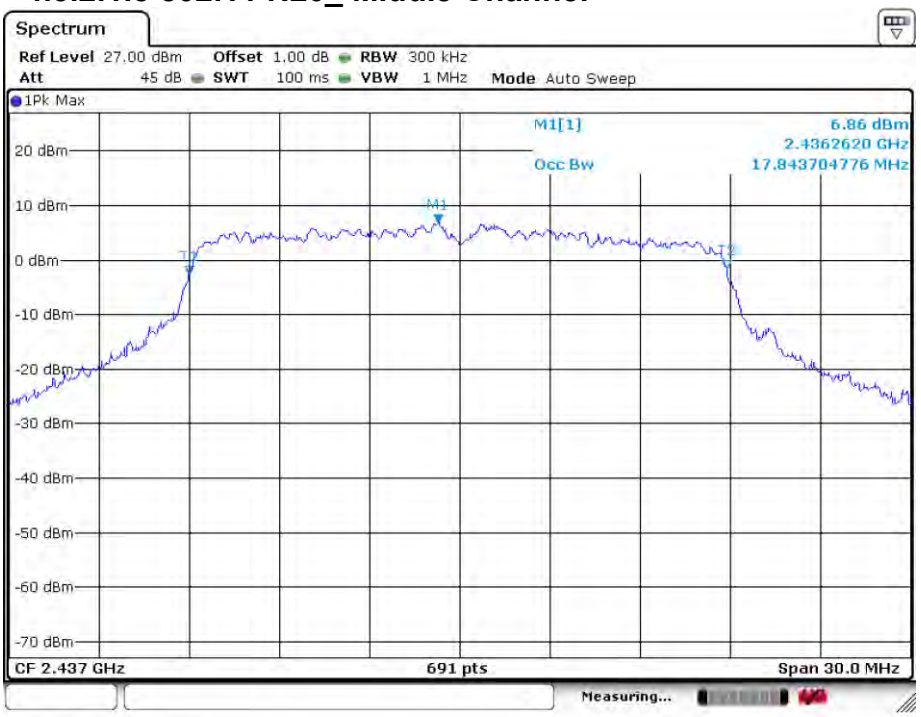
4.5.2.1.8 802.11 N20_ Middle Channel



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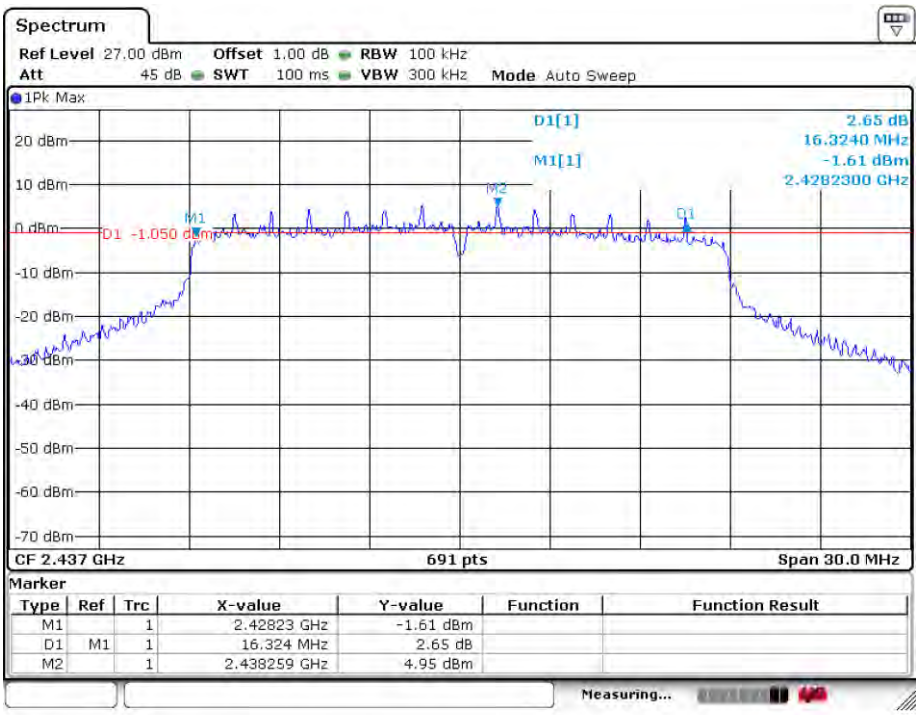

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.42823 GHz	-1.61 dBm		
D1	M1	1	16.324 MHz	2.65 dB		
M2		1	2.438259 GHz	4.95 dBm		

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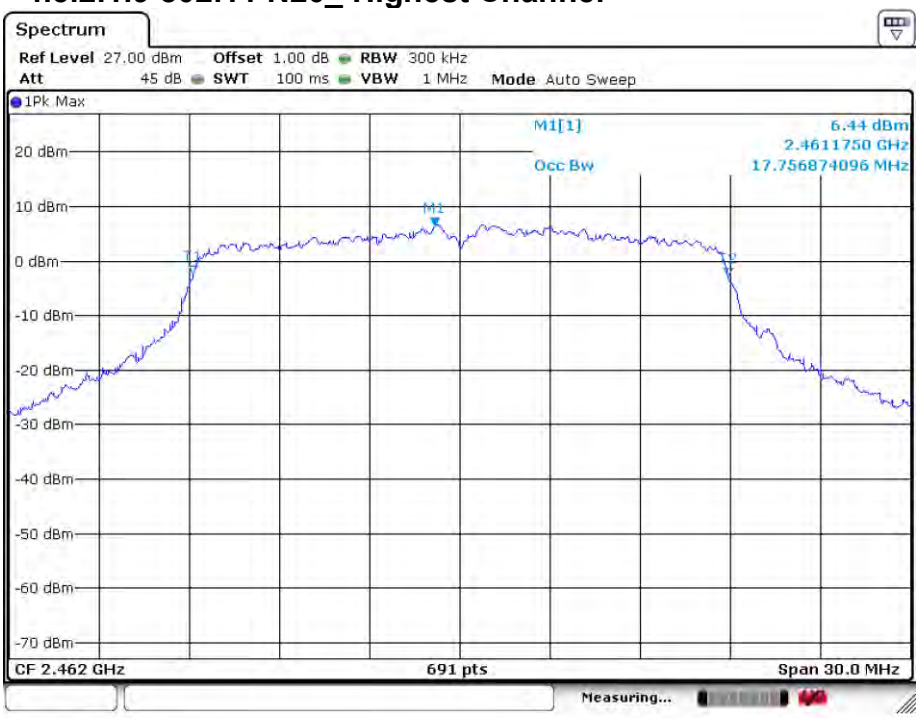
4.5.2.1.9 802.11 N20_ Highest Channel



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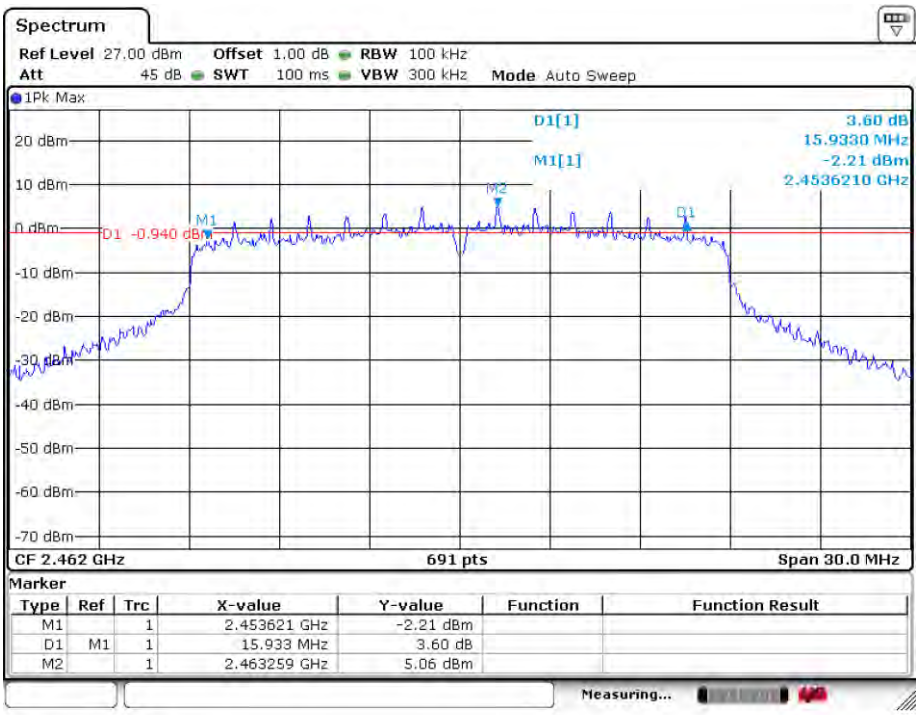

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.453621 GHz	-2.21 dBm		
D1	M1	1	15.933 MHz	3.60 dB		
M2		1	2.463259 GHz	5.06 dBm		

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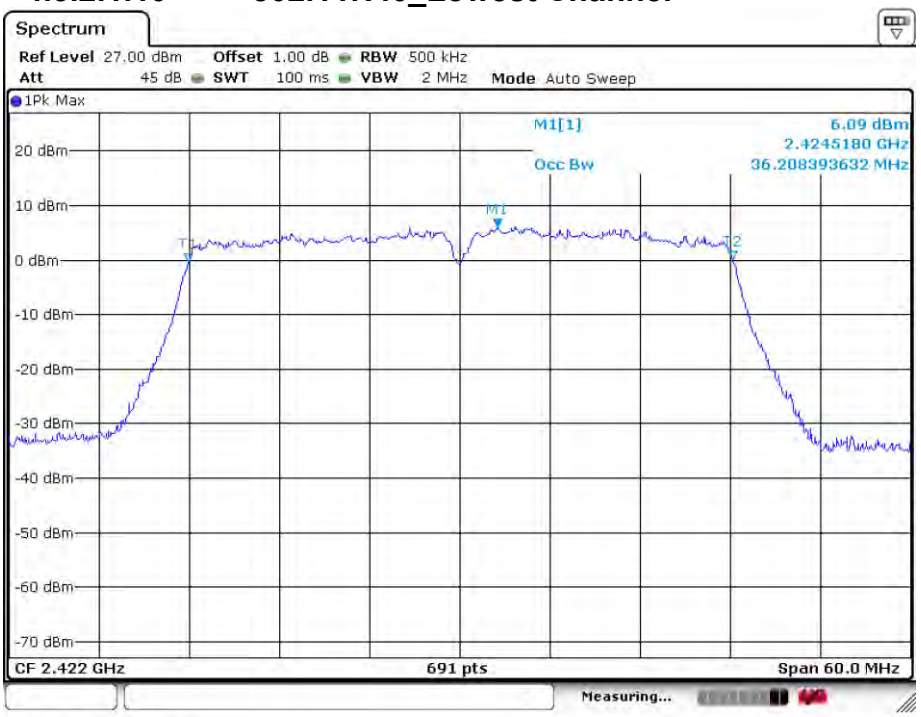
4.5.2.1.10 802.11N40_Lowest Channel



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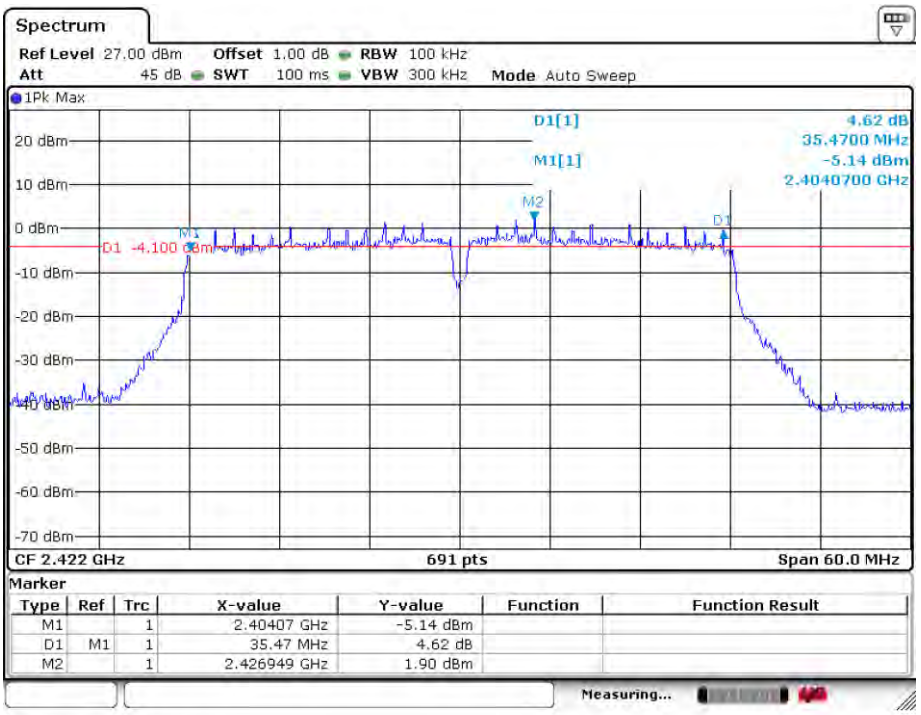

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40407 GHz	-5.14 dBm		
D1	M1	1	35.47 MHz	4.62 dB		
M2		1	2.426949 GHz	1.90 dBm		

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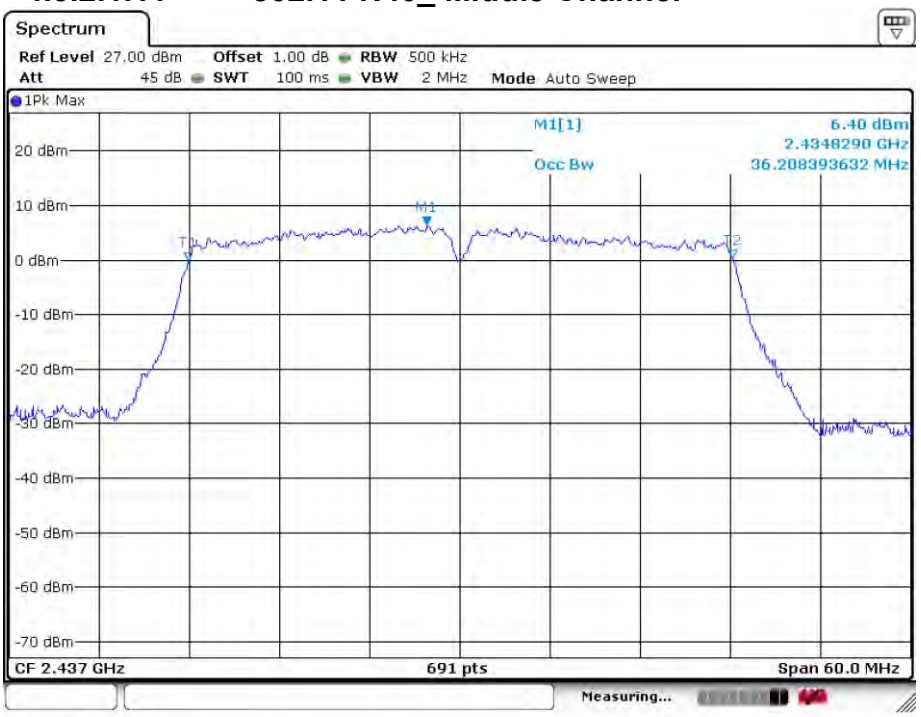
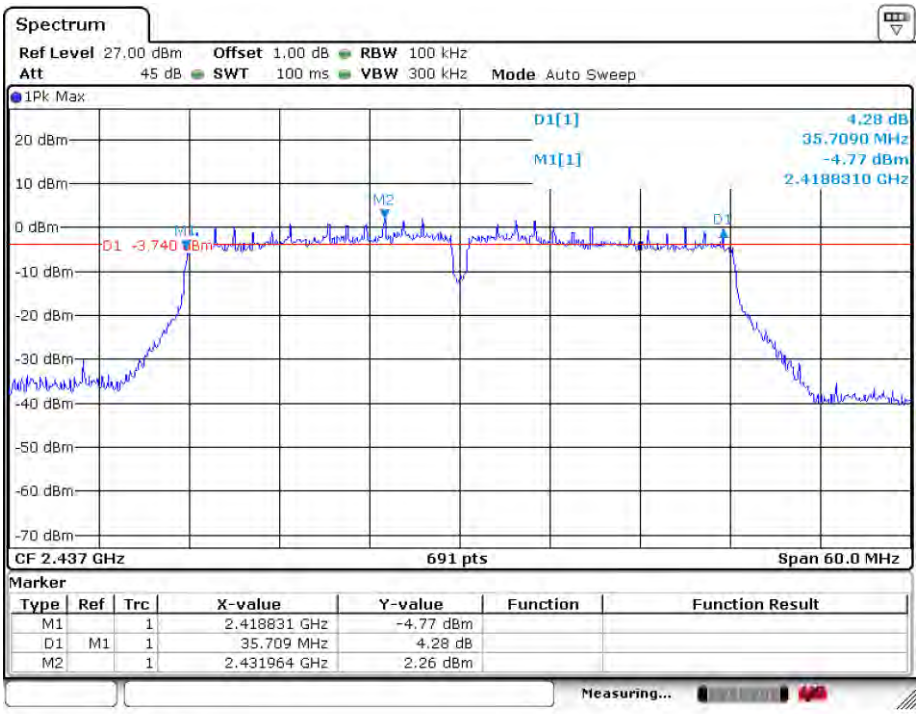
4.5.2.1.11 802.11 N40_ Middle Channel



Date: 28.SEP.2020 08:57:02



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.418831 GHz	-4.77 dBm		
D1	M1	1	35.709 MHz	4.28 dB		
M2		1	2.431964 GHz	2.26 dBm		

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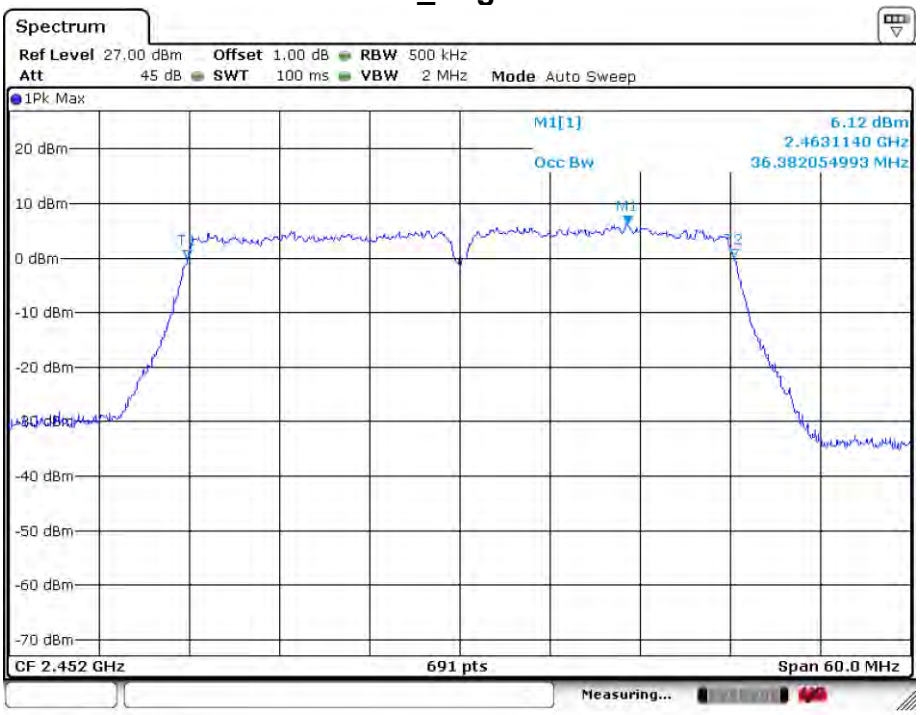
4.5.2.1.12 802.11 N40_ Highest Channel



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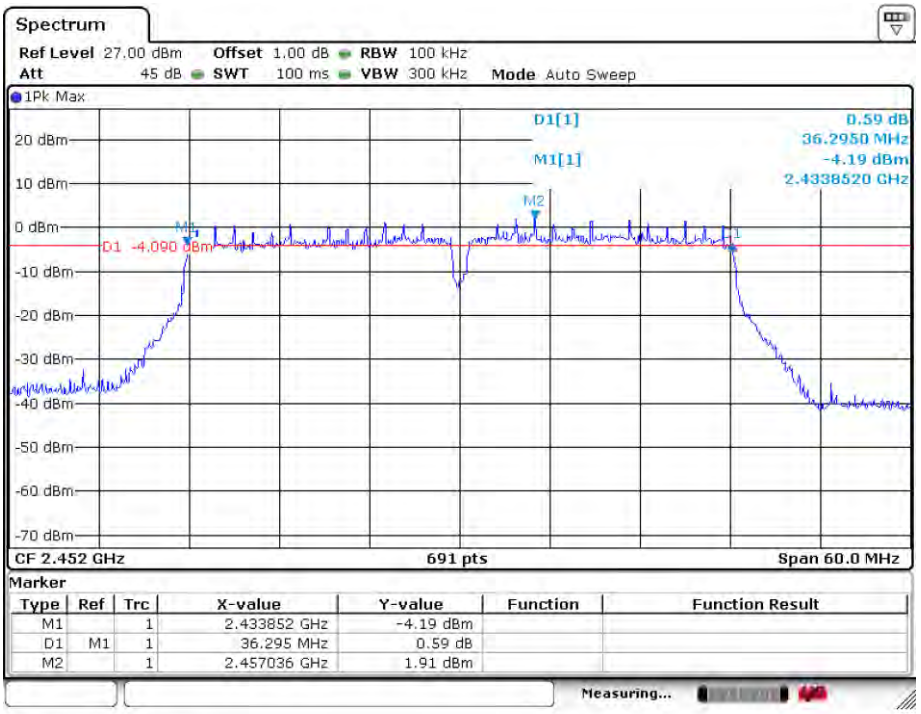

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.433852 GHz	-4.19 dBm		
D1	M1	1	36.295 MHz	0.59 dB		
M2		1	2.457036 GHz	1.91 dBm		

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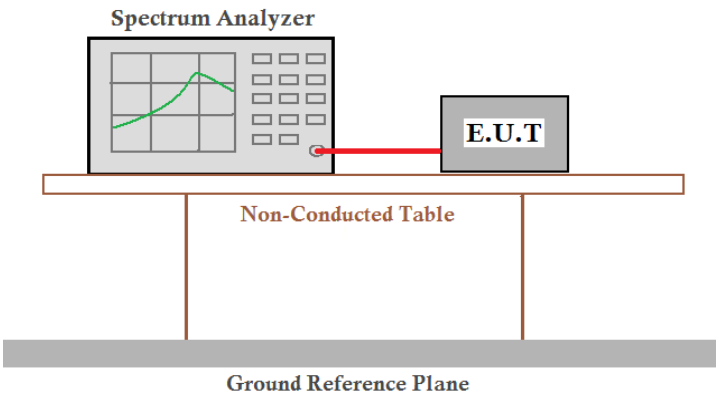
4.6 Power Spectral Density

Test Requirement:	47 CFR Part 15C Section 15.247 (e)
Test Method:	ANSI C63.10 :2013 Section 11.10.2
Test Setup:	
Test Instruments:	Refer to section 5.10 for details
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G ; 6.5Mbps of rate is the worst case of 802.11N(HT20); 13.5Mbps of rate is the worst case of 802.11N(HT40).
Limit:	≤8.00dBm/3kHz
Test Results:	Pass

4.6.1 Test Results

Mode	Test Channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
802.11B	Lowest	-8.62	≤8.00	Pass
	Middle	-8.18	≤8.00	Pass
	Highest	-8.61	≤8.00	Pass
802.11G	Lowest	-8.72	≤8.00	Pass
	Middle	-10.39	≤8.00	Pass
	Highest	-9.58	≤8.00	Pass
802.11N20	Lowest	-10.58	≤8.00	Pass
	Middle	-10.12	≤8.00	Pass
	Highest	-11.31	≤8.00	Pass
802.11N40	Lowest	-12.60	≤8.00	Pass
	Middle	-11.54	≤8.00	Pass
	Highest	-12.59	≤8.00	Pass

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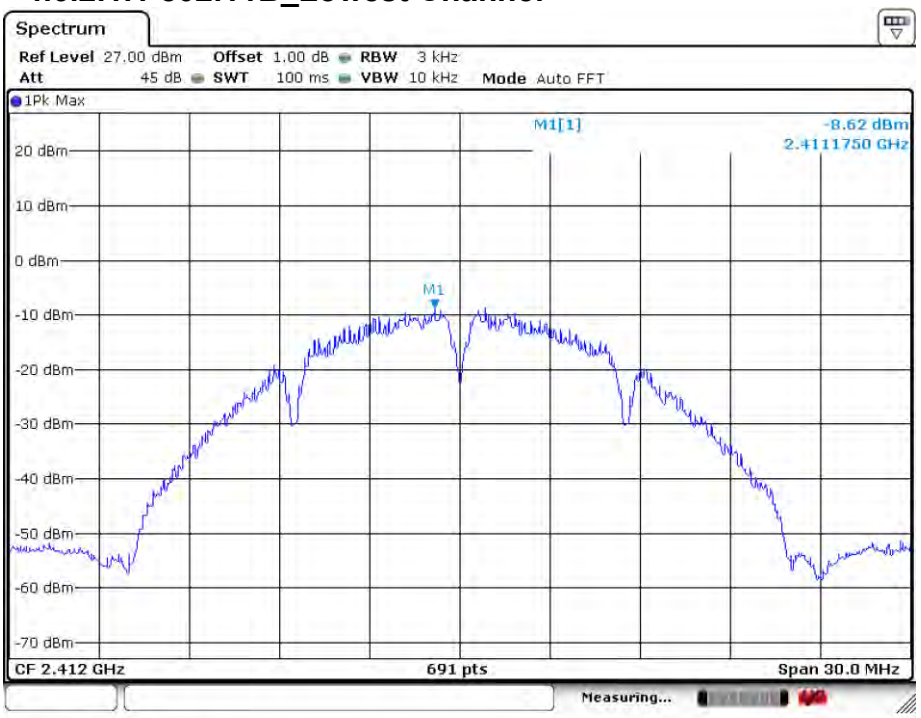
4.6.2 Test plots

4.6.2.1 ANT1

4.6.2.1.1 802.11B_Lowest Channel



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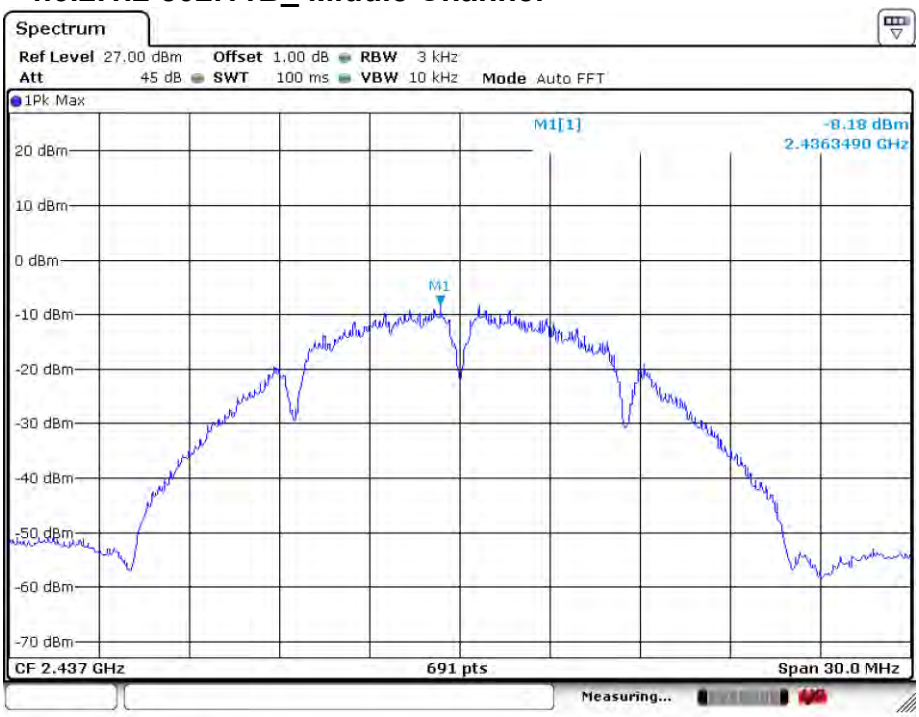
4.6.2.1.2 802.11B_ Middle Channel



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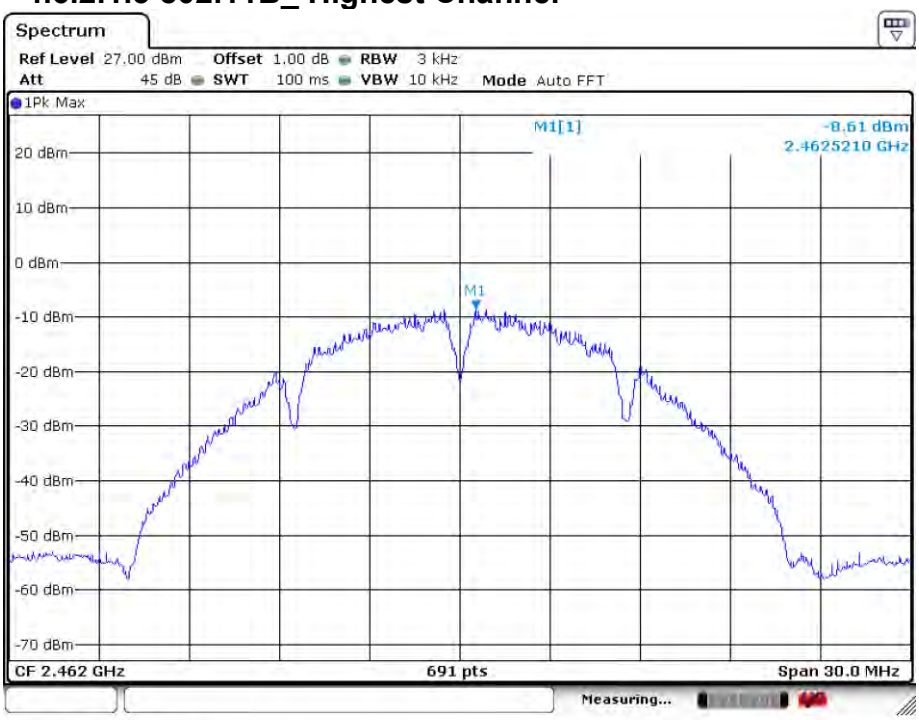
4.6.2.1.3 802.11B_ Highest Channel



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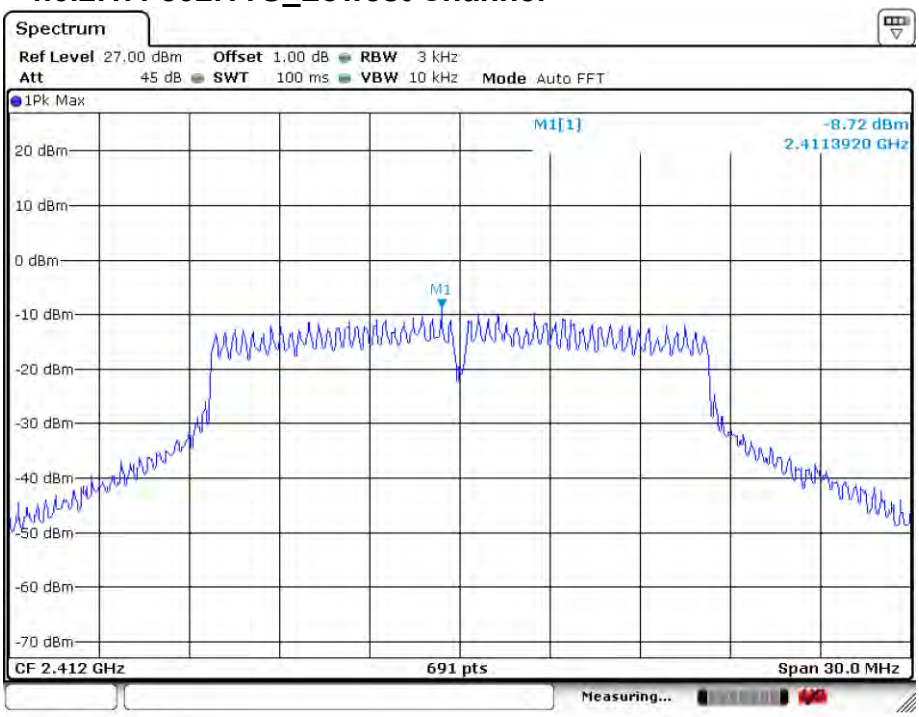
4.6.2.1.4 802.11G_Lowest Channel



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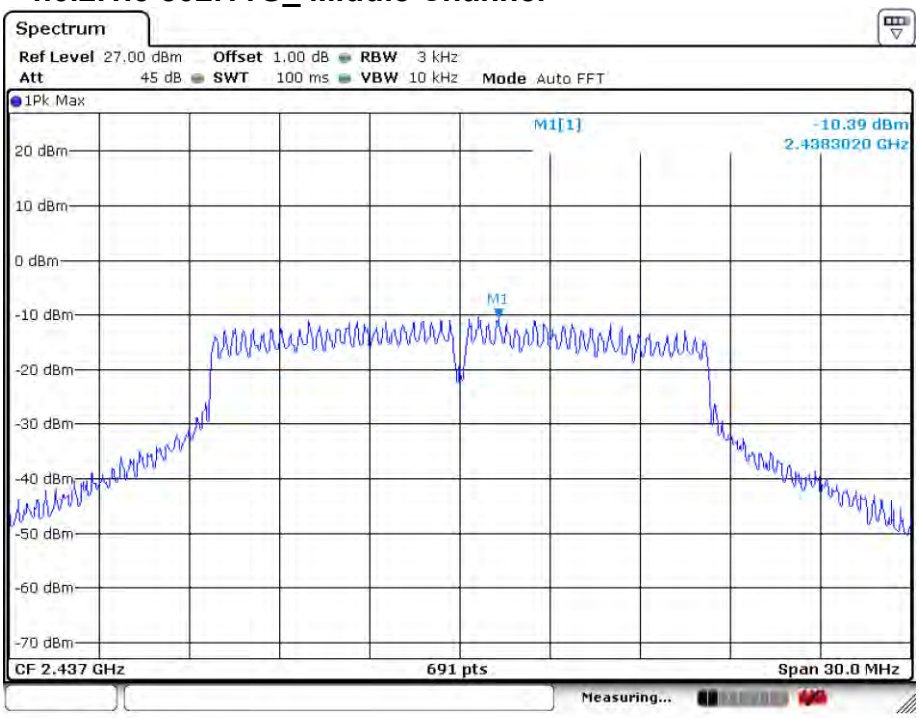
4.6.2.1.5 802.11G_ Middle Channel



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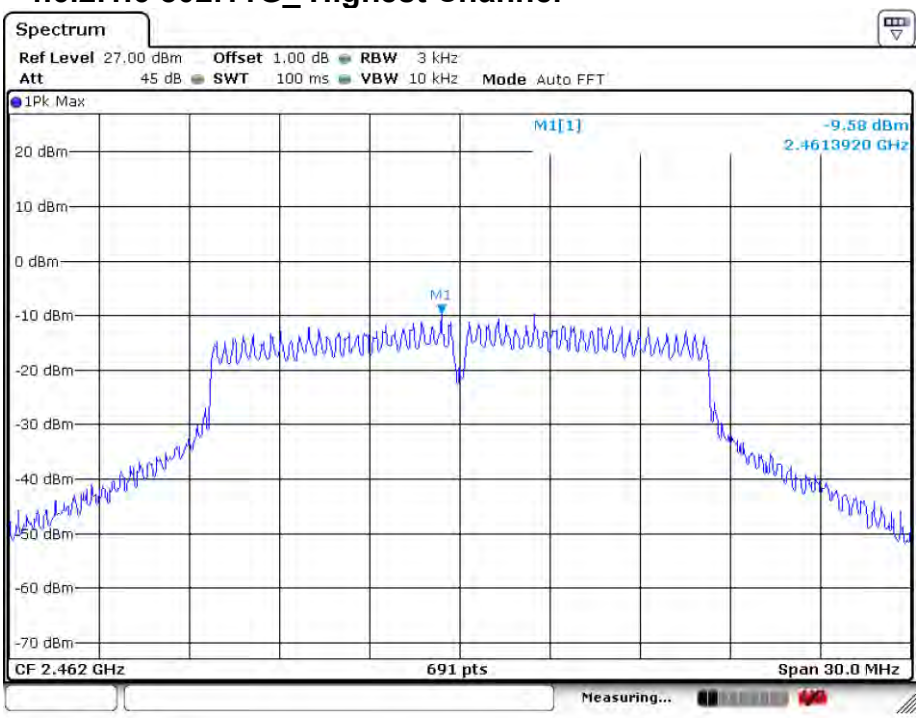
4.6.2.1.6 802.11G_ Highest Channel



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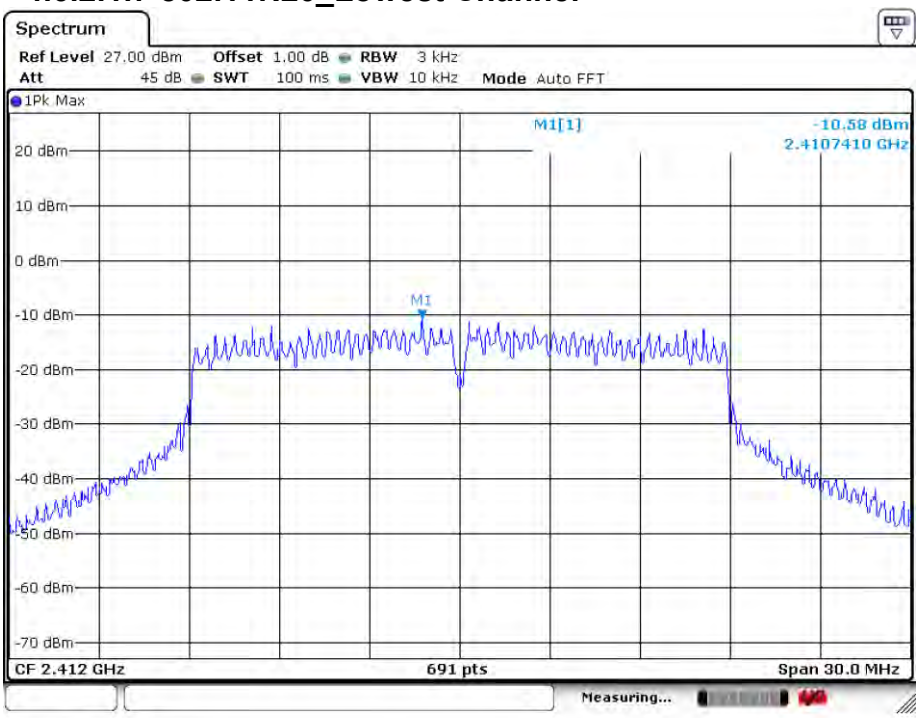
4.6.2.1.7 802.11N20_Lowest Channel



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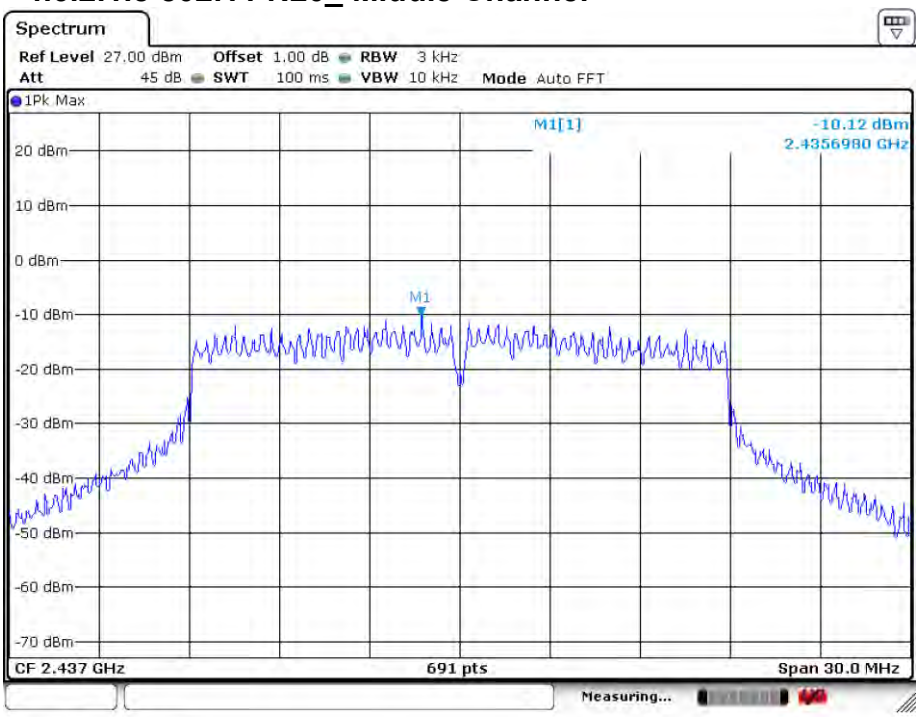
4.6.2.1.8 802.11 N20_ Middle Channel



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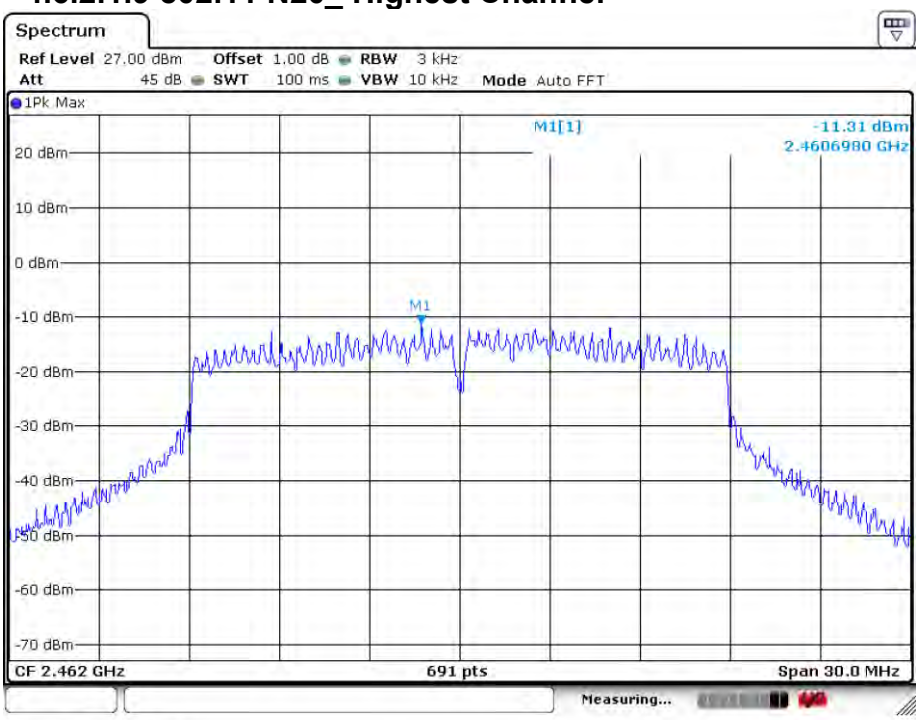
4.6.2.1.9 802.11 N20_ Highest Channel



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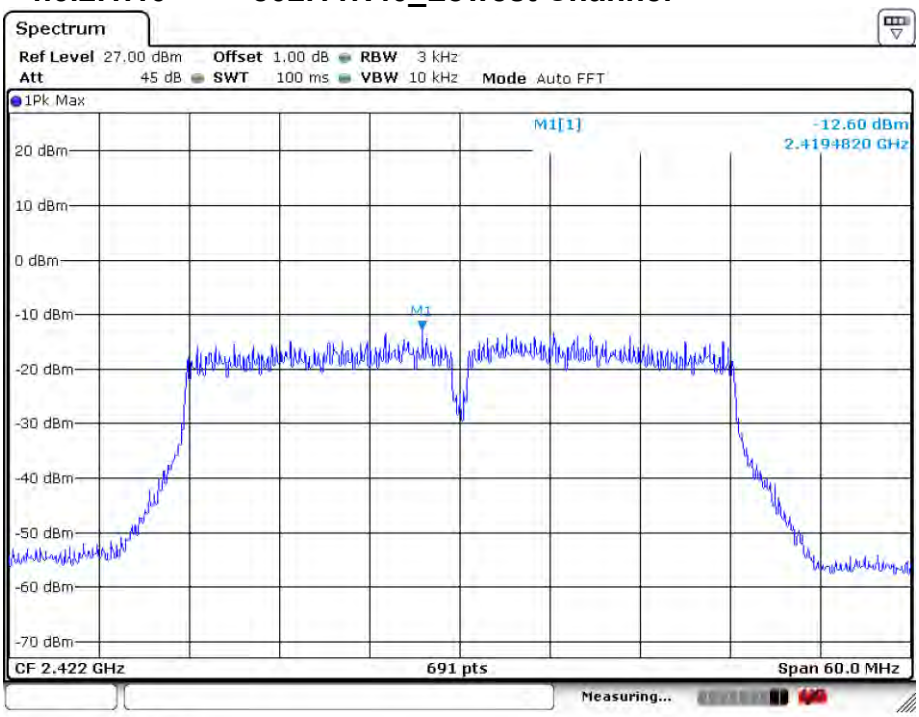
4.6.2.1.10 802.11N40_Lowest Channel



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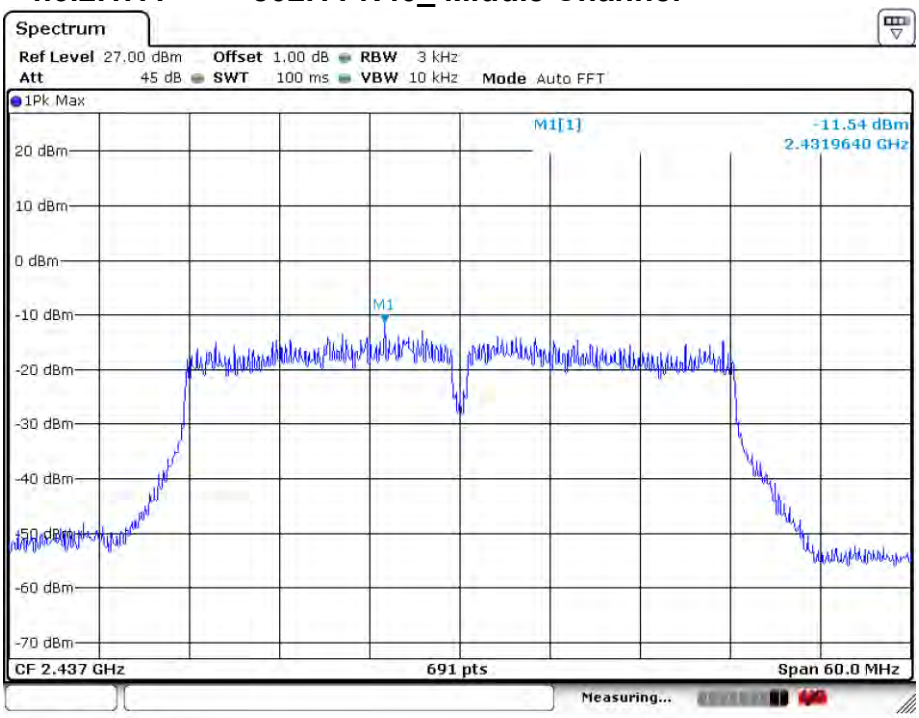
4.6.2.1.11 802.11 N40_ Middle Channel



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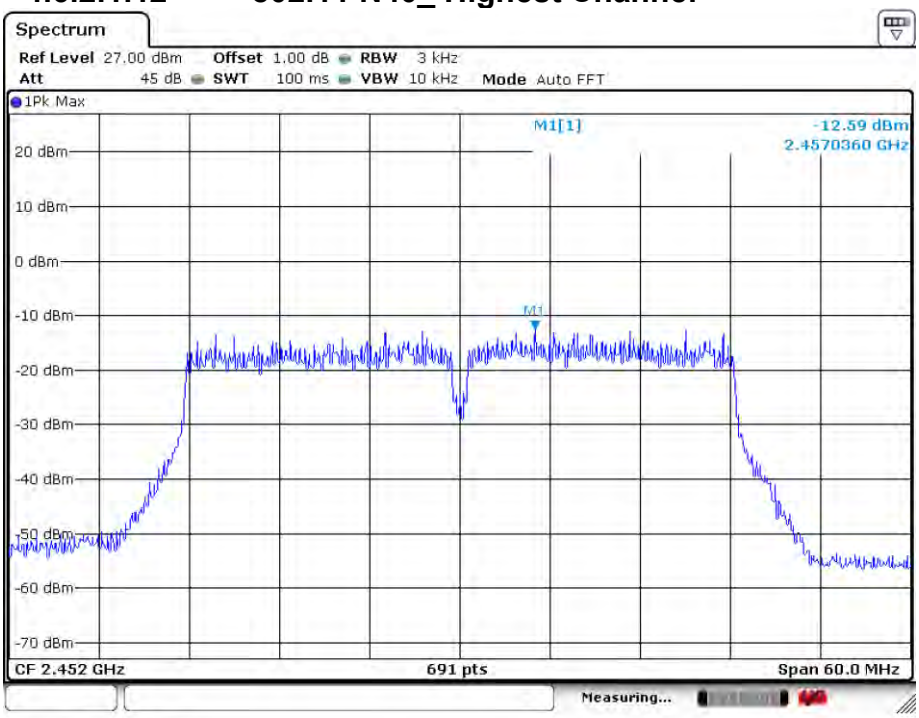
4.6.2.1.12 802.11 N40_ Highest Channel



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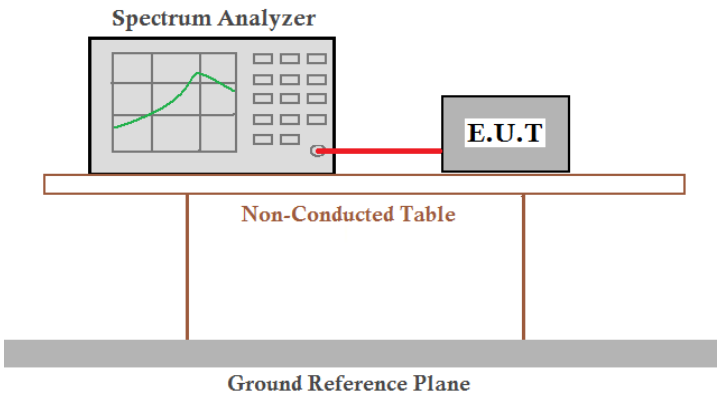
4.7 Band-edge for RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.13
Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G ; 6.5Mbps of rate is the worst case of 802.11N(HT20) ; 13.5Mbps of rate is the worst case of 802.11N(HT40).
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

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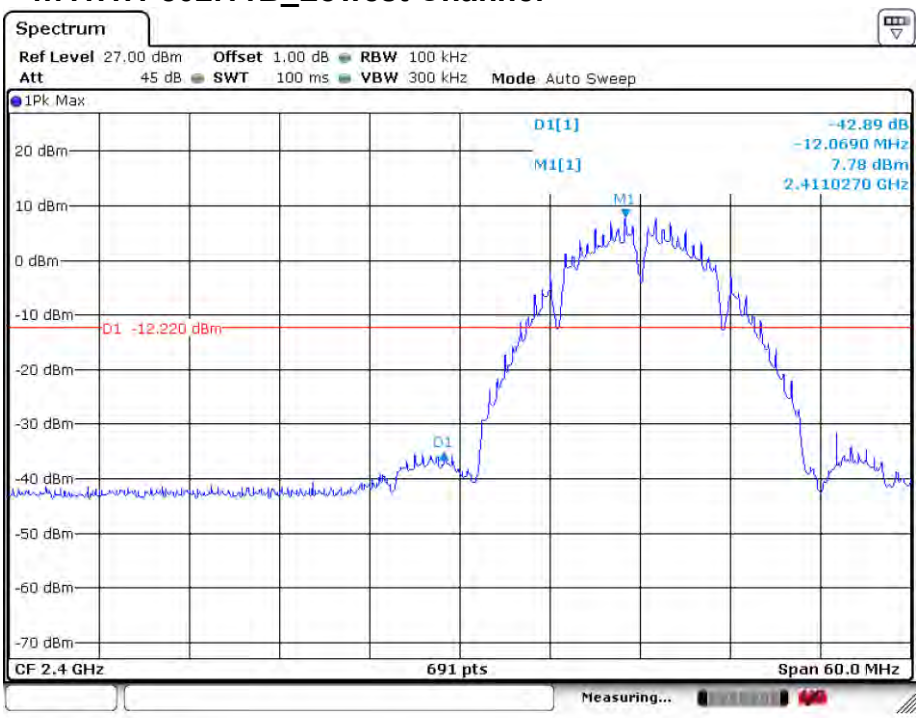
4.7.1 Test plots

4.7.1.1 ANT1

4.7.1.1.1 802.11B_Lowest Channel



Date: 28.SEP.2020 09:05:07

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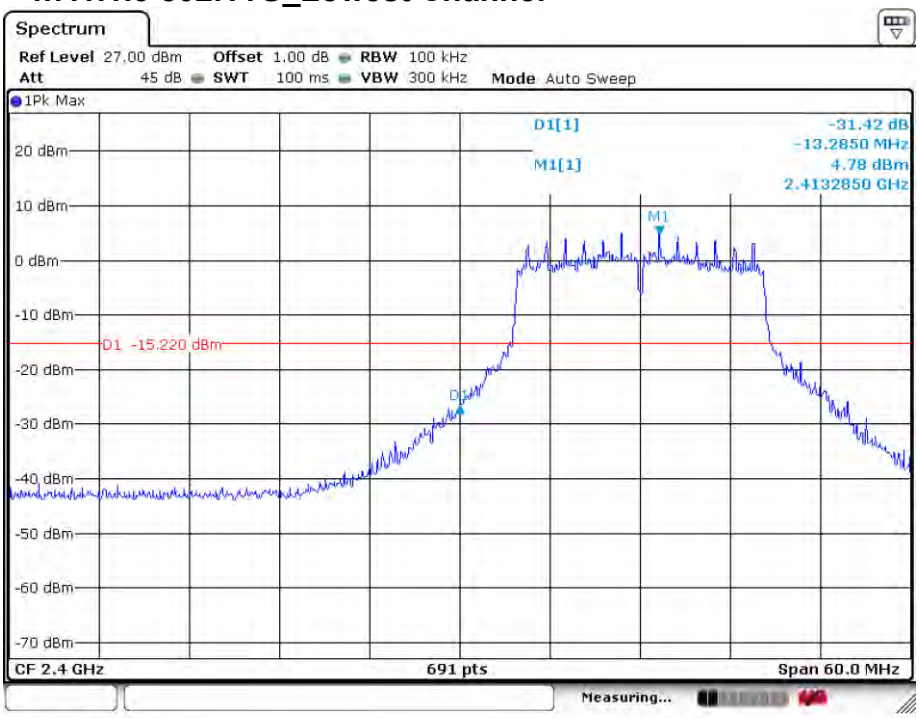
4.7.1.1.2 802.11B_ Highest Channel

Date: 28.SEP.2020 09:06:28

4.7.1.1.3 802.11G_Lowest Channel



Date: 28.SEP.2020 09:03:39

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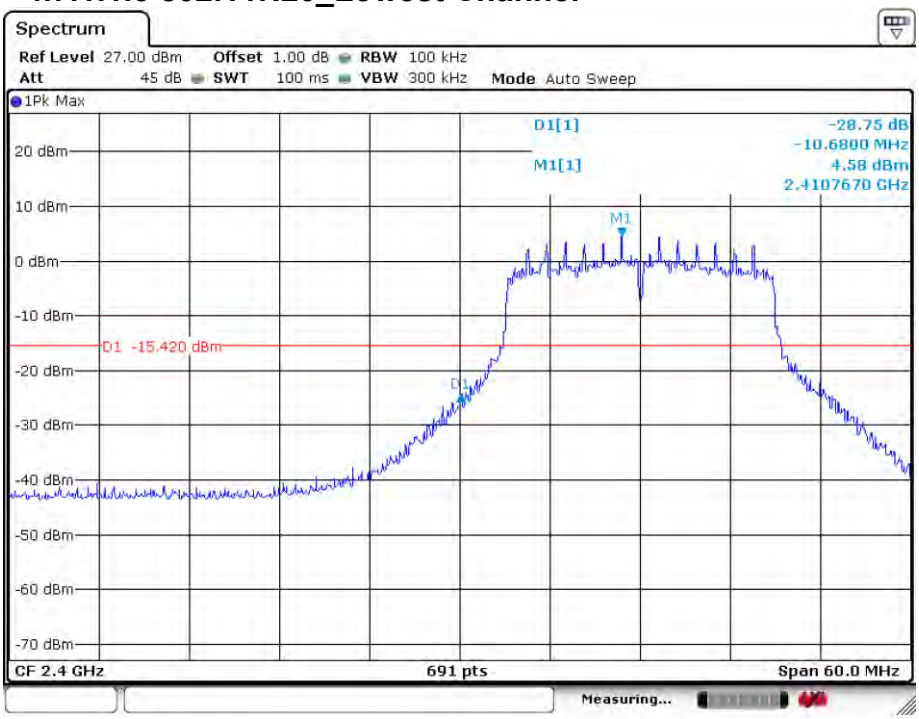
4.7.1.1.4 802.11G_ Highest Channel

Date: 28.SEP.2020 09:02:39

4.7.1.1.5 802.11N20_Lowest Channel



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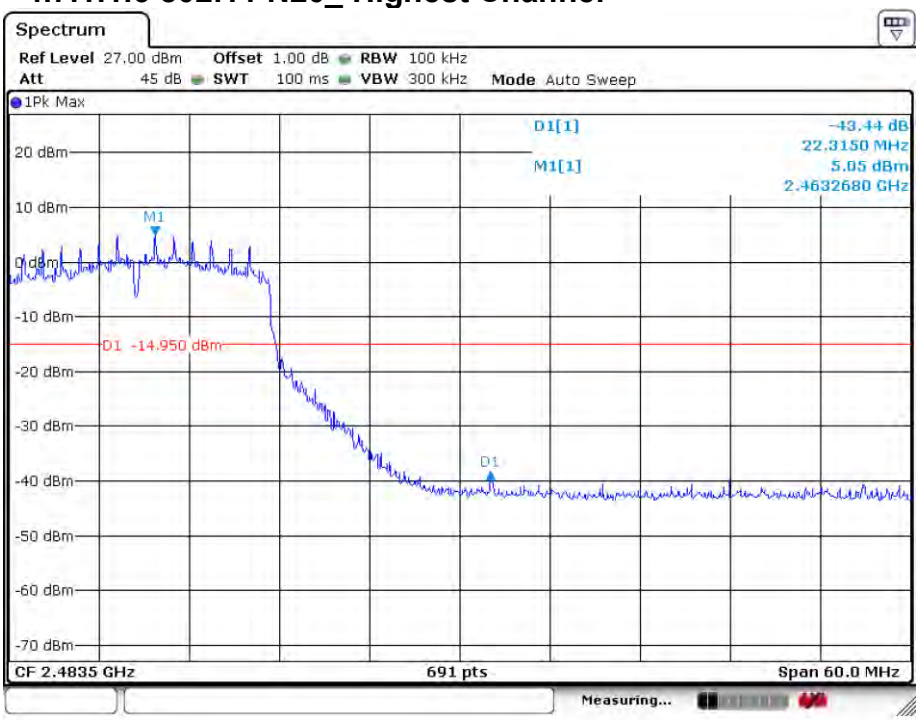
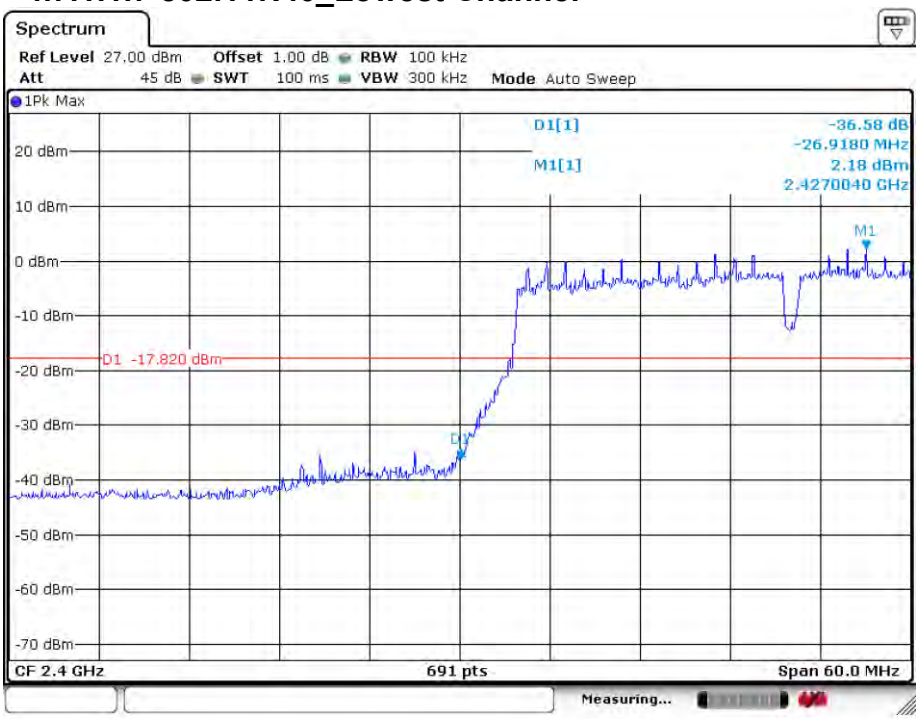
4.7.1.1.6 802.11 N20_ Highest Channel



Date: 28.SEP.2020 09:01:25

4.7.1.1.7 802.11N40_Lowest Channel



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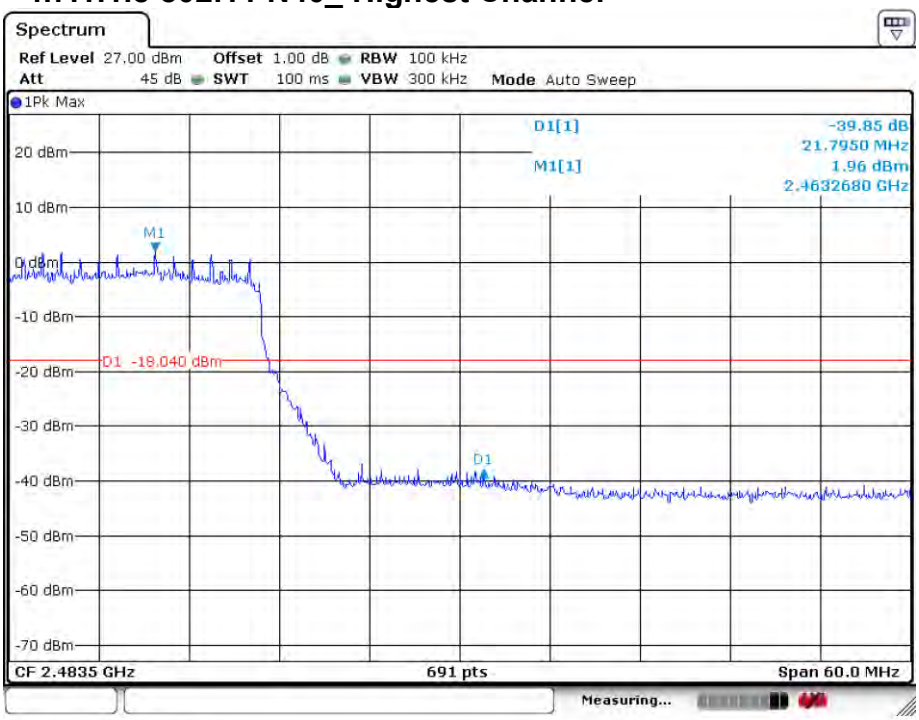
4.7.1.1.8 802.11 N40_ Highest Channel



Date: 28.SEP.2020 08:58:16

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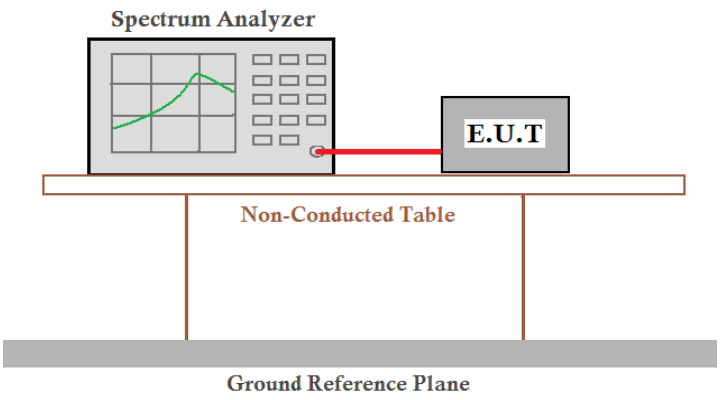
4.8 RF Conducted Spurious Emissions

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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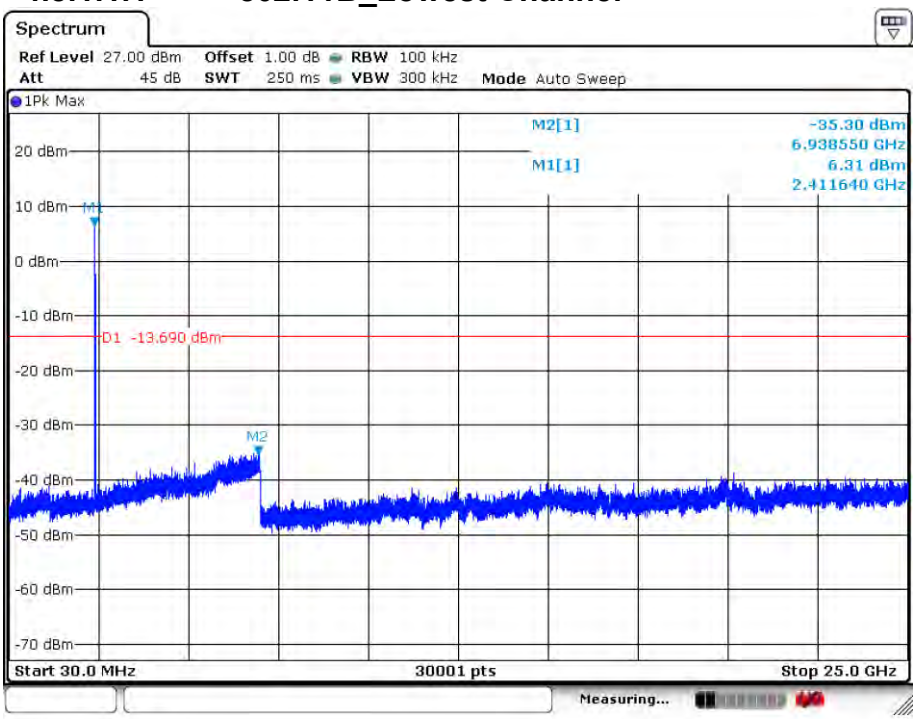
4.8.1 Test plots

4.8.1.1 ANT1

4.8.1.1.1 802.11B_Lowest Channel



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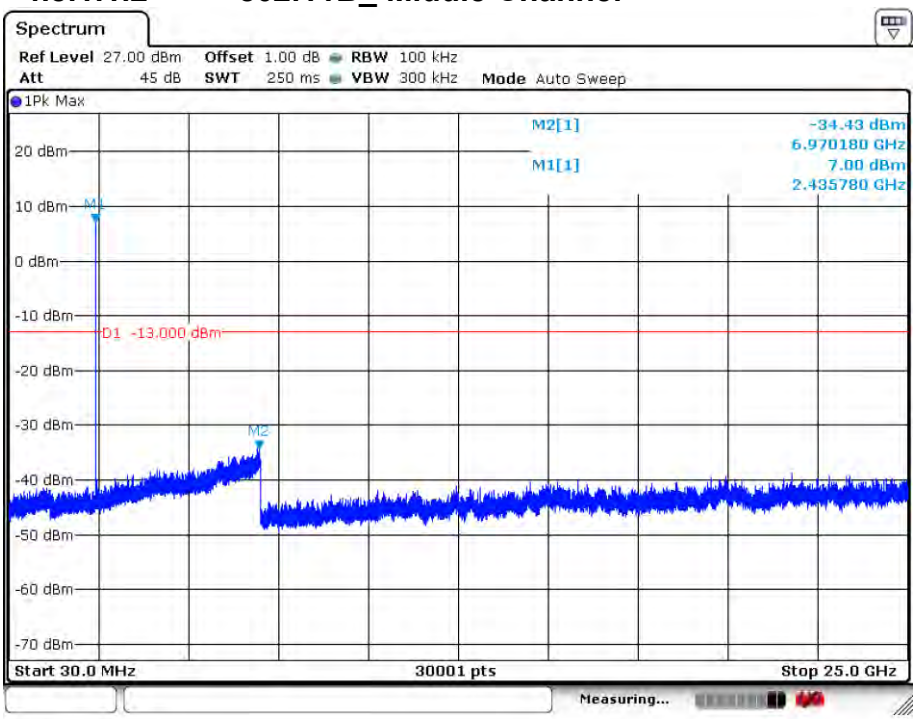
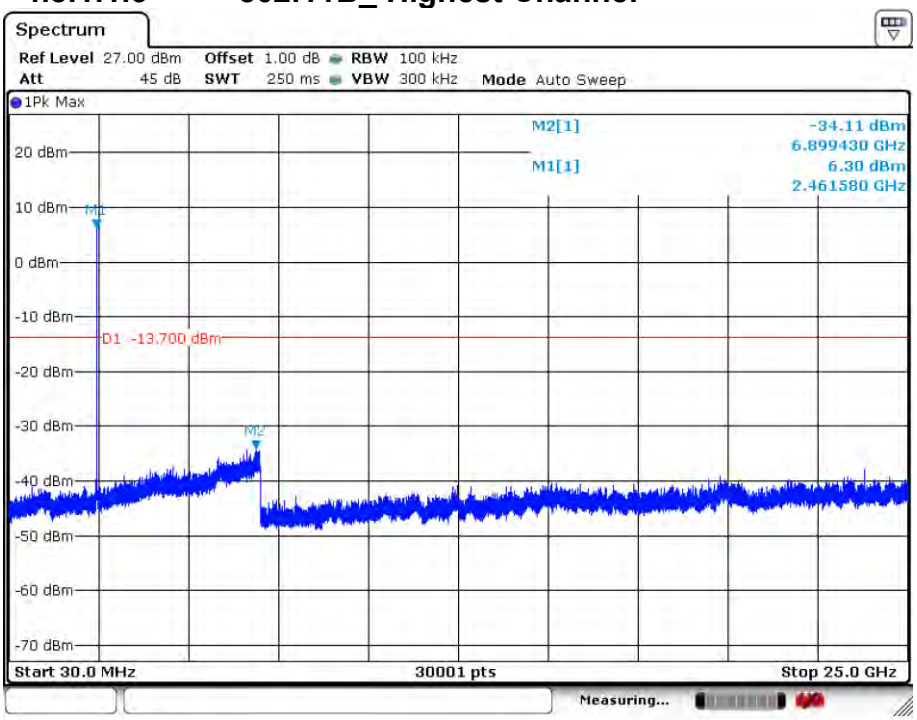
4.8.1.1.2 802.11B_ Middle Channel



Date: 28.SEP.2020 09:09:06

4.8.1.1.3 802.11B_ Highest Channel



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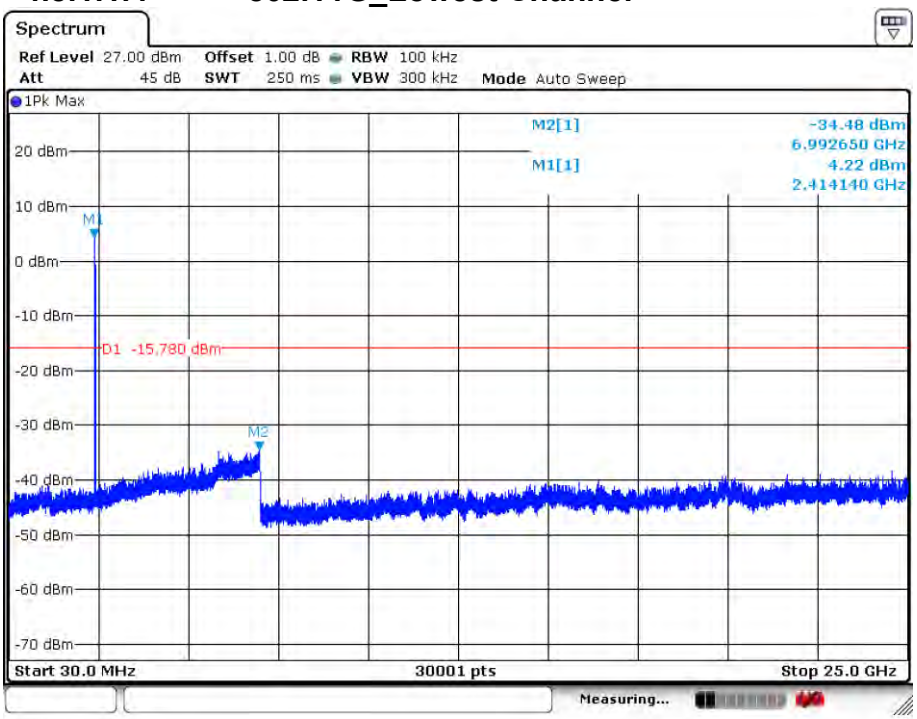
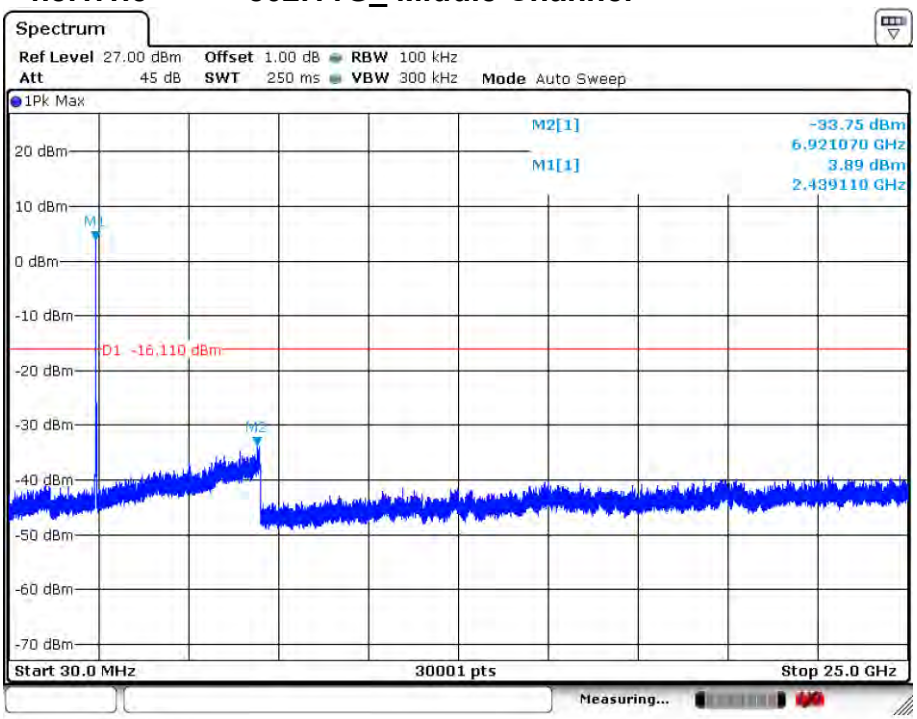
4.8.1.1.4 802.11G_Lowest Channel



Date: 28.SEP.2020 09:11:00

4.8.1.1.5 802.11G_ Middle Channel



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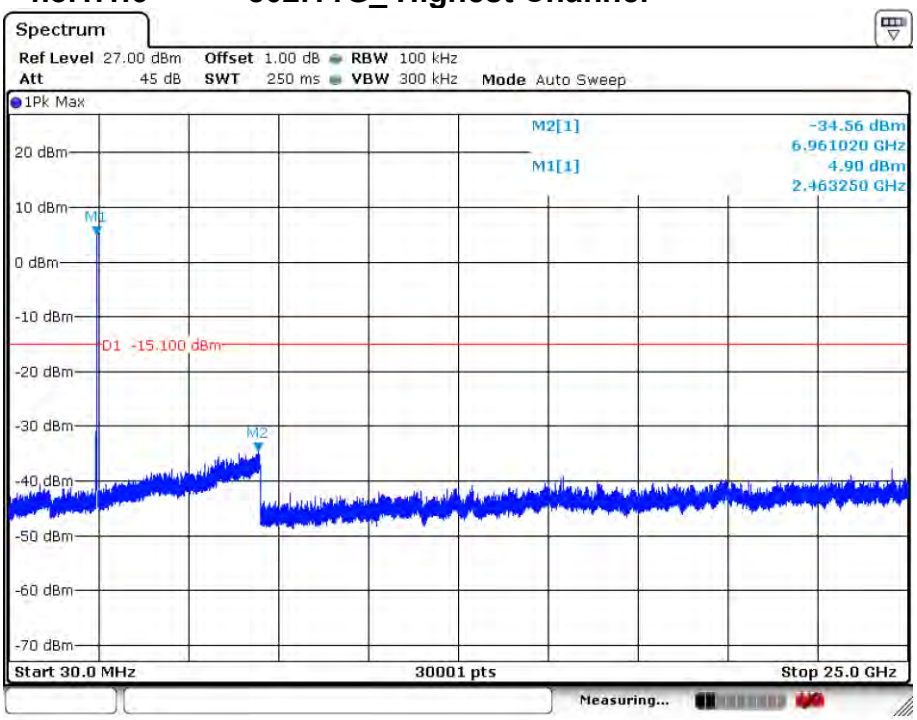
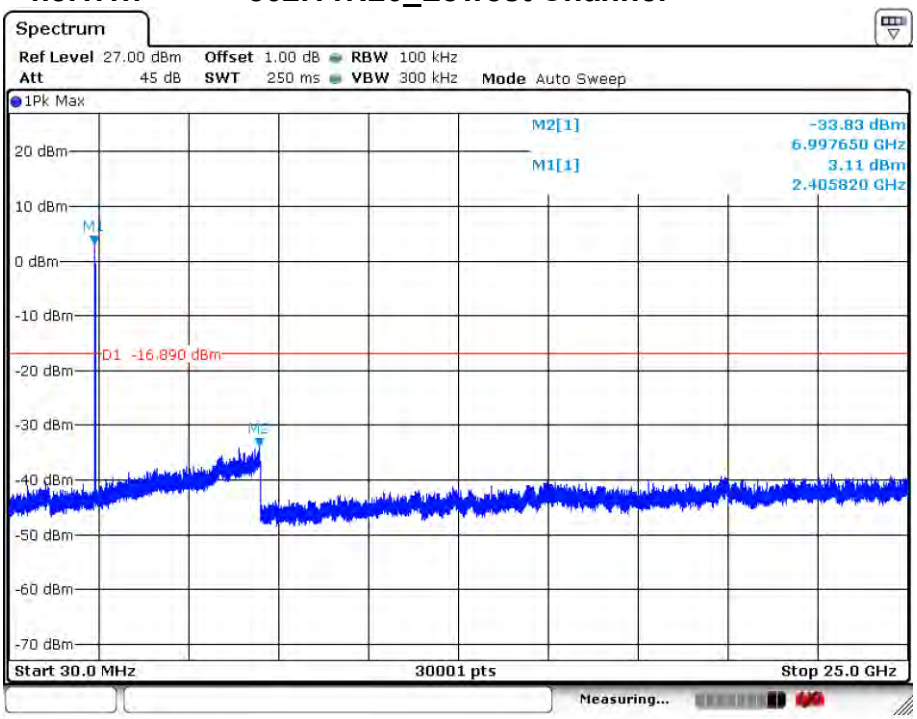
4.8.1.1.6 802.11G_ Highest Channel



Date: 28.SEP.2020 09:12:50

4.8.1.1.7 802.11N20_Lowest Channel



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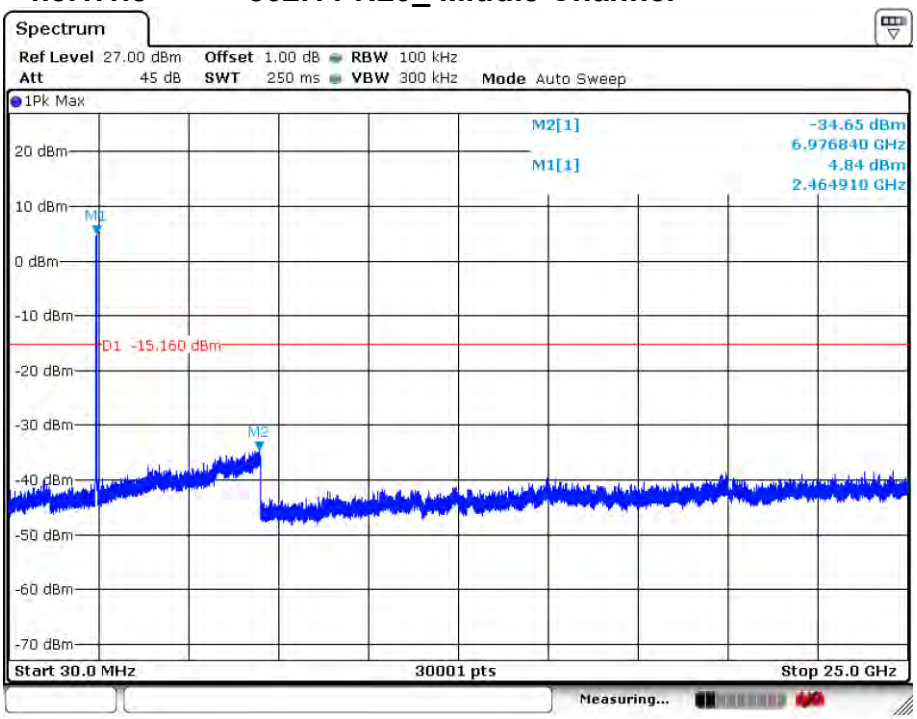
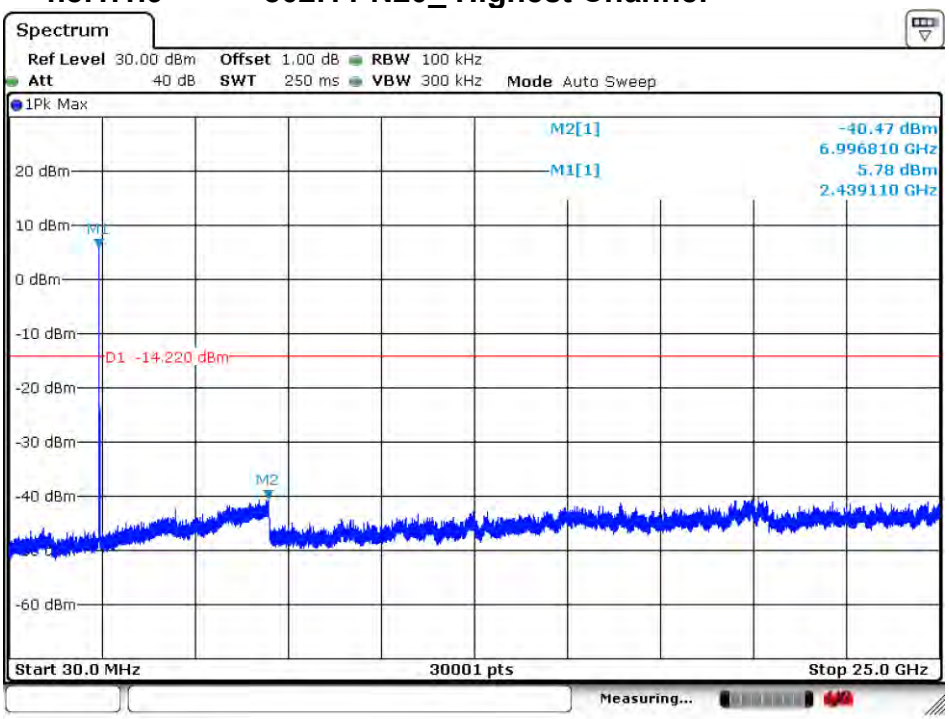
4.8.1.1.8 802.11 N20_ Middle Channel



Date: 28.SEP.2020 09:15:01

4.8.1.1.9 802.11 N20_ Highest Channel



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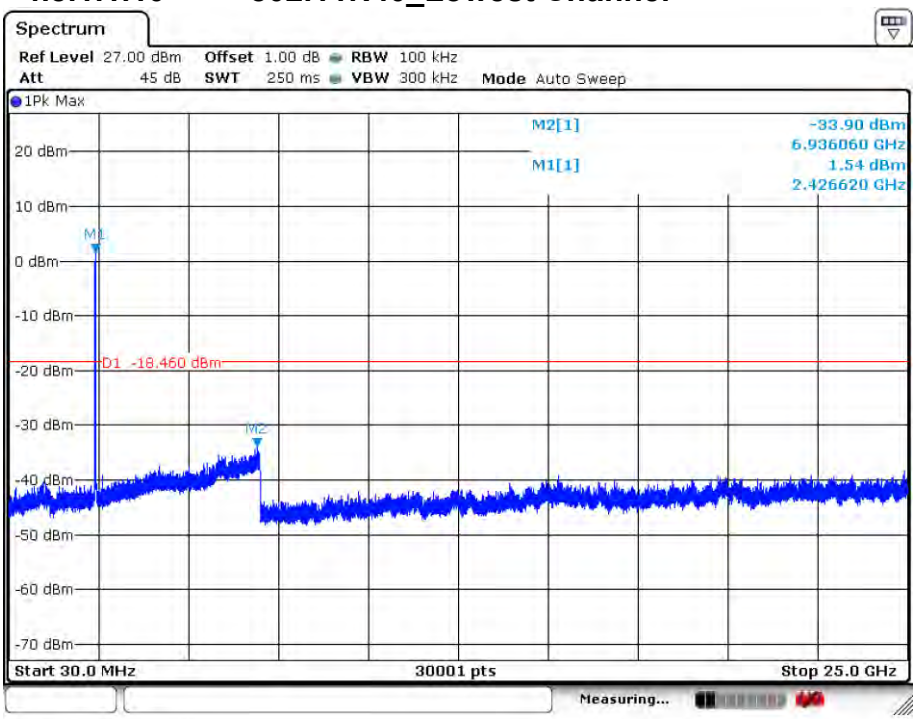
4.8.1.1.10 802.11N40_Lowest Channel



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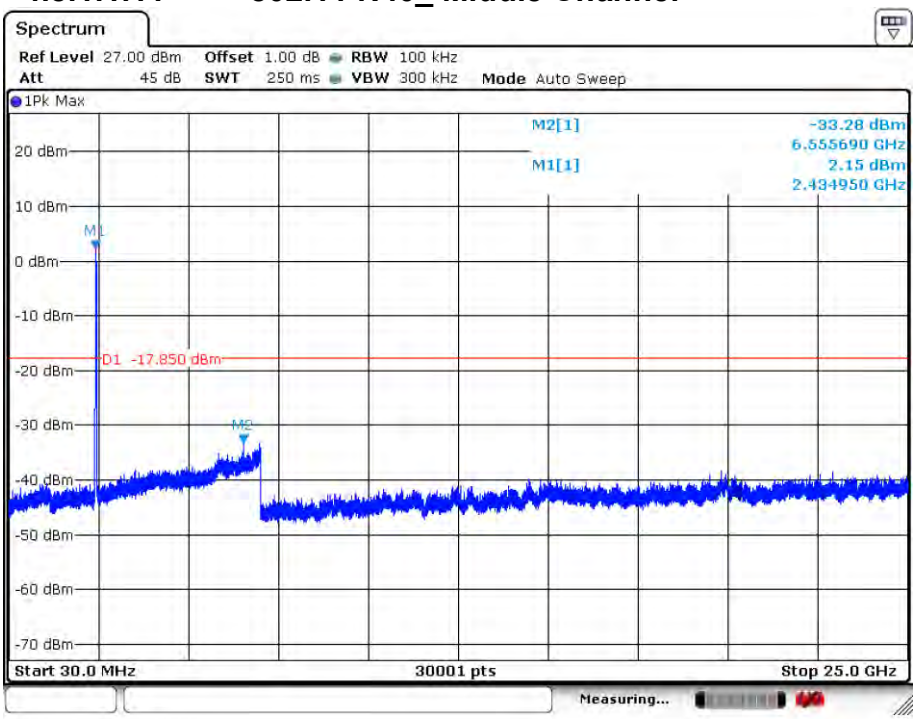
4.8.1.1.11 802.11 N40_ Middle Channel



Date: 28.SEP.2020 09:25:35

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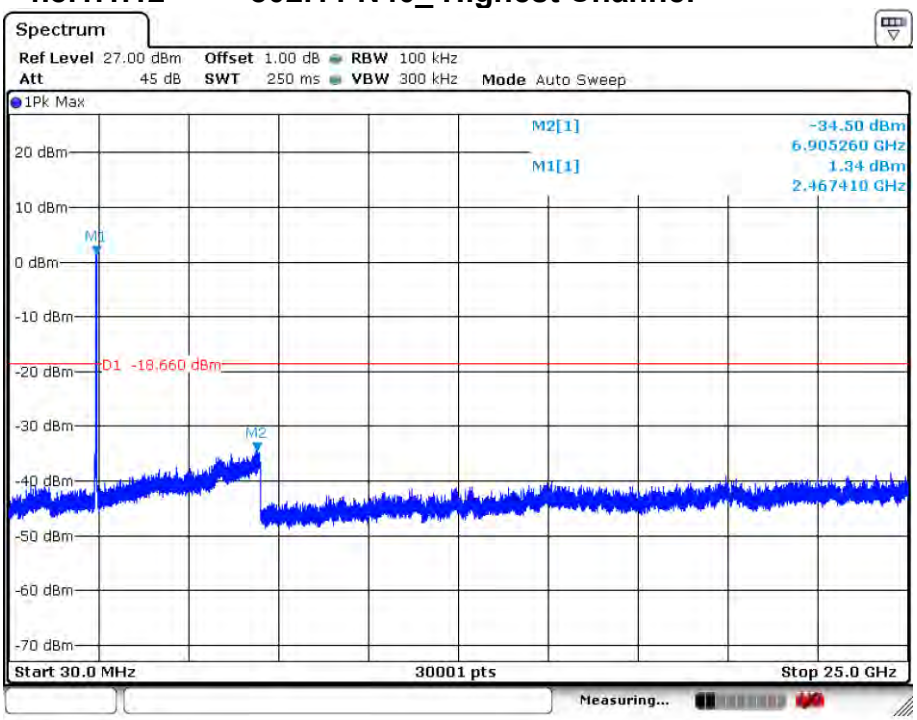
4.8.1.1.12 802.11 N40_ Highest Channel



Date: 28.SEP.2020 09:26:47

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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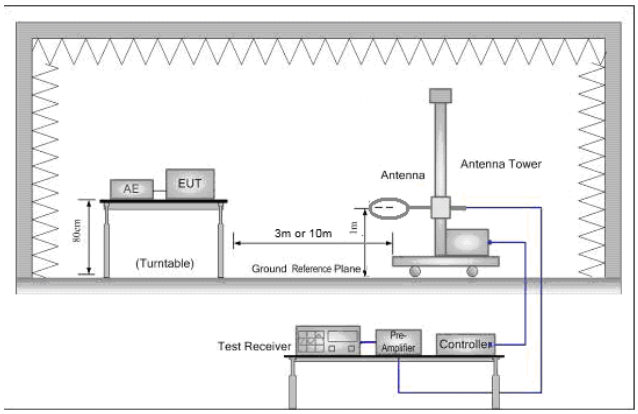

Figure 1. Below 30MHz

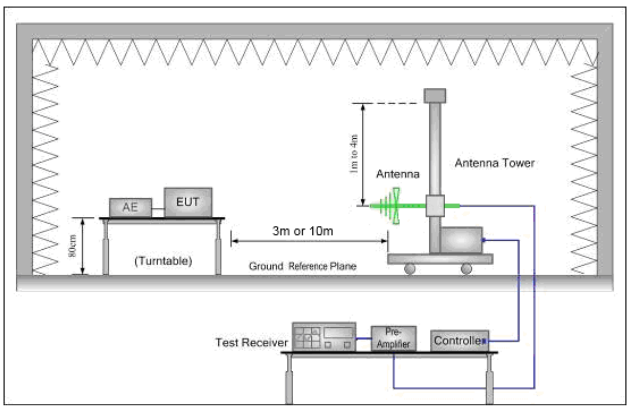

Figure 2. 30MHz to 1GHz

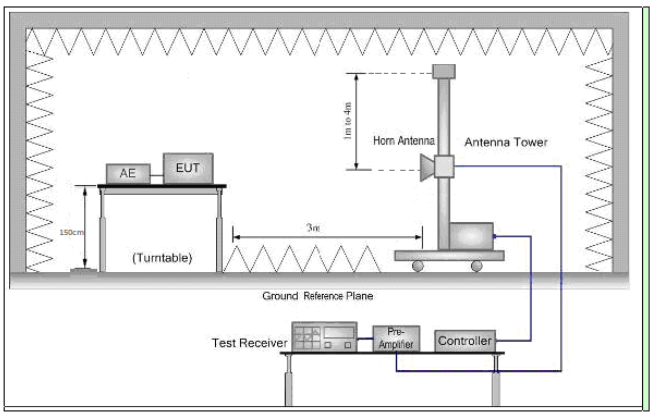

Figure 3. Above 1 GHz

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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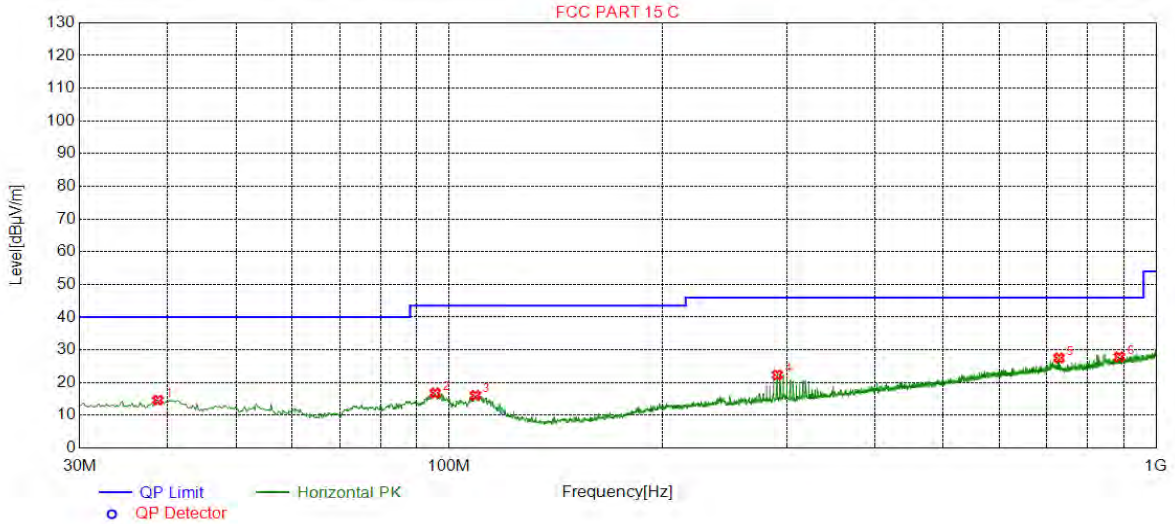
4.9.1 Radiated emission below 1GHz

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	14.64	-28.75	40.00	25.36	200	229	Horizontal
2	95.5851	16.80	-32.79	43.50	26.70	200	329	Horizontal
3	108.973	16.09	-32.00	43.50	27.41	200	346	Horizontal
4	291.176	22.37	-28.60	46.00	23.63	100	267	Horizontal
5	729.121	27.52	-18.82	46.00	18.48	100	360	Horizontal
6	887.263	27.86	-16.25	46.00	18.14	200	144	Horizontal

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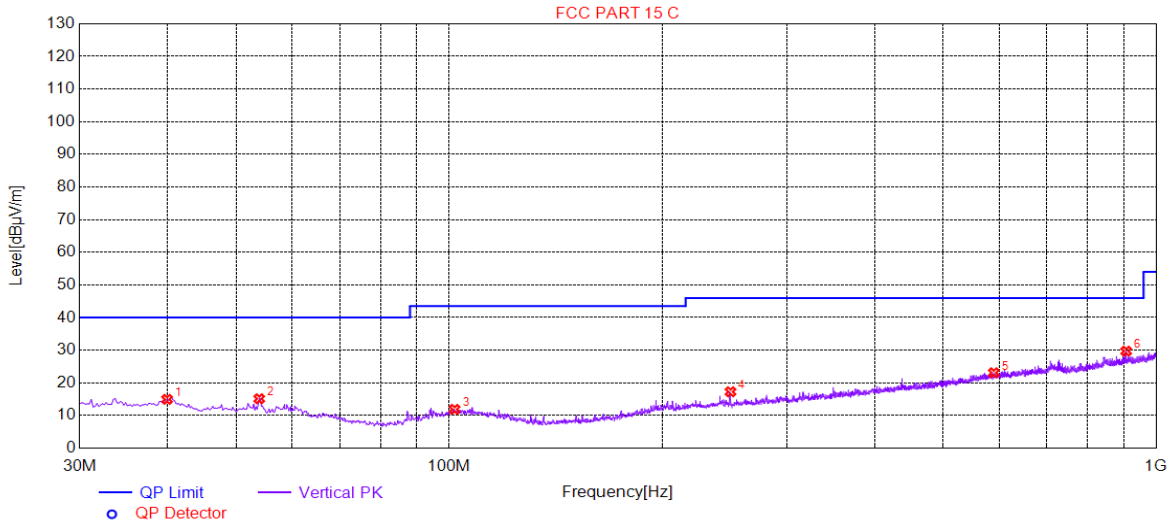
Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	39.8960	14.96	-28.37	40.00	25.04	100	72	Vertical
2	53.8668	15.15	-30.95	40.00	24.85	100	292	Vertical
3	101.794	11.90	-32.00	43.50	31.60	100	232	Vertical
4	250.040	17.28	-29.66	46.00	28.72	100	31	Vertical
5	589.413	23.11	-20.93	46.00	22.89	100	22	Vertical
6	907.055	29.73	-15.95	46.00	16.27	100	14	Vertical

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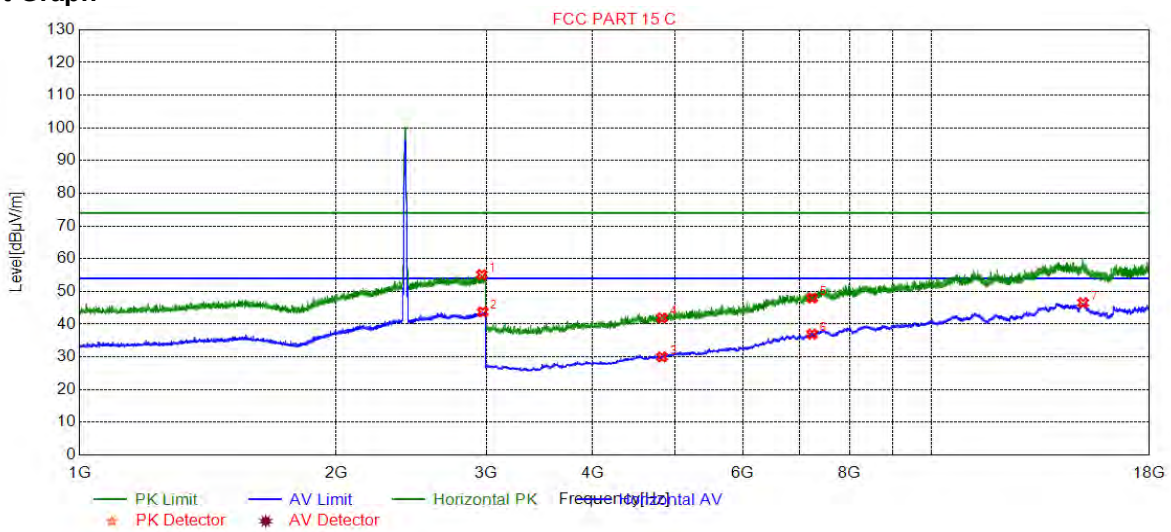
4.9.2 Transmitter emission above 1GHz

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	2964.49	55.15	9.61	74.00	18.85	150	224	Horizontal
2	2971.99	43.77	9.58	54.00	10.23	150	347	Horizontal
3	4824.00	29.99	-18.21	54.00	24.01	150	342	Horizontal
4	4824.00	41.92	-18.21	74.00	32.08	150	0	Horizontal
5	7236.00	48.00	-9.76	74.00	26.00	150	96	Horizontal
6	7236.00	36.95	-9.76	54.00	17.05	150	0	Horizontal
7	15043.2	46.55	2.62	54.00	7.45	150	287	Horizontal

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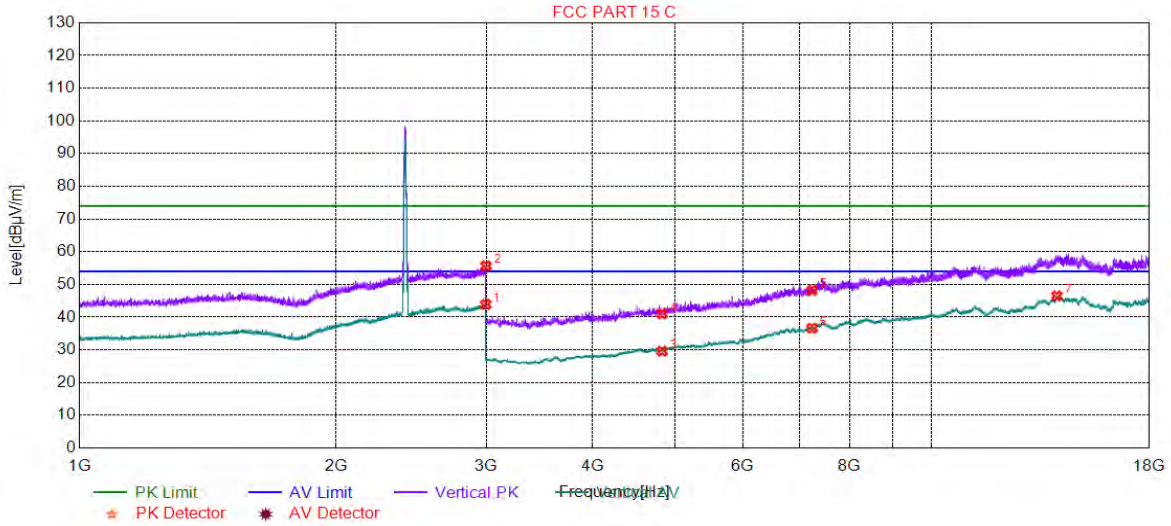
4.9.2.2 802.11B_Channel 1

Test Graph



Suspected List

Suspected List								
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1	2996.49	43.91	9.47	54.00	10.09	150	55	Vertical
2	2998.99	55.68	9.45	74.00	18.32	150	192	Vertical
3	4824.00	29.61	-18.21	54.00	24.39	150	182	Vertical
4	4824.00	40.99	-18.21	74.00	33.01	150	360	Vertical
5	7236.00	48.22	-9.76	74.00	25.78	150	344	Vertical
6	7236.00	36.63	-9.76	54.00	17.37	150	18	Vertical
7	14014.1	46.49	2.41	54.00	7.51	150	154	Vertical

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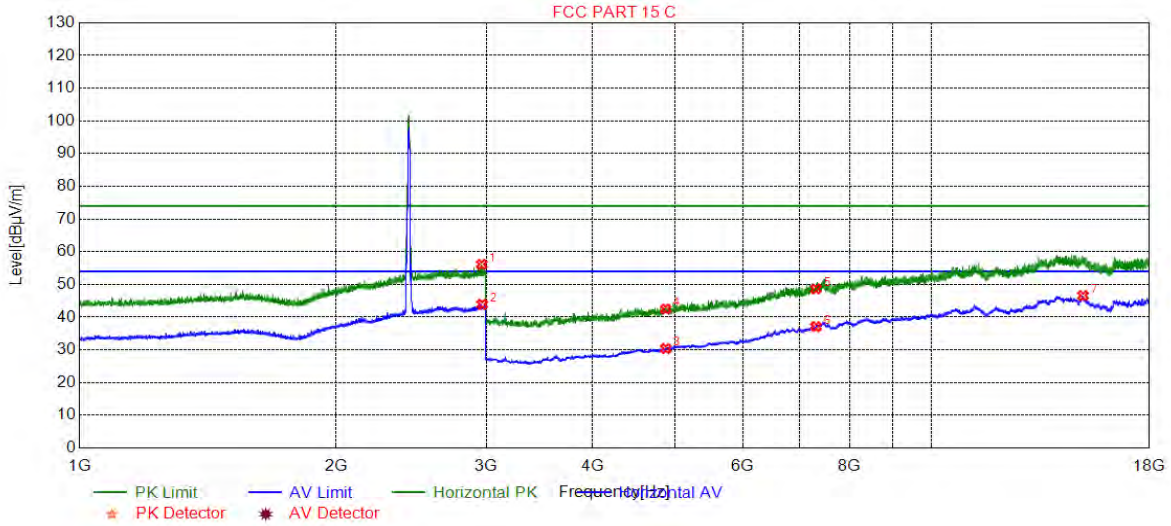
4.9.2.3 802.11B_Channel 6

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2963.99	56.14	9.62	74.00	17.86	150	194	Horizontal
2	2967.49	43.94	9.60	54.00	10.06	150	98	Horizontal
3	4874.00	30.41	-17.99	54.00	23.59	150	14	Horizontal
4	4874.00	42.52	-17.99	74.00	31.48	150	122	Horizontal
5	7311.00	48.63	-9.59	74.00	25.37	150	260	Horizontal
6	7311.00	37.11	-9.59	54.00	16.89	150	260	Horizontal
7	15040.2	46.58	2.62	54.00	7.42	150	150	Horizontal

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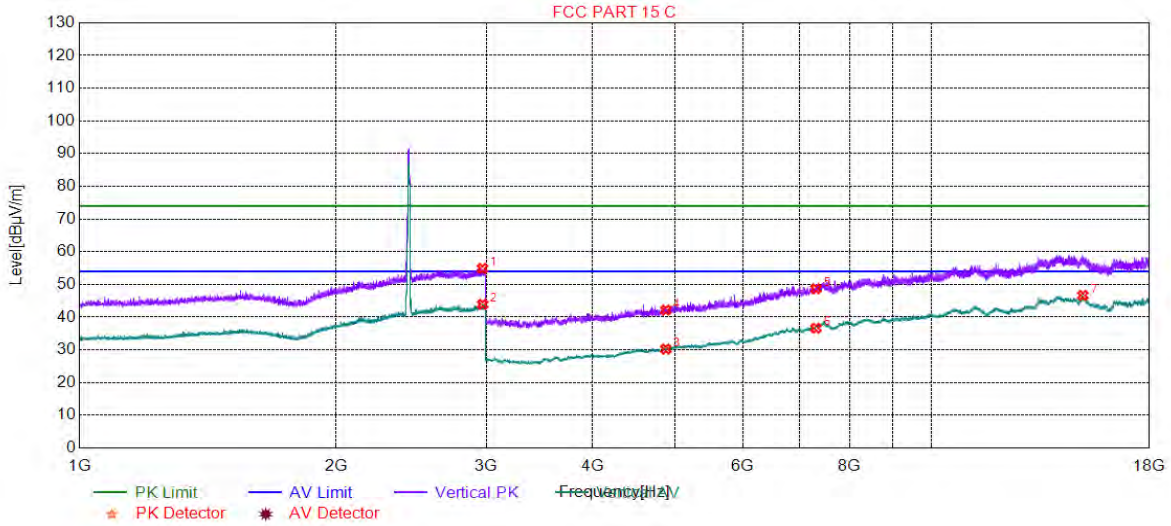
4.9.2.4 802.11B_Channel 6

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2969.49	54.89	9.59	74.00	19.11	150	1	Vertical
2	2970.99	43.94	9.58	54.00	10.06	150	50	Vertical
3	4874.00	30.25	-17.99	54.00	23.75	150	360	Vertical
4	4874.00	42.16	-17.99	74.00	31.84	150	18	Vertical
5	7311.00	48.68	-9.59	74.00	25.32	150	127	Vertical
6	7311.00	36.65	-9.59	54.00	17.35	150	182	Vertical
7	15032.7	46.65	2.61	54.00	7.35	150	18	Vertical

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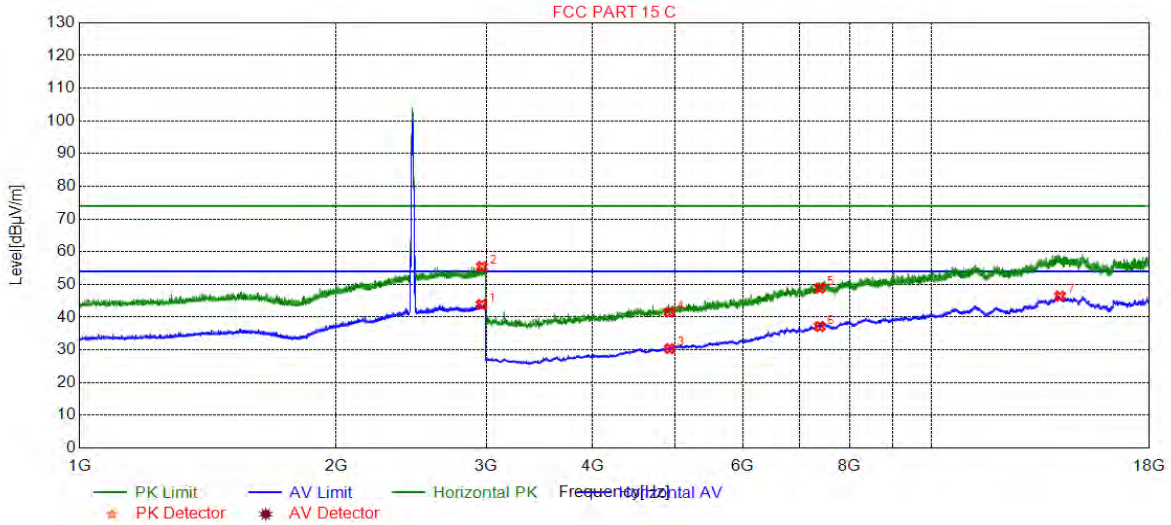
4.9.2.5 802.11B_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2962.99	43.86	9.62	54.00	10.14	150	32	Horizontal
2	2965.49	55.44	9.61	74.00	18.56	150	18	Horizontal
3	4924.00	30.37	-17.71	54.00	23.63	150	71	Horizontal
4	4924.00	41.55	-17.71	74.00	32.45	150	44	Horizontal
5	7386.00	48.90	-9.20	74.00	25.10	150	16	Horizontal
6	7386.00	37.15	-9.20	54.00	16.85	150	261	Horizontal
7	14134.1	46.43	2.53	54.00	7.57	150	261	Horizontal

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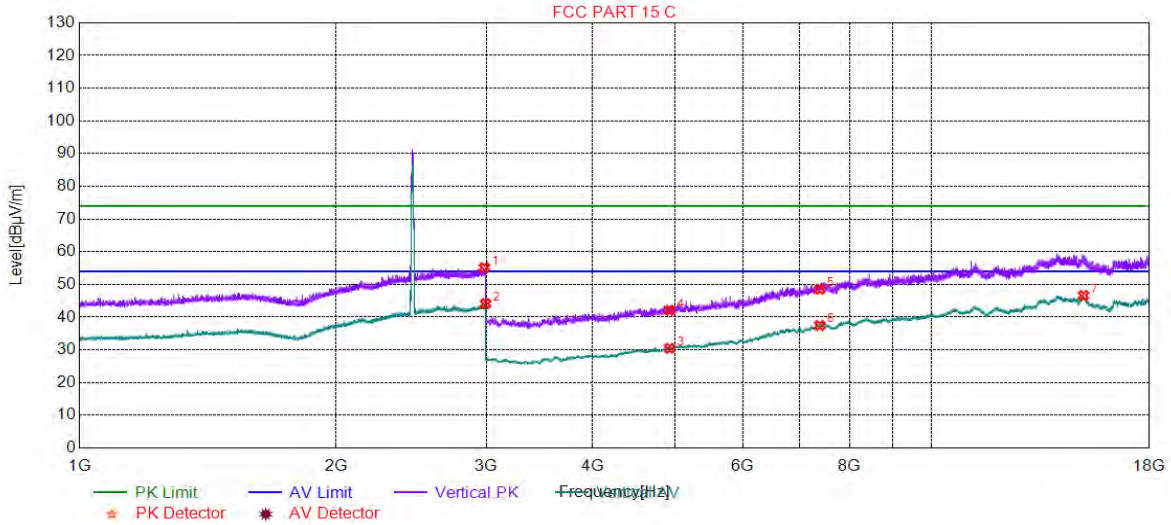
4.9.2.6 802.11B_Channel 11

Test Graph



Suspected List

Suspected List								
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1	2985.49	55.16	9.52	74.00	18.84	150	234	Vertical
2	2994.99	44.16	9.47	54.00	9.84	150	0	Vertical
3	4924.00	30.47	-17.71	54.00	23.53	150	99	Vertical
4	4924.00	42.10	-17.71	74.00	31.90	150	237	Vertical
5	7386.00	48.55	-9.20	74.00	25.45	150	126	Vertical
6	7386.00	37.48	-9.20	54.00	16.52	150	264	Vertical
7	15059.7	46.62	2.65	54.00	7.38	150	18	Vertical

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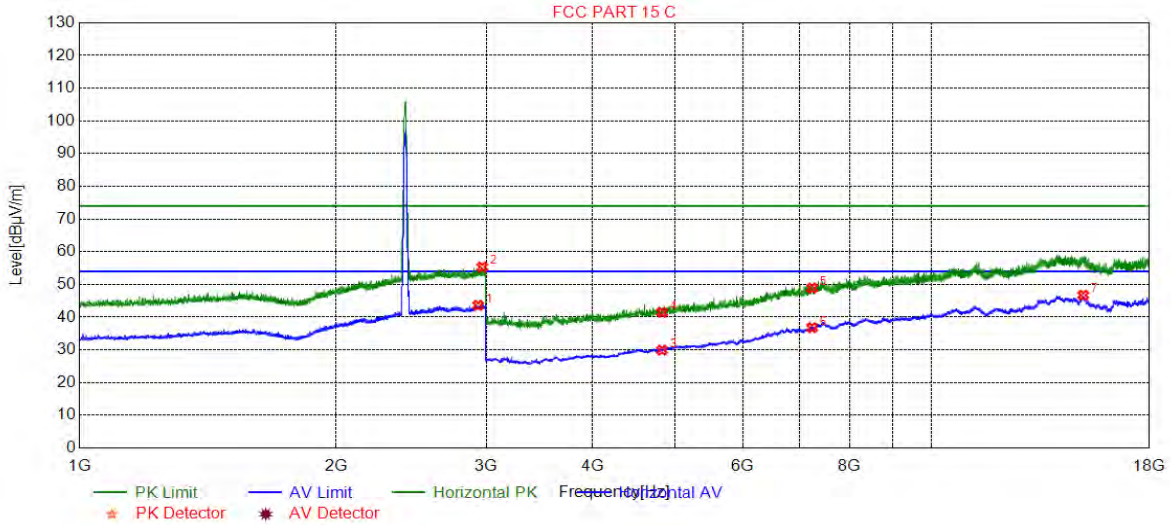
4.9.2.7 802.11G_Channel 1

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2934.98	43.62	9.52	54.00	10.38	150	113	Horizontal
2	2967.99	55.34	9.60	74.00	18.66	150	355	Horizontal
3	4824.00	29.92	-18.21	54.00	24.08	150	16	Horizontal
4	4824.00	41.49	-18.21	74.00	32.51	150	342	Horizontal
5	7236.00	48.91	-9.76	74.00	25.09	150	130	Horizontal
6	7236.00	36.80	-9.76	54.00	17.20	150	342	Horizontal
7	15052.2	46.73	2.64	54.00	7.27	150	130	Horizontal

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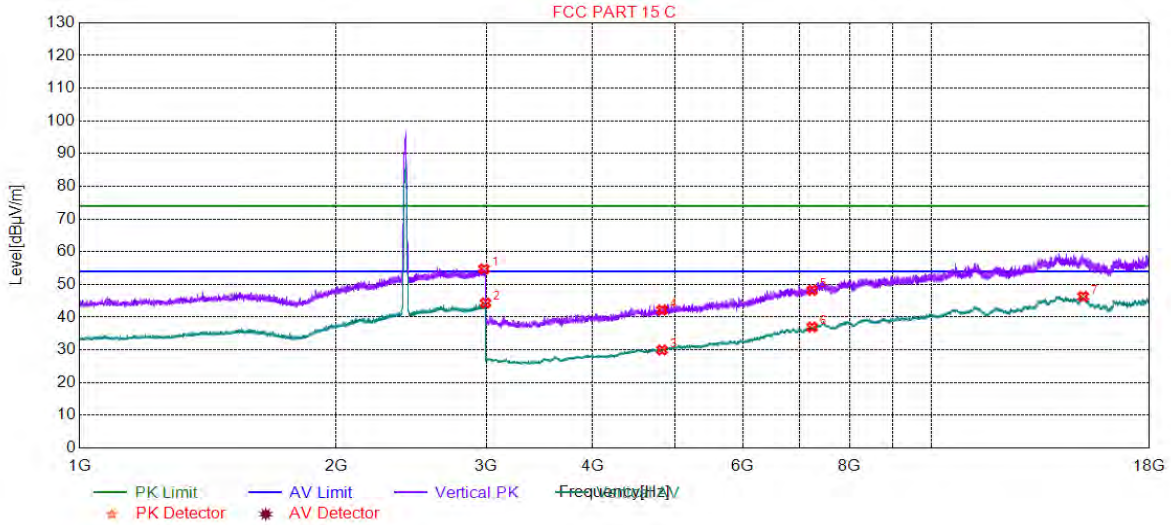
4.9.2.8 802.11G_Channel 1

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2982.99	54.76	9.53	74.00	19.24	150	302	Vertical
2	2994.49	44.34	9.48	54.00	9.66	150	110	Vertical
3	4824.00	29.96	-18.21	54.00	24.04	150	270	Vertical
4	4824.00	42.19	-18.21	74.00	31.81	150	84	Vertical
5	7236.00	48.20	-9.76	74.00	25.80	150	332	Vertical
6	7236.00	36.97	-9.76	54.00	17.03	150	84	Vertical
7	15047.7	46.33	2.63	54.00	7.67	150	208	Vertical

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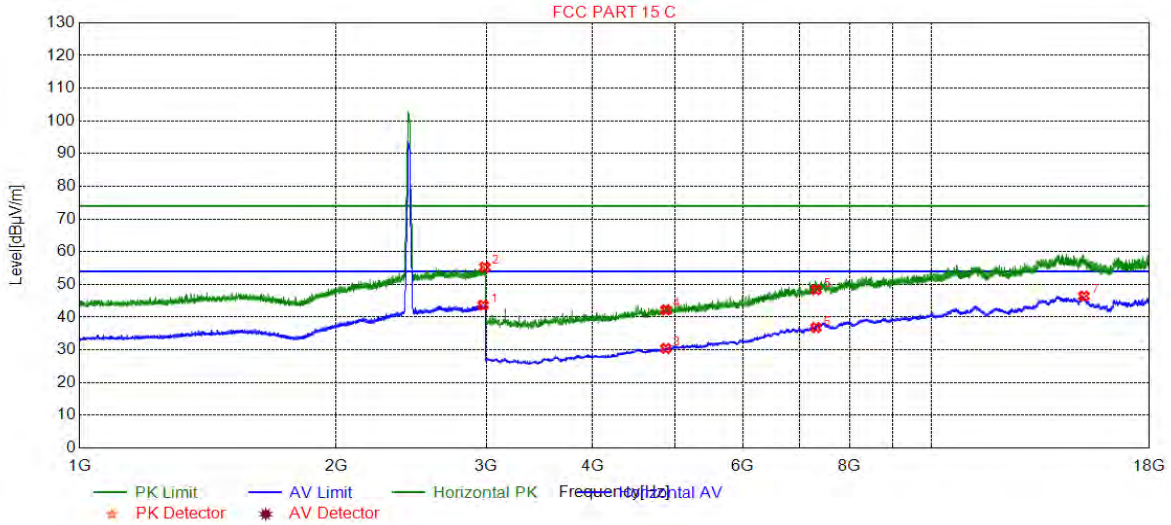
4.9.2.9 802.11G_Channel 6

Test Graph



Suspected List

Suspected List								
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1	2974.99	43.68	9.57	54.00	10.32	150	357	Horizontal
2	2988.99	55.31	9.50	74.00	18.69	150	45	Horizontal
3	4874.00	30.44	-17.99	54.00	23.56	150	68	Horizontal
4	4874.00	42.21	-17.99	74.00	31.79	150	288	Horizontal
5	7311.00	48.38	-9.59	74.00	25.62	150	124	Horizontal
6	7311.00	36.84	-9.59	54.00	17.16	150	233	Horizontal
7	15076.2	46.45	2.68	54.00	7.55	150	179	Horizontal

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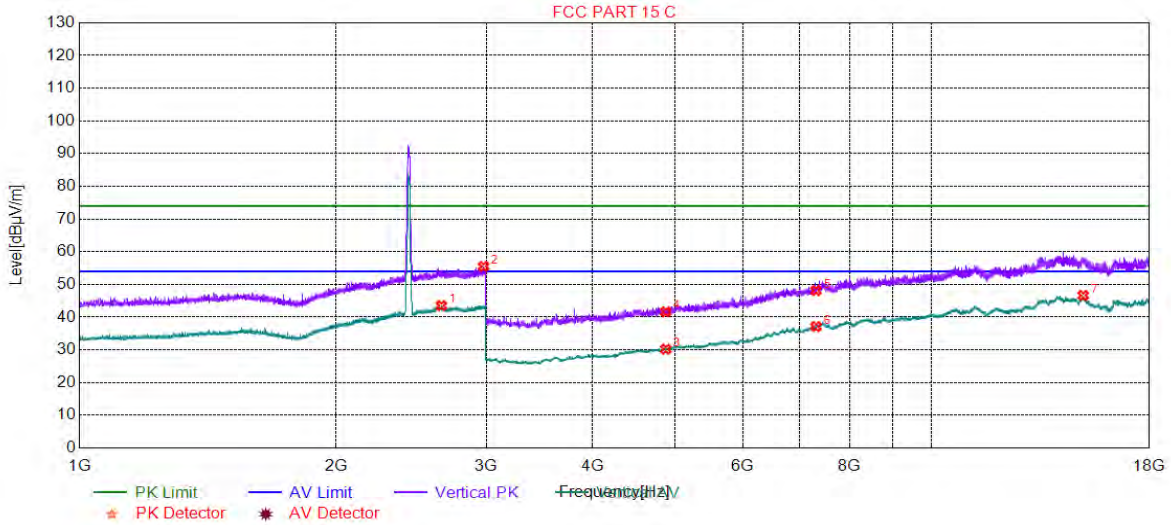
4.9.2.10 802.11G_Channel 6

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2658.41	43.52	8.69	54.00	10.48	150	234	Vertical
2	2979.49	55.51	9.54	74.00	18.49	150	98	Vertical
3	4874.00	30.22	-17.99	54.00	23.78	150	157	Vertical
4	4874.00	41.64	-17.99	74.00	32.36	150	239	Vertical
5	7311.00	48.15	-9.59	74.00	25.85	150	293	Vertical
6	7311.00	37.13	-9.59	54.00	16.87	150	239	Vertical
7	15050.7	46.65	2.64	54.00	7.35	150	212	Vertical

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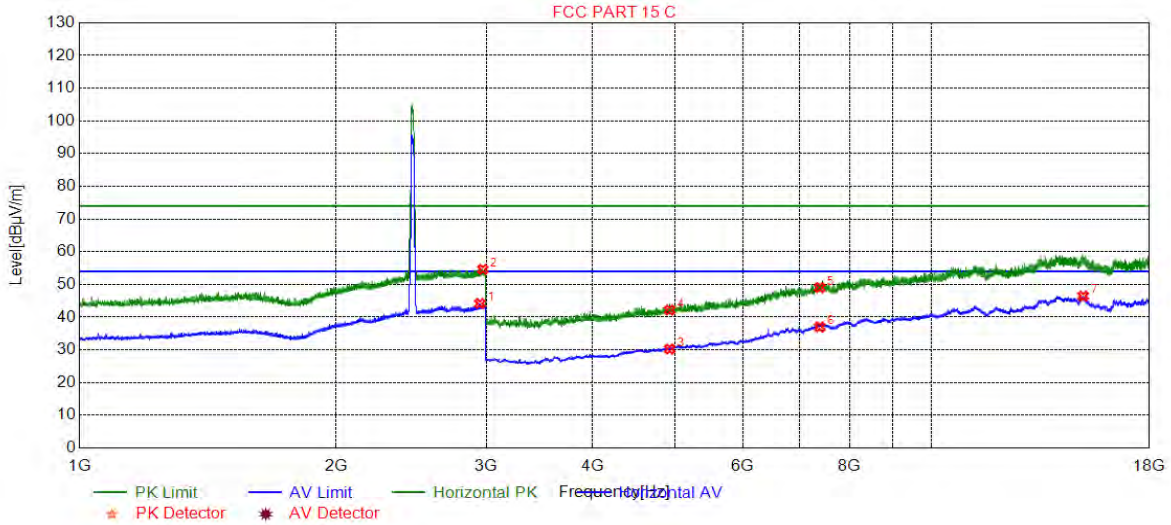
4.9.2.11 802.11G_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2949.48	44.20	9.67	54.00	9.80	150	222	Horizontal
2	2972.49	54.65	9.58	74.00	19.35	150	168	Horizontal
3	4924.00	30.25	-17.71	54.00	23.75	150	234	Horizontal
4	4924.00	42.19	-17.71	74.00	31.81	150	71	Horizontal
5	7386.00	49.04	-9.20	74.00	24.96	150	43	Horizontal
6	7386.00	37.01	-9.20	54.00	16.99	150	342	Horizontal
7	15047.7	46.44	2.63	54.00	7.56	150	206	Horizontal

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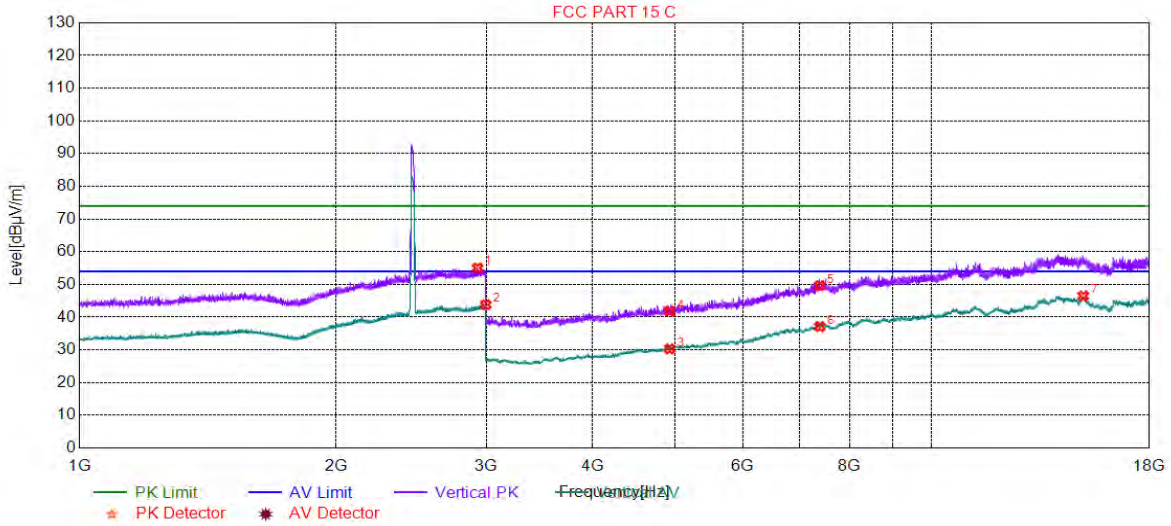
4.9.2.12 802.11G_Channel 11

Test Graph



Suspected List

Suspected List								
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1	2930.48	55.06	9.47	74.00	18.94	150	3	Vertical
2	2996.99	43.79	9.46	54.00	10.21	150	234	Vertical
3	4924.00	30.31	-17.71	54.00	23.69	150	208	Vertical
4	4924.00	41.86	-17.71	74.00	32.14	150	18	Vertical
5	7386.00	49.62	-9.20	74.00	24.38	150	360	Vertical
6	7386.00	37.12	-9.20	54.00	16.88	150	181	Vertical
7	15050.7	46.46	2.64	54.00	7.54	150	18	Vertical

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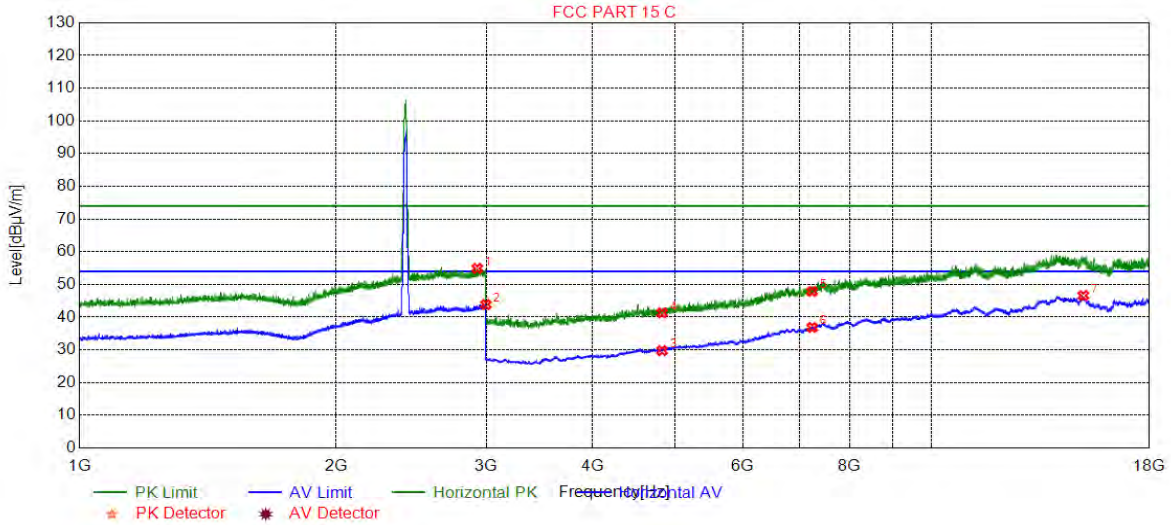
4.9.2.13 802.11N20_Channel 1

Test Graph



Suspected List

Suspected List								
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1	2928.48	54.91	9.45	74.00	19.09	150	306	Horizontal
2	2997.99	43.85	9.46	54.00	10.15	150	86	Horizontal
3	4824.00	29.78	-18.21	54.00	24.22	150	178	Horizontal
4	4824.00	41.31	-18.21	74.00	32.69	150	261	Horizontal
5	7236.00	47.87	-9.76	74.00	26.13	150	342	Horizontal
6	7236.00	36.86	-9.76	54.00	17.14	150	178	Horizontal
7	15055.2	46.60	2.64	54.00	7.40	150	342	Horizontal

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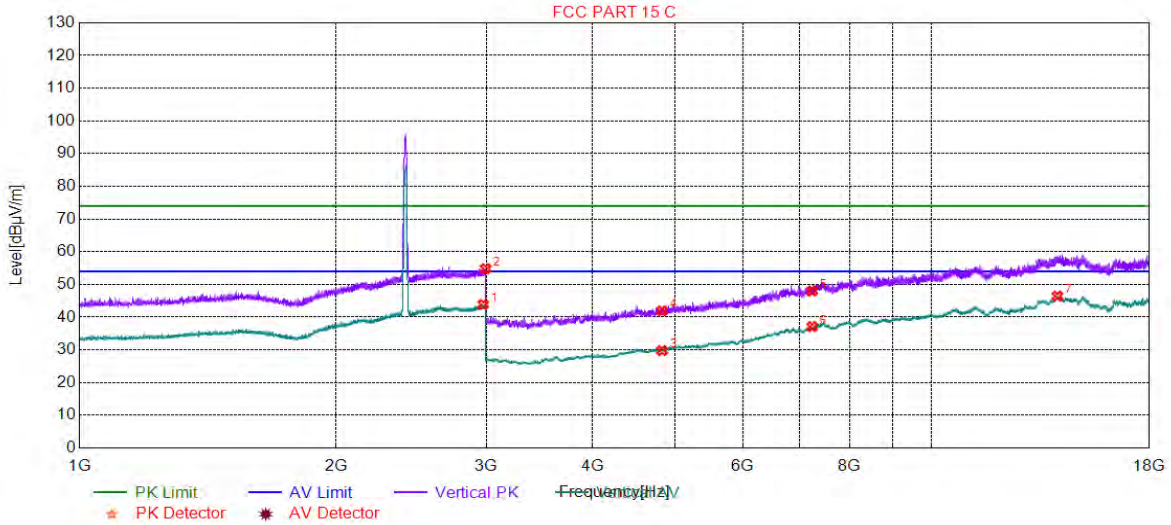
4.9.2.14 802.11N20_Channel 1

Test Graph



Suspected List

Suspected List								
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1	2975.99	43.91	9.56	54.00	10.09	150	274	Vertical
2	2995.99	54.83	9.47	74.00	19.17	150	274	Vertical
3	4824.00	29.79	-18.21	54.00	24.21	150	128	Vertical
4	4824.00	41.98	-18.21	74.00	32.02	150	156	Vertical
5	7236.00	48.01	-9.76	74.00	25.99	150	360	Vertical
6	7236.00	37.12	-9.76	54.00	16.88	150	183	Vertical
7	14038.1	46.45	2.47	54.00	7.55	150	210	Vertical

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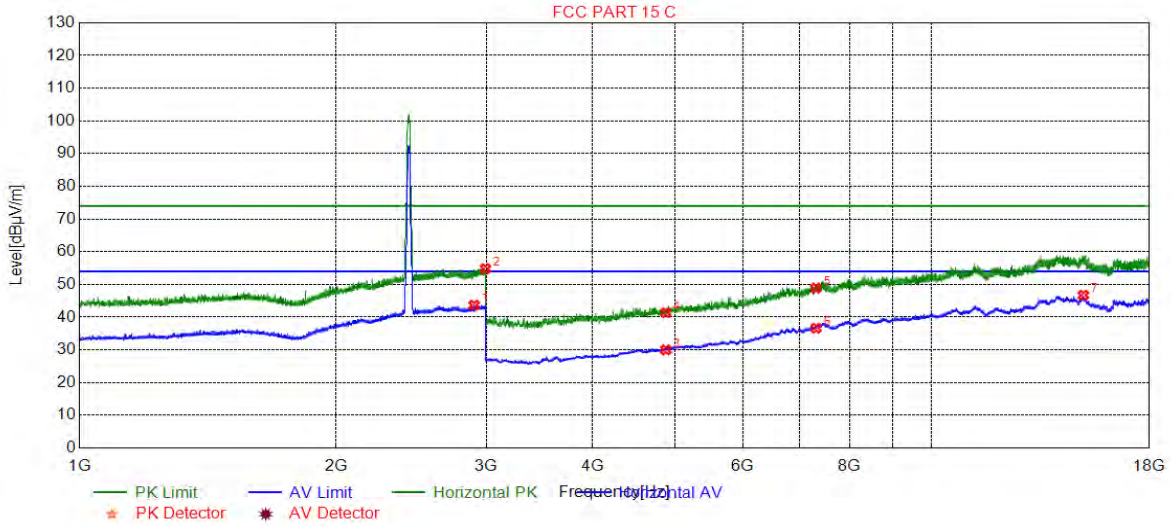
4.9.2.15 802.11N20_Channel 6

Test Graph



Suspected List

Suspected List								
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1	2903.47	43.70	9.18	54.00	10.30	150	317	Horizontal
2	2993.49	54.84	9.48	74.00	19.16	150	250	Horizontal
3	4874.00	30.00	-17.99	54.00	24.00	150	342	Horizontal
4	4874.00	41.36	-17.99	74.00	32.64	150	97	Horizontal
5	7311.00	48.91	-9.59	74.00	25.09	150	232	Horizontal
6	7311.00	36.63	-9.59	54.00	17.37	150	232	Horizontal
7	15053.7	46.73	2.64	54.00	7.27	150	260	Horizontal

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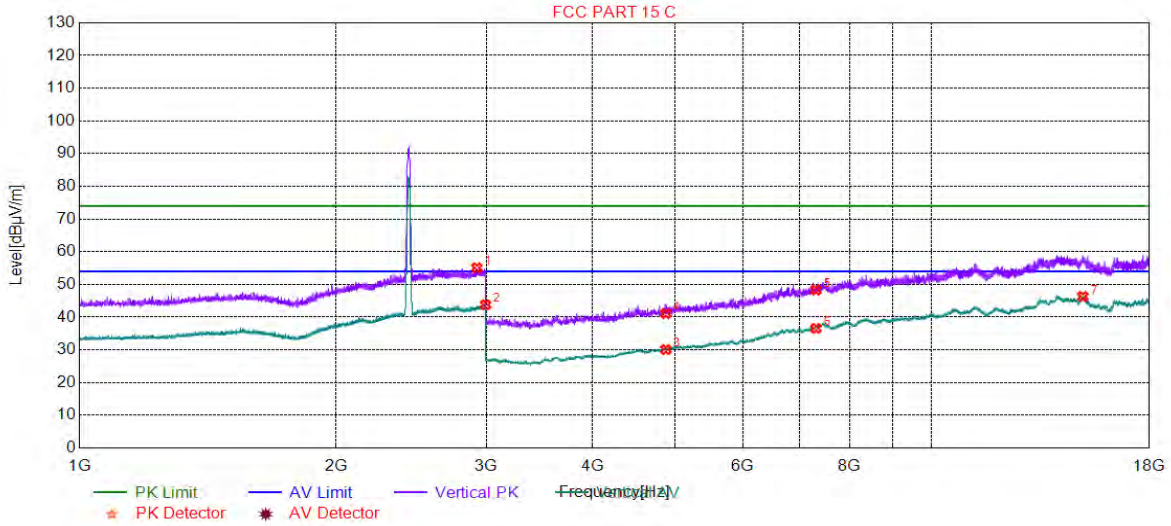
4.9.2.16 802.11N20_Channel 6

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2924.98	55.11	9.41	74.00	18.89	150	261	Vertical
2	2994.99	43.81	9.47	54.00	10.19	150	56	Vertical
3	4874.00	30.11	-17.99	54.00	23.89	150	293	Vertical
4	4874.00	41.11	-17.99	74.00	32.89	150	347	Vertical
5	7311.00	48.32	-9.59	74.00	25.68	150	100	Vertical
6	7311.00	36.58	-9.59	54.00	17.42	150	46	Vertical
7	15032.7	46.34	2.61	54.00	7.66	150	263	Vertical

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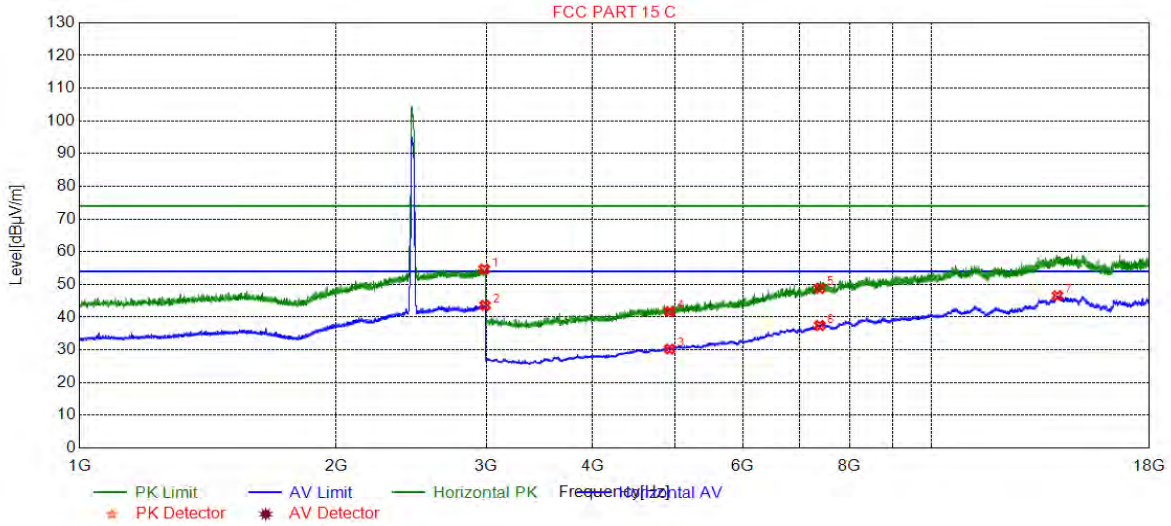
4.9.2.17 802.11N20_Channel 11

Test Graph



Suspected List

Suspected List								
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1	2984.49	54.68	9.52	74.00	19.32	150	334	Horizontal
2	2990.49	43.60	9.49	54.00	10.40	150	358	Horizontal
3	4924.00	30.25	-17.71	54.00	23.75	150	260	Horizontal
4	4924.00	41.71	-17.71	74.00	32.29	150	315	Horizontal
5	7386.00	48.81	-9.20	74.00	25.19	150	287	Horizontal
6	7386.00	37.43	-9.20	54.00	16.57	150	287	Horizontal
7	14036.6	46.56	2.46	54.00	7.44	150	124	Horizontal

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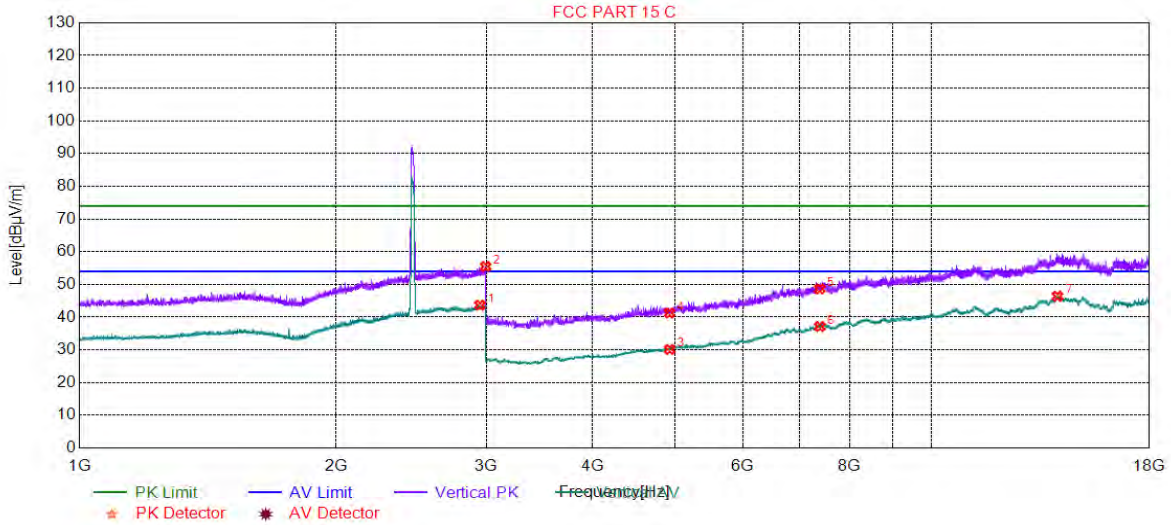
4.9.2.18 802.11N20_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2949.48	43.67	9.67	54.00	10.33	150	329	Vertical
2	2995.49	55.49	9.47	74.00	18.51	150	28	Vertical
3	4924.00	30.15	-17.71	54.00	23.85	150	237	Vertical
4	4924.00	41.25	-17.71	74.00	32.75	150	346	Vertical
5	7386.00	48.66	-9.20	74.00	25.34	150	346	Vertical
6	7386.00	37.14	-9.20	54.00	16.86	150	210	Vertical
7	14039.6	46.39	2.47	54.00	7.61	150	100	Vertical

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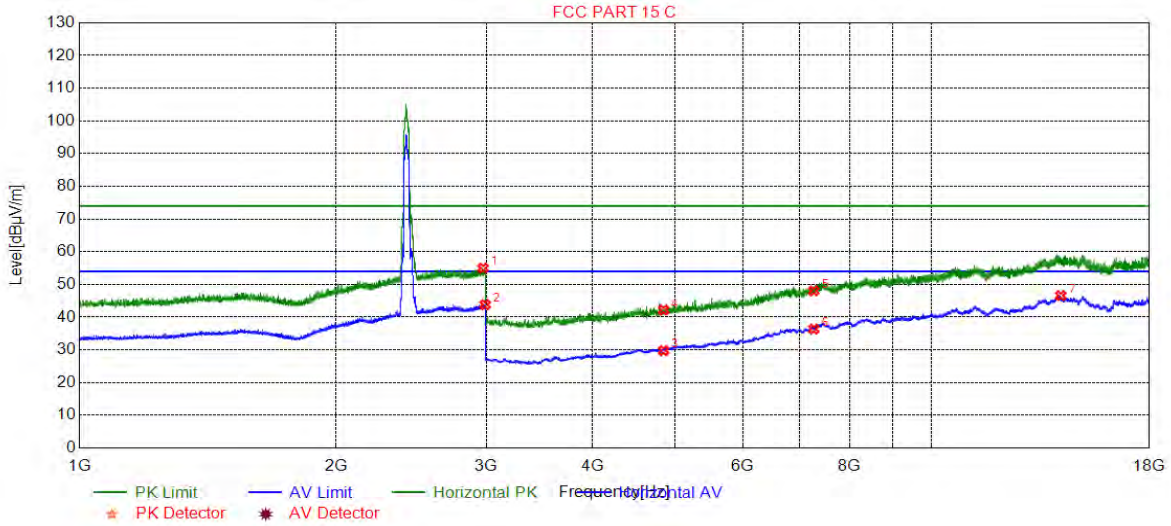
4.9.2.19 802.11N40_Channel 3

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2973.49	55.00	9.57	74.00	19.00	150	166	Horizontal
2	2990.99	43.83	9.49	54.00	10.17	150	17	Horizontal
3	4844.00	29.79	-18.12	54.00	24.21	150	98	Horizontal
4	4844.00	42.18	-18.12	74.00	31.82	150	16	Horizontal
5	7266.00	48.05	-9.71	74.00	25.95	150	287	Horizontal
6	7266.00	36.37	-9.71	54.00	17.63	150	98	Horizontal
7	14164.1	46.59	2.46	54.00	7.41	150	315	Horizontal

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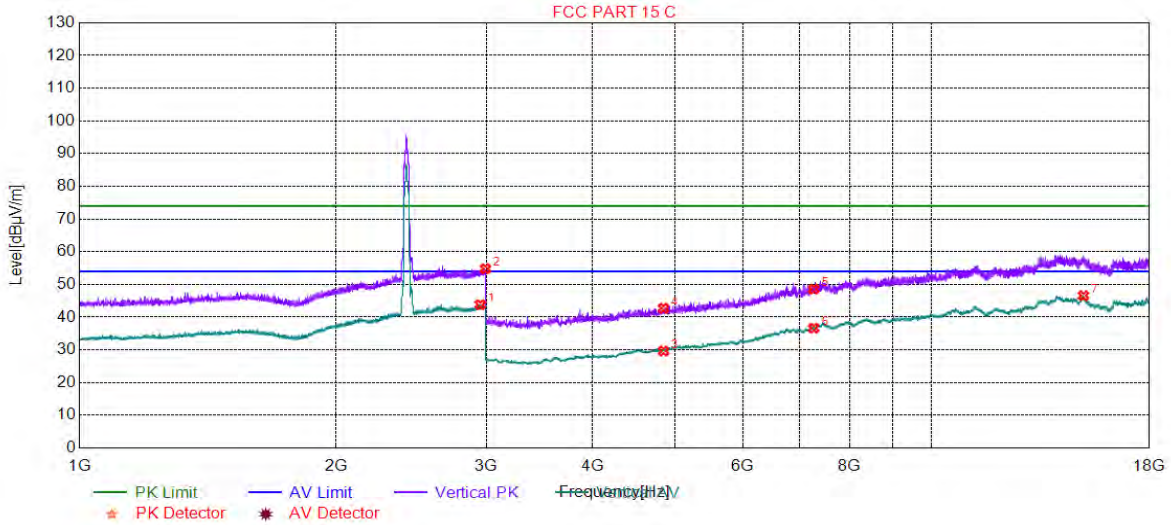
4.9.2.20 802.11N40_Channel 3

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2951.98	43.82	9.67	54.00	10.18	150	304	Vertical
2	2993.99	54.84	9.48	74.00	19.16	150	360	Vertical
3	4844.00	29.66	-18.12	54.00	24.34	150	182	Vertical
4	4844.00	42.75	-18.12	74.00	31.25	150	209	Vertical
5	7266.00	48.57	-9.71	74.00	25.43	150	264	Vertical
6	7266.00	36.64	-9.71	54.00	17.36	150	319	Vertical
7	15059.7	46.57	2.65	54.00	7.43	150	45	Vertical

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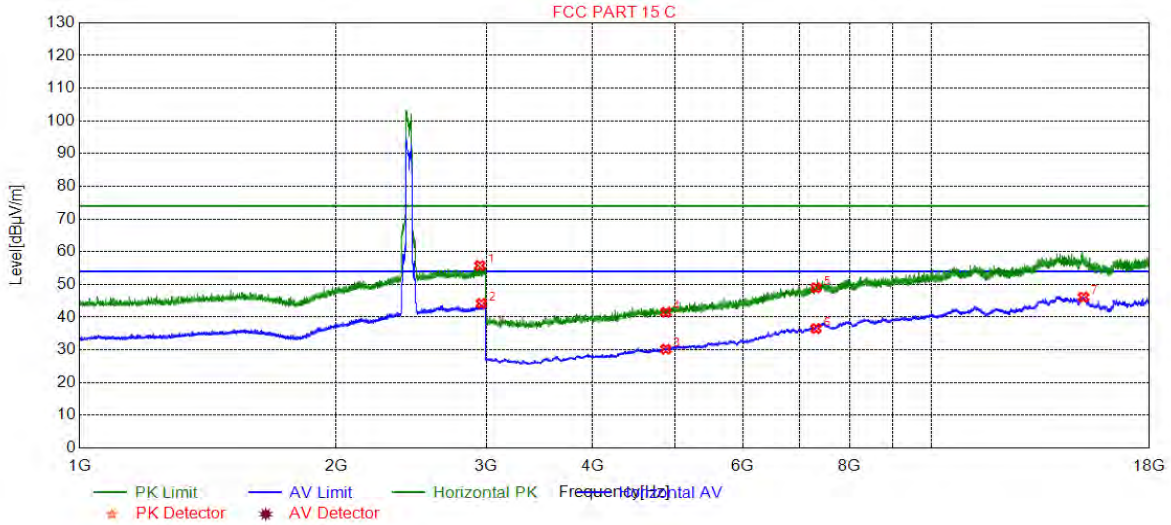
4.9.2.21 802.11N40_Channel 6

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2949.48	55.80	9.67	74.00	18.20	150	110	Horizontal
2	2960.49	44.19	9.63	54.00	9.81	150	15	Horizontal
3	4874.00	30.22	-17.99	54.00	23.78	150	178	Horizontal
4	4874.00	41.49	-17.99	74.00	32.51	150	342	Horizontal
5	7311.00	48.99	-9.59	74.00	25.01	150	14	Horizontal
6	7311.00	36.52	-9.59	54.00	17.48	150	342	Horizontal
7	15062.7	46.13	2.66	54.00	7.87	150	96	Horizontal

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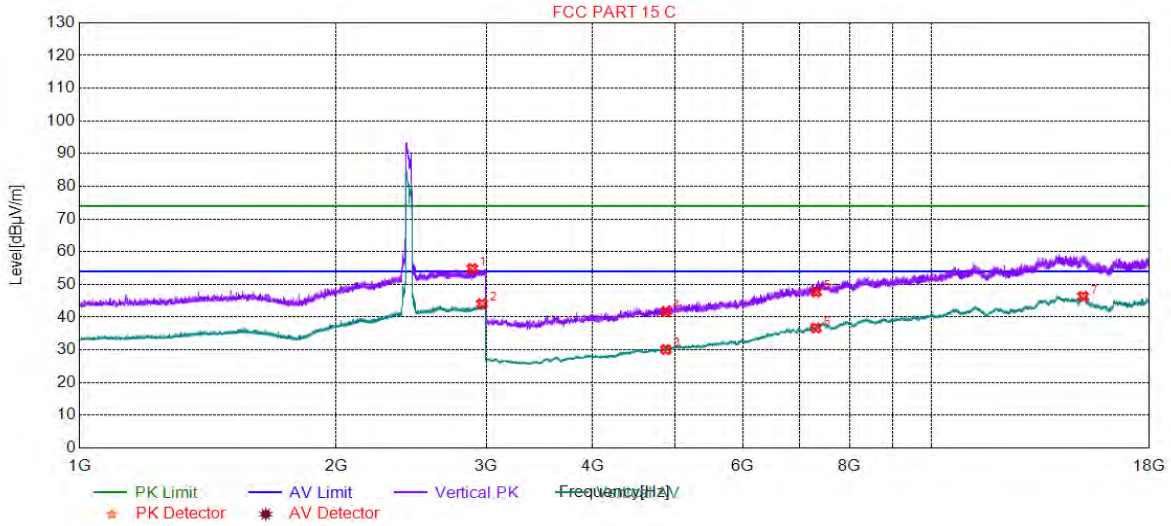
4.9.2.22 802.11N40_Channel 6

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2889.47	54.87	9.16	74.00	19.13	150	276	Vertical
2	2966.49	44.09	9.60	54.00	9.91	150	71	Vertical
3	4874.00	30.09	-17.99	54.00	23.91	150	262	Vertical
4	4874.00	41.76	-17.99	74.00	32.24	150	45	Vertical
5	7311.00	47.72	-9.59	74.00	26.28	150	262	Vertical
6	7311.00	36.70	-9.59	54.00	17.30	150	72	Vertical
7	15046.2	46.36	2.63	54.00	7.64	150	180	Vertical

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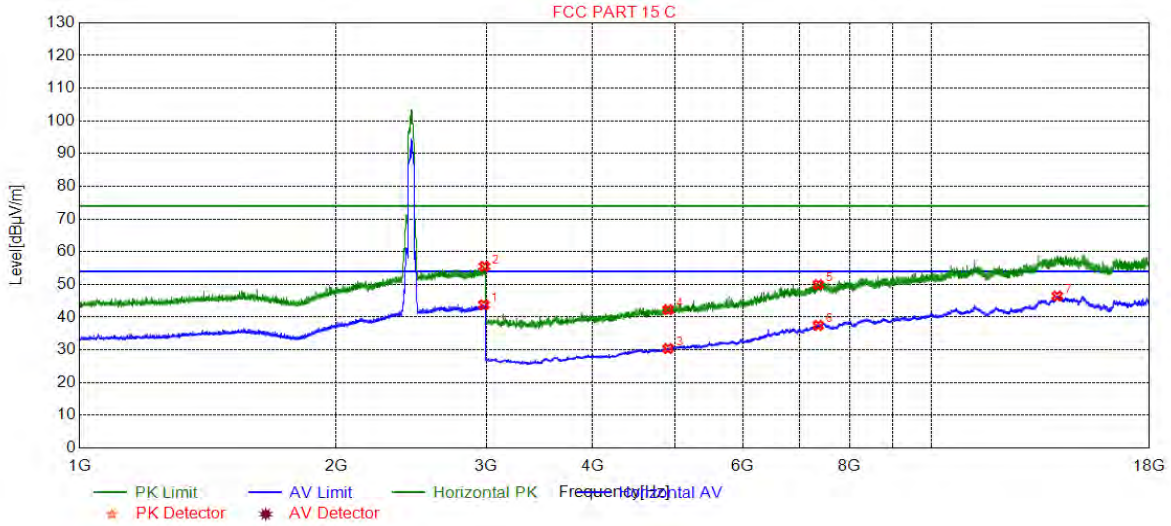
4.9.2.23 802.11N40_Channel 9

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2980.99	43.80	9.54	54.00	10.20	150	301	Horizontal
2	2985.49	55.53	9.52	74.00	18.47	150	192	Horizontal
3	4904.00	30.41	-17.84	54.00	23.59	150	234	Horizontal
4	4904.00	42.28	-17.84	74.00	31.72	150	43	Horizontal
5	7356.00	49.95	-9.36	74.00	24.05	150	0	Horizontal
6	7356.00	37.49	-9.36	54.00	16.51	150	261	Horizontal
7	14029.1	46.47	2.45	54.00	7.53	150	234	Horizontal

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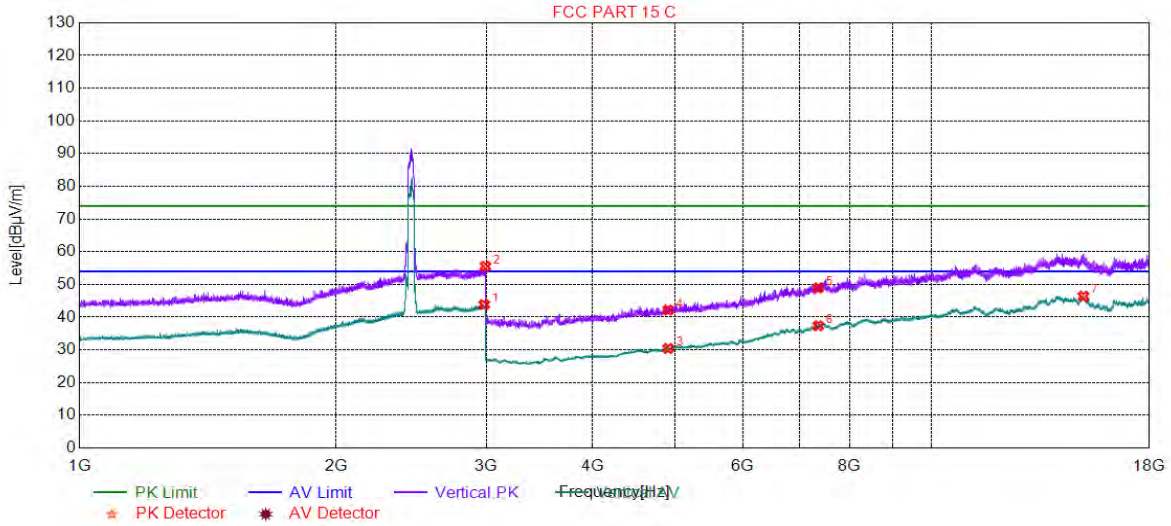
4.9.2.24 802.11N40_Channel 9

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2983.49	43.87	9.53	54.00	10.13	150	113	Vertical
2	2992.99	55.58	9.48	74.00	18.42	150	127	Vertical
3	4904.00	30.43	-17.84	54.00	23.57	150	45	Vertical
4	4904.00	42.18	-17.84	74.00	31.82	150	182	Vertical
5	7356.00	48.96	-9.36	74.00	25.04	150	345	Vertical
6	7356.00	37.39	-9.36	54.00	16.61	150	100	Vertical
7	15059.7	46.39	2.65	54.00	7.61	150	73	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:			

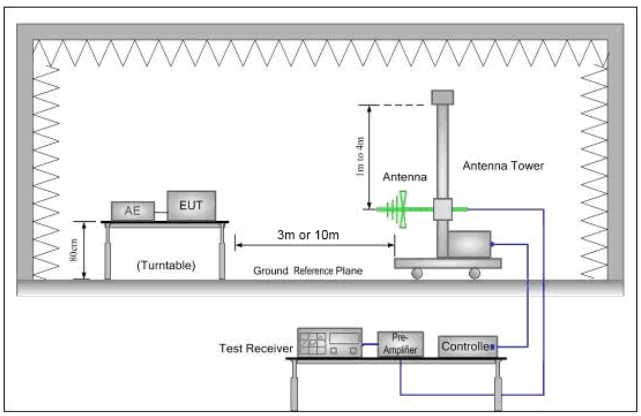

Figure 1. 30MHz to 1GHz

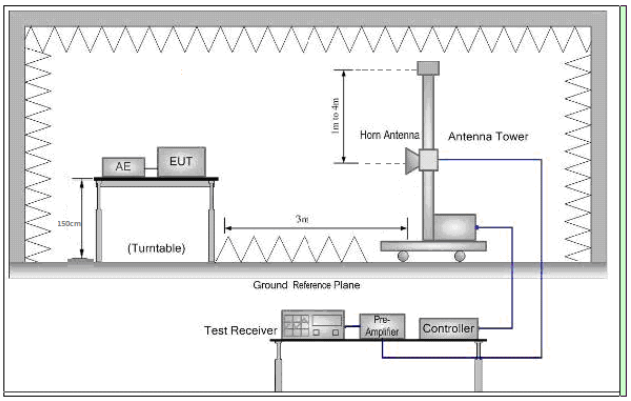

Figure 2. Above 1 GHz

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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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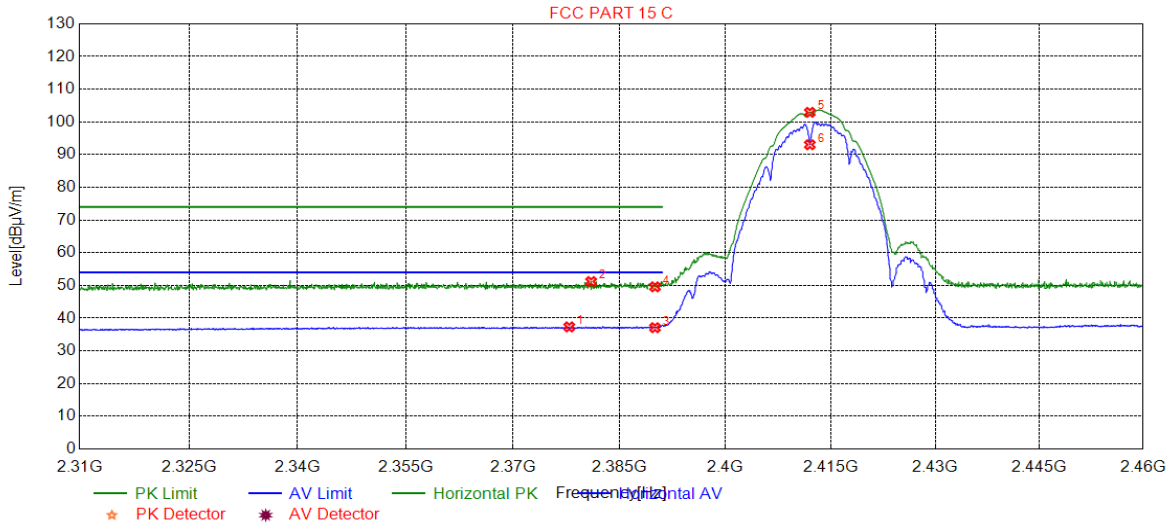
Test plot as follows:

4.10.1 Test plots

4.10.1.1 ANT1

4.10.1.1.1 802.11B_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	2377.90	37.34	7.78	54.00	16.66	150	74	Horizontal
2	2380.98	51.21	7.78	74.00	22.79	150	74	Horizontal
3	2390.00	37.10	7.77	54.00	16.90	150	301	Horizontal
4	2390.00	49.59	7.77	74.00	24.41	150	57	Horizontal
5	2412.00	102.94	7.81	0.00	-102.94	150	234	Horizontal
6	2412.00	93.03	7.81	0.00	-93.03	150	234	Horizontal

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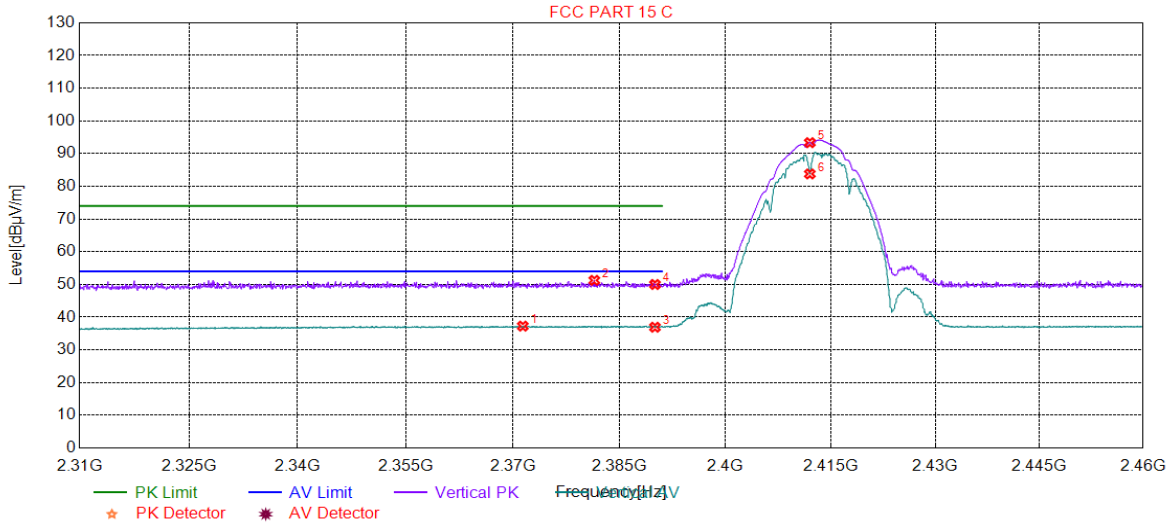
4.10.1.1.2 802.11B_Channel 1

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2371.38	37.27	7.79	54.00	16.73	150	222	Vertical
2	2381.43	51.27	7.78	74.00	22.73	150	238	Vertical
3	2390.00	36.94	7.77	54.00	17.06	150	108	Vertical
4	2390.00	50.00	7.77	74.00	24.00	150	189	Vertical
5	2412.00	93.36	7.81	0.00	-93.36	150	330	Vertical
6	2412.00	83.80	7.81	0.00	-83.80	150	330	Vertical

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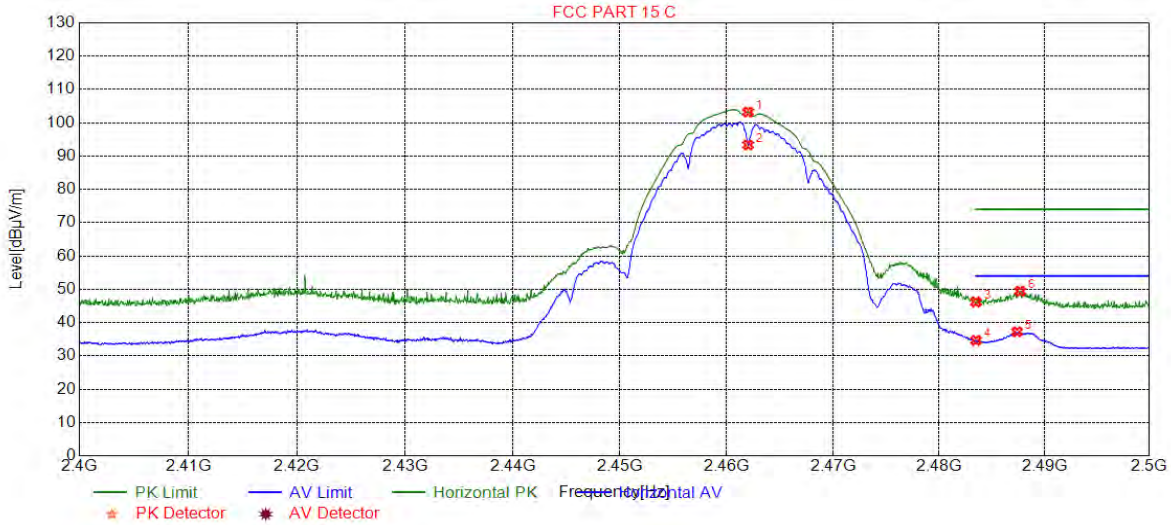
4.10.1.1.3 802.11B_Channel 11

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	103.24	7.98	0.00	-103.24	150	78	Horizontal
2	2462.00	93.35	7.98	0.00	-93.35	150	78	Horizontal
3	2483.50	46.22	8.01	74.00	27.78	150	116	Horizontal
4	2483.50	34.68	8.01	54.00	19.32	150	116	Horizontal
5	2487.39	37.26	8.01	54.00	16.74	150	78	Horizontal
6	2487.69	49.47	8.02	74.00	24.53	150	215	Horizontal

Final Data List

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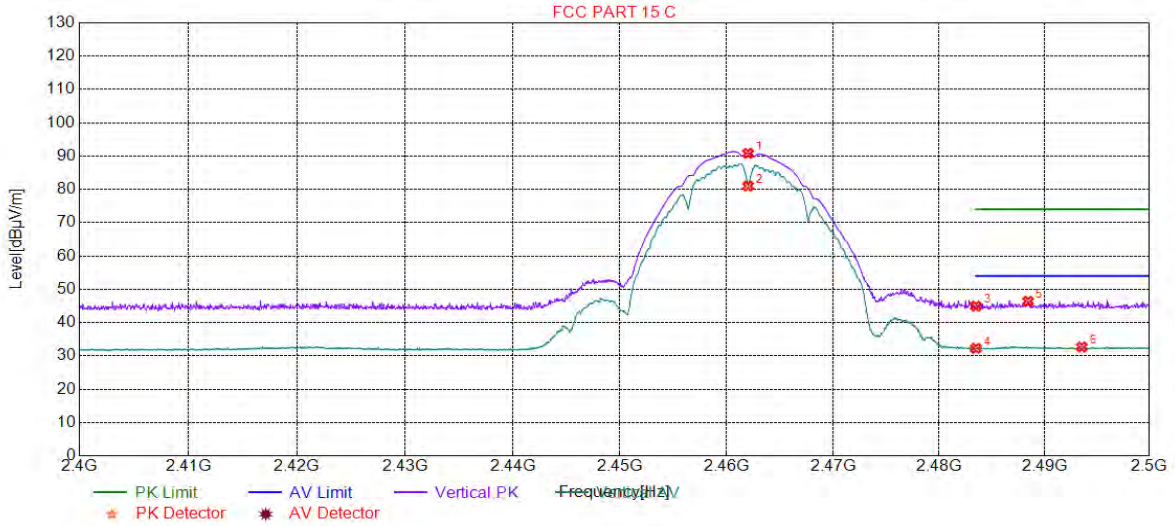
4.10.1.1.4 802.11B_Channel 11

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	90.84	7.98	0.00	-90.84	150	297	Vertical
2	2462.00	81.03	7.98	0.00	-81.03	150	55	Vertical
3	2483.50	44.96	8.01	74.00	29.04	150	88	Vertical
4	2483.50	32.31	8.01	54.00	21.69	150	286	Vertical
5	2488.44	46.43	8.02	74.00	27.57	150	346	Vertical
6	2493.54	32.71	8.02	54.00	21.29	150	149	Vertical

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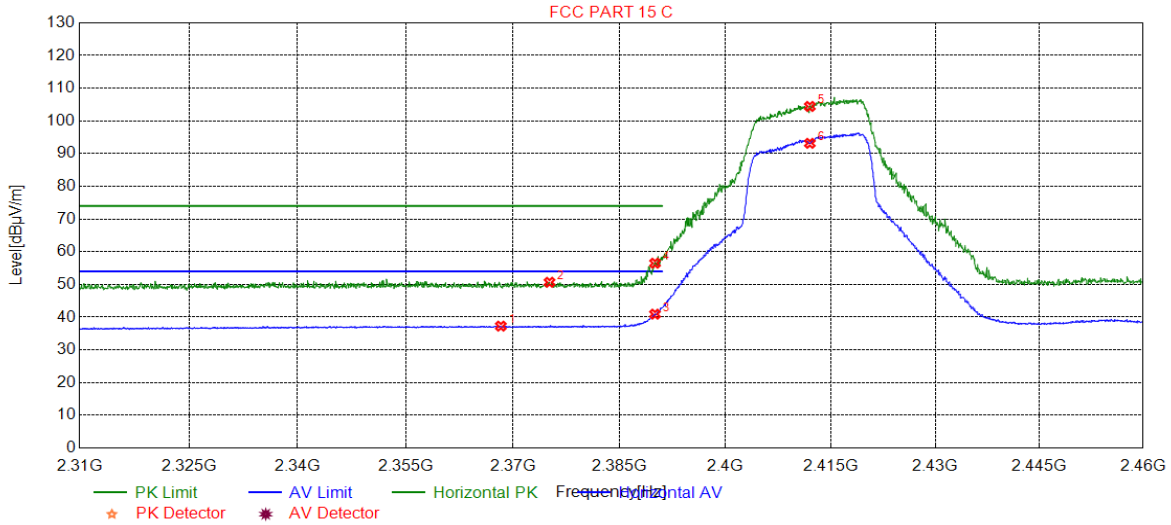
4.10.1.1.5 802.11G_Channel 1

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2368.30	37.27	7.79	54.00	16.73	150	329	Horizontal
2	2375.13	50.68	7.78	74.00	23.32	150	214	Horizontal
3	2390.00	40.93	7.77	54.00	13.07	150	78	Horizontal
4	2390.00	56.51	7.77	74.00	17.49	150	122	Horizontal
5	2412.00	104.44	7.81	0.00	-104.44	150	78	Horizontal
6	2412.00	93.16	7.81	0.00	-93.16	150	72	Horizontal

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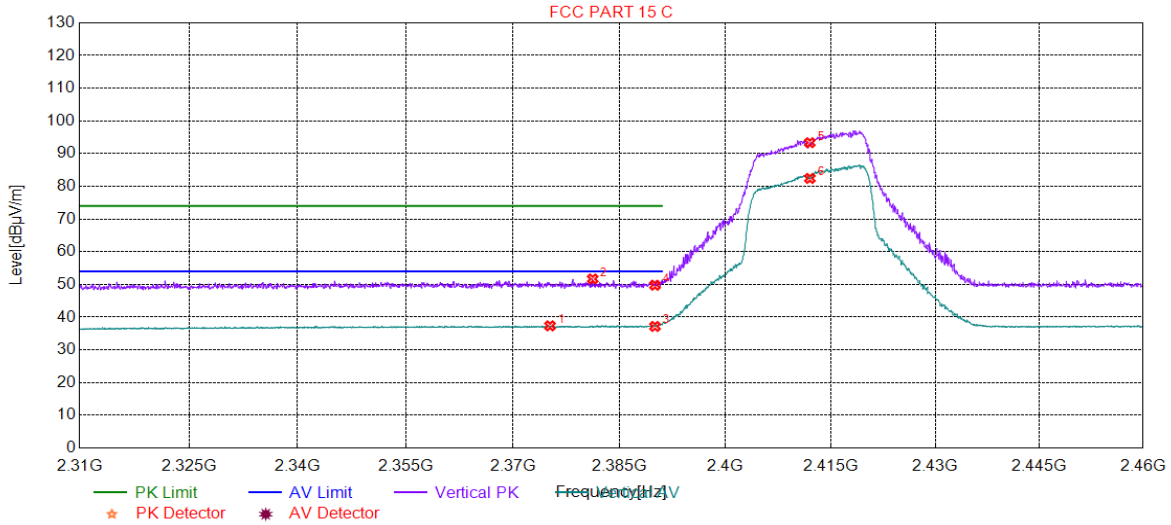
4.10.1.1.6 802.11G_Channel 1

Test Graph



Suspected List

Suspected List								
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1	2375.20	37.36	7.78	54.00	16.64	150	297	Vertical
2	2381.21	51.70	7.78	74.00	22.30	150	102	Vertical
3	2390.00	37.17	7.77	54.00	16.83	150	341	Vertical
4	2390.00	49.78	7.77	74.00	24.22	150	25	Vertical
5	2412.00	93.35	7.81	0.00	-93.35	150	336	Vertical
6	2412.00	82.43	7.81	0.00	-82.43	150	341	Vertical

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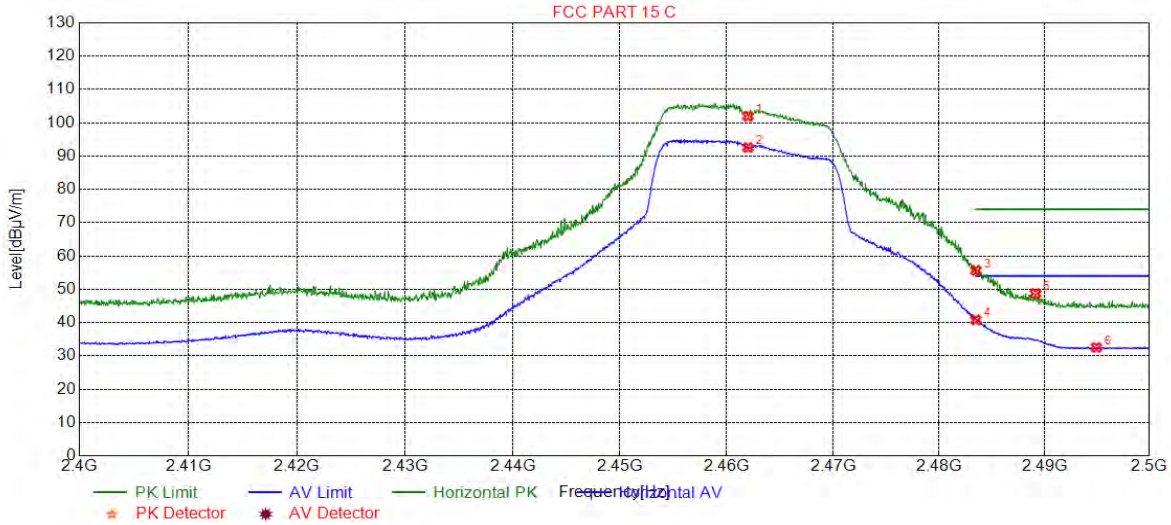
4.10.1.1.7 802.11G_Channel 11

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	101.92	7.98	0.00	-101.92	150	79	Horizontal
2	2462.00	92.54	7.98	0.00	-92.54	150	74	Horizontal
3	2483.50	55.69	8.01	74.00	18.31	150	85	Horizontal
4	2483.50	40.83	8.01	54.00	13.17	150	79	Horizontal
5	2489.14	48.72	8.02	74.00	25.28	150	218	Horizontal
6	2494.94	32.58	8.02	54.00	21.42	150	63	Horizontal

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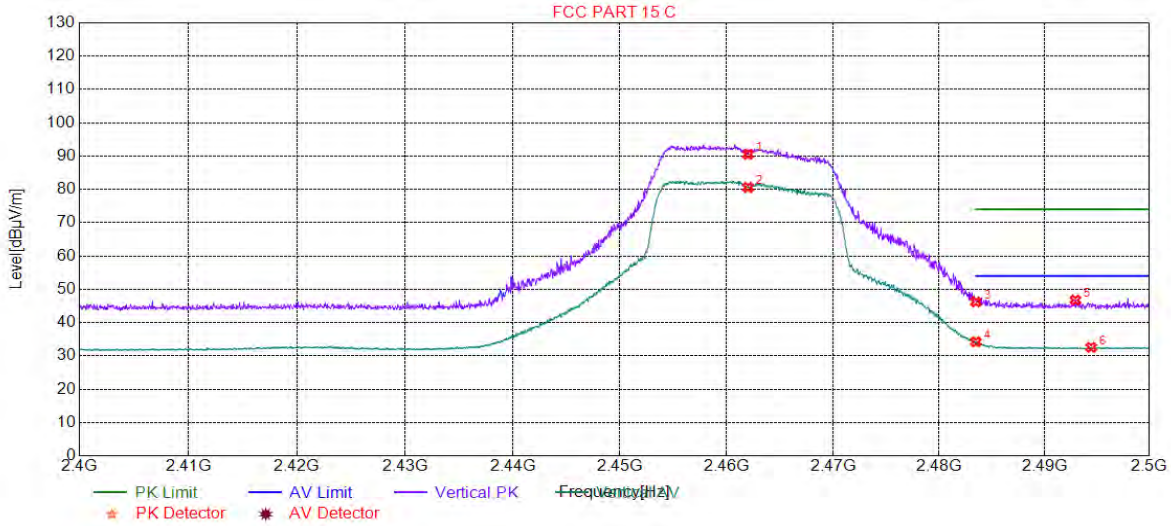
4.10.1.1.8 802.11G_Channel 11

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	90.53	7.98	0.00	-90.53	150	298	Vertical
2	2462.00	80.60	7.98	0.00	-80.60	150	319	Vertical
3	2483.50	46.25	8.01	74.00	27.75	150	330	Vertical
4	2483.50	34.24	8.01	54.00	19.76	150	330	Vertical
5	2492.94	46.78	8.02	74.00	27.22	150	336	Vertical
6	2494.44	32.60	8.02	54.00	21.40	150	105	Vertical

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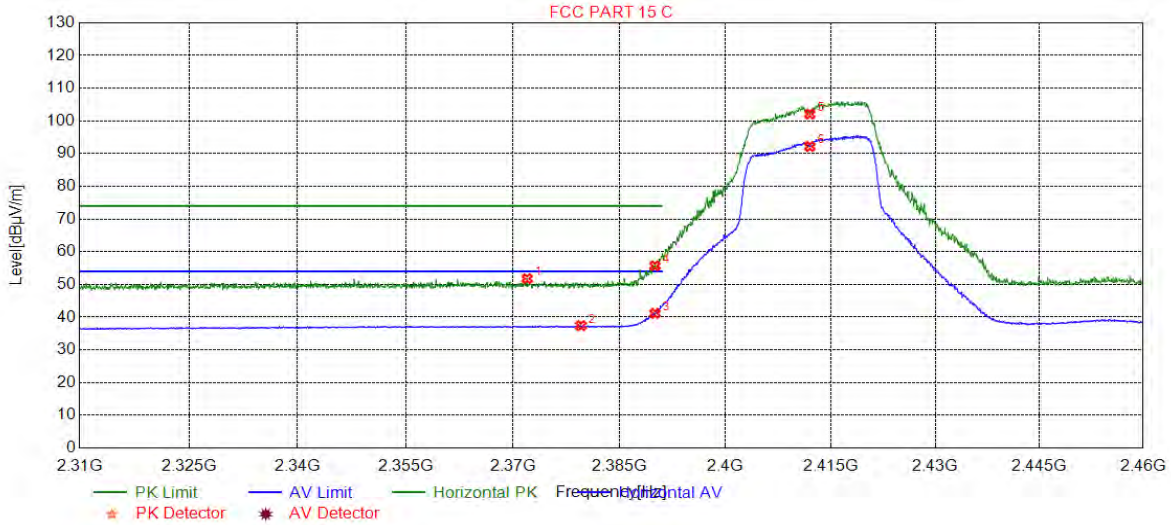
4.10.1.1.9 802.11N20_Channel 1

Test Graph



Suspected List

Suspected List								
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1	2371.98	51.79	7.79	74.00	22.21	150	322	Horizontal
2	2379.55	37.41	7.78	54.00	16.59	150	69	Horizontal
3	2390.00	41.17	7.77	54.00	12.83	150	218	Horizontal
4	2390.00	55.72	7.77	74.00	18.28	150	85	Horizontal
5	2412.00	102.12	7.81	0.00	-102.12	150	69	Horizontal
6	2412.00	92.17	7.81	0.00	-92.17	150	74	Horizontal

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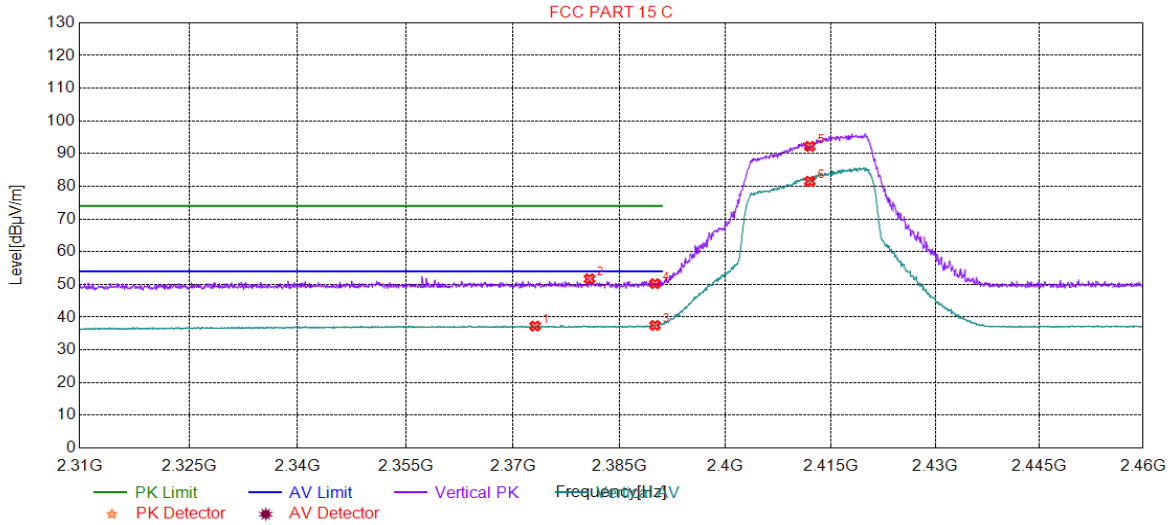
4.10.1.1.10 802.11N20_Channel 1

Test Graph



Suspected List

Suspected List								
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1	2373.10	37.29	7.79	54.00	16.71	150	176	Vertical
2	2380.76	51.73	7.78	74.00	22.27	150	193	Vertical
3	2390.00	37.48	7.77	54.00	16.52	150	341	Vertical
4	2390.00	50.25	7.77	74.00	23.75	150	82	Vertical
5	2412.00	92.22	7.81	0.00	-92.22	150	336	Vertical
6	2412.00	81.56	7.81	0.00	-81.56	150	341	Vertical

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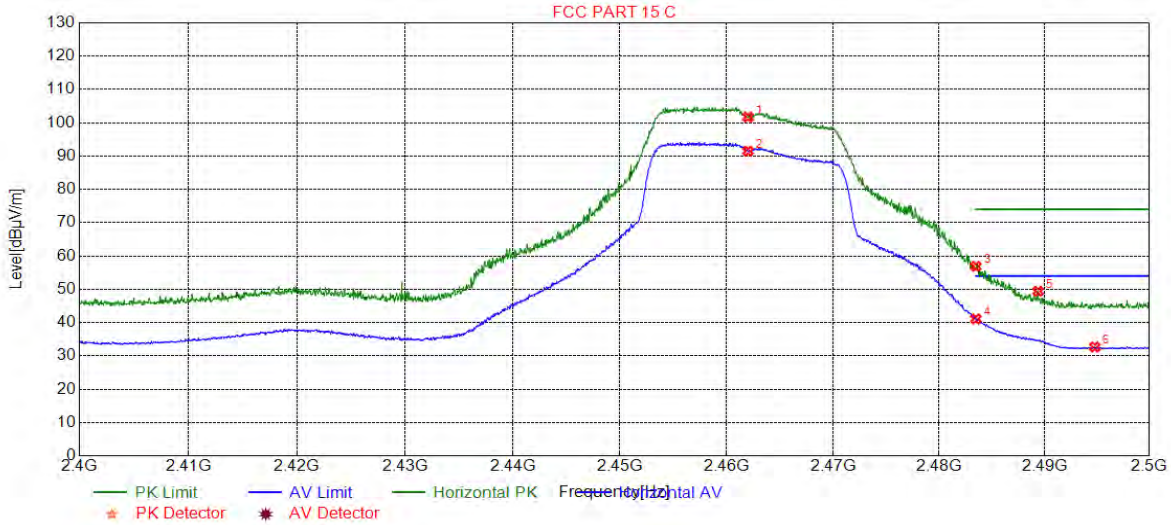
4.10.1.1.11 802.11N20_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	101.72	7.98	0.00	-101.72	150	75	Horizontal
2	2462.00	91.48	7.98	0.00	-91.48	150	75	Horizontal
3	2483.50	56.89	8.01	74.00	17.11	150	210	Horizontal
4	2483.50	41.12	8.01	54.00	12.88	150	114	Horizontal
5	2489.39	49.41	8.02	74.00	24.59	150	199	Horizontal
6	2494.79	32.72	8.02	54.00	21.28	150	114	Horizontal

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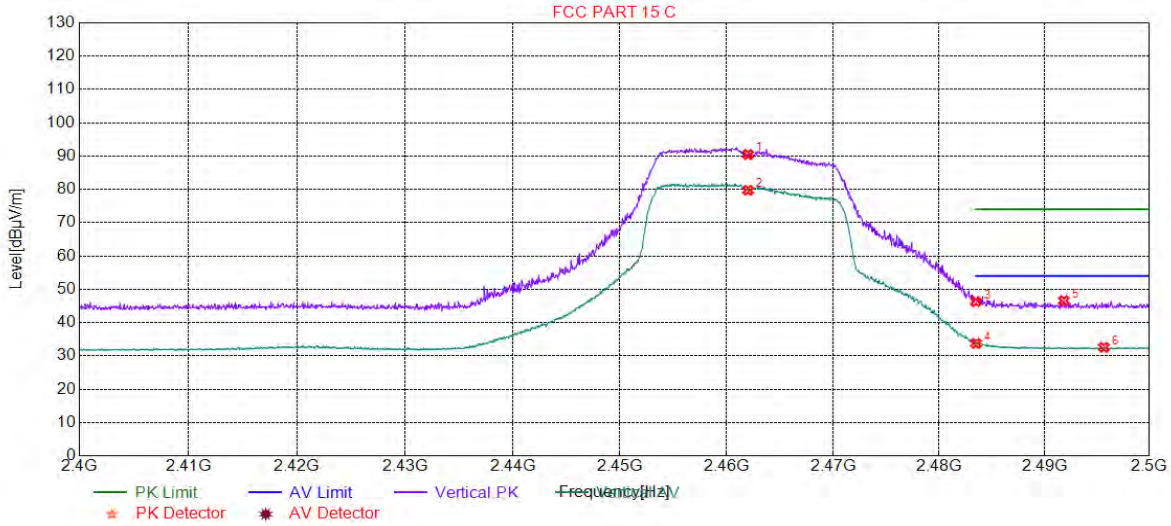
4.10.1.1.12 802.11N20_Channel 11

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	90.47	7.98	0.00	-90.47	150	318	Vertical
2	2462.00	79.74	7.98	0.00	-79.74	150	318	Vertical
3	2483.50	46.30	8.01	74.00	27.70	150	24	Vertical
4	2483.50	33.78	8.01	54.00	20.22	150	24	Vertical
5	2491.84	46.63	8.02	74.00	27.37	150	290	Vertical
6	2495.64	32.61	8.02	54.00	21.39	150	225	Vertical

Final Data List

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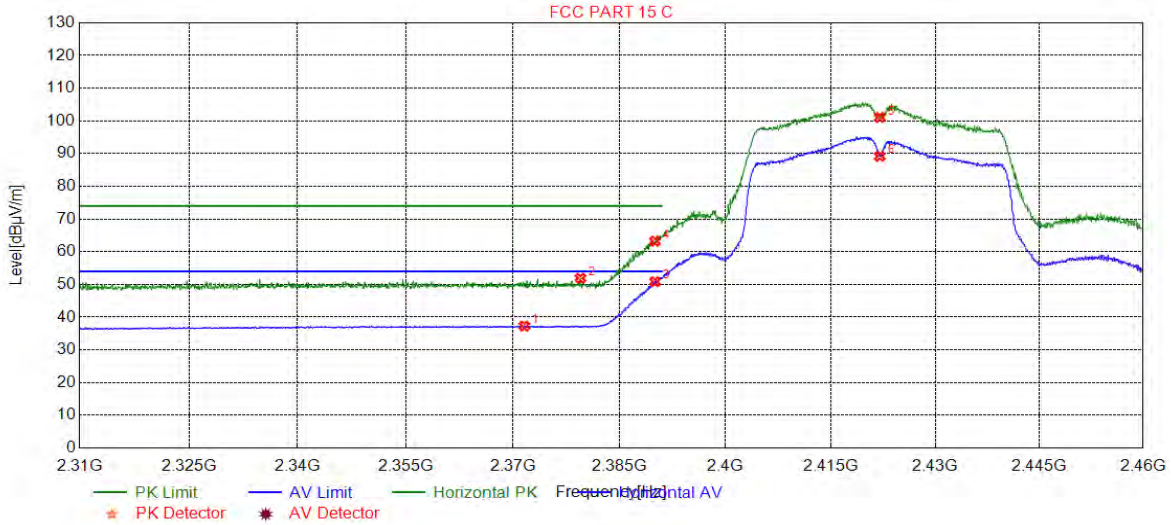
4.10.1.1.13 802.11N40_Channel 3

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2371.60	37.30	7.79	54.00	16.70	150	15	Horizontal
2	2379.48	51.92	7.78	74.00	22.08	150	261	Horizontal
3	2390.00	50.84	7.77	54.00	3.16	150	75	Horizontal
4	2390.00	63.23	7.77	74.00	10.77	150	107	Horizontal
5	2422.00	101.07	7.85	0.00	-101.07	150	113	Horizontal
6	2422.00	89.20	7.85	0.00	-89.20	150	69	Horizontal

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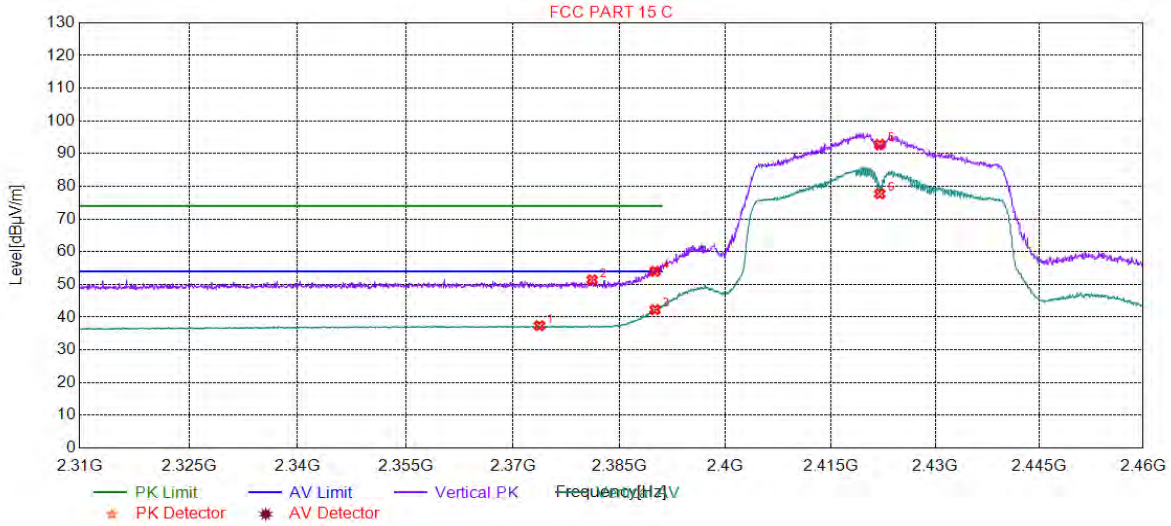
4.10.1.1.14 802.11N40_Channel 3

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2373.70	37.40	7.79	54.00	16.60	150	14	Vertical
2	2381.13	51.42	7.78	74.00	22.58	150	222	Vertical
3	2390.00	42.29	7.77	54.00	11.71	150	336	Vertical
4	2390.00	54.02	7.77	74.00	19.98	150	320	Vertical
5	2422.00	92.83	7.85	0.00	-92.83	150	342	Vertical
6	2422.00	77.73	7.85	0.00	-77.73	150	348	Vertical

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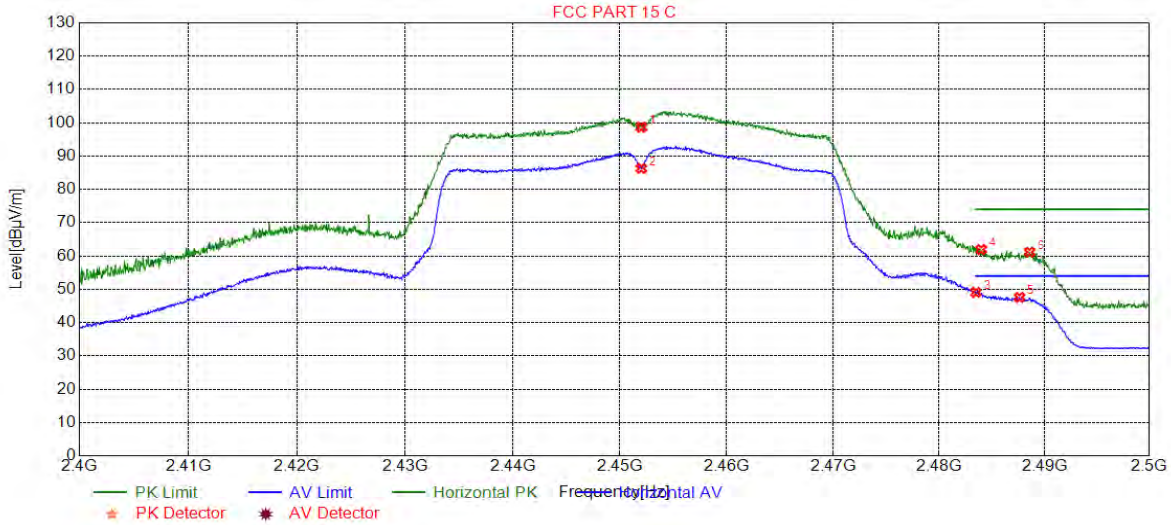
4.10.1.1.15 802.11N40_Channel 9

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2452.00	98.66	7.97	0.00	-98.66	150	67	Horizontal
2	2452.00	86.30	7.97	0.00	-86.30	150	78	Horizontal
3	2483.50	49.11	8.01	54.00	4.89	150	216	Horizontal
4	2483.99	61.95	8.01	74.00	12.05	150	210	Horizontal
5	2487.64	47.59	8.02	54.00	6.41	150	117	Horizontal
6	2488.59	61.19	8.02	74.00	12.81	150	111	Horizontal

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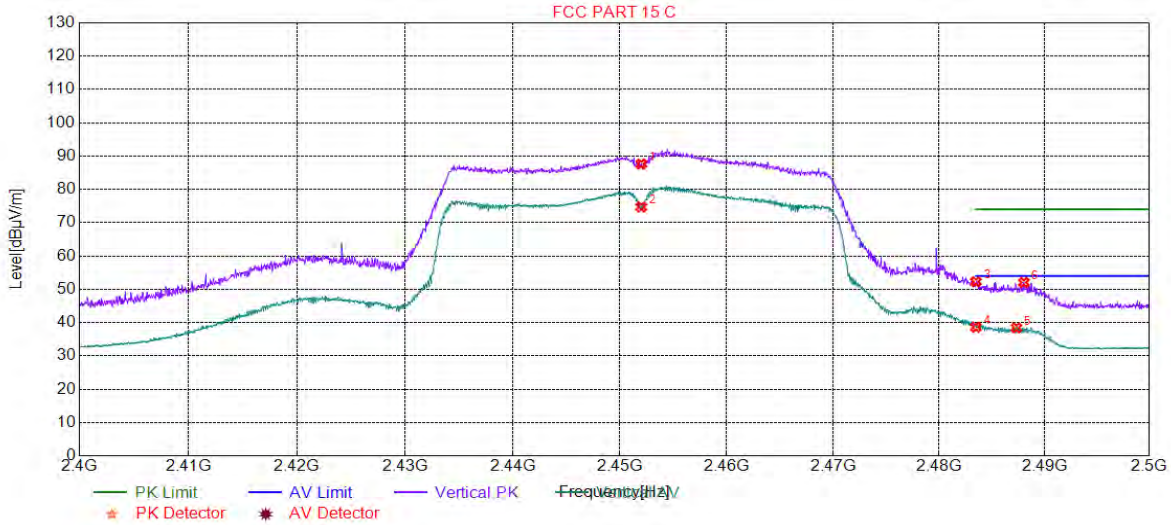
4.10.1.1.16 802.11N40_Channel 9

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2452.00	87.65	7.97	0.00	-87.65	150	340	Vertical
2	2452.00	74.74	7.97	0.00	-74.74	150	14	Vertical
3	2483.50	52.29	8.01	74.00	21.71	150	24	Vertical
4	2483.50	38.64	8.01	54.00	15.36	150	24	Vertical
5	2487.34	38.45	8.01	54.00	15.55	150	24	Vertical
6	2488.04	52.07	8.02	74.00	21.93	150	62	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	2023/7/14
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 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

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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	e3V8.2014-6-27	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 Technologies 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	2017/10/17	2020/10/16
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 Technologies	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 Technologies	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

7 Photographs - EUT Constructional Details

Refer to Appendix A - Photographs of Set-Up for ZR/2020/90037.

The End

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