FCC TEST REPORT

Application No:	HR/2019/50006
Applicant:	Quectel Wireless Solutions Co., Ltd.
Address of Applicant	7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China
Manufacturer:	Quectel Wireless Solutions Co., Ltd.
Address of Manufacturer	7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China
Factory:	Quectel Wireless Solutions Co., Ltd.
Address of Factory	7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China
EUT Description:	LTE Module
Model No.:	SC600Y-NA, SC600T-NA
Trade Mark:	Quectel
FCC ID:	XMR2019SC600NA
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:	2019/5/29
Date of Test:	2019/5/30 to 2019/7/3
Date of Issue:	2019/7/3
Test Result:	**PASS ***

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

Derek Yang
Wireless Laboratory Manager

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1 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
00		2019/7/3		Original

Authorized for issue by:				
Tested By		Mike Hu **(Mike Hu) /Project Engineer**		2019/7/3 **Date**
Checked By		David Chen **(David Chen) /Reviewer**		2019/7/3 **Date**

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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

Remark:
The difference between SC600Y-NA and SC600T-NA showed as following:
SC600Y-NA and SC600T-NA are all LTE modules. They share the same software & hardware design（the chip component is pin-for-pin compatible；have the same basic function；no change in radio parameters has occurred.）. The difference is on chipset with different CPU frequency. The Chipset SDM450 is a de-rated version of the MSM8953. We hereby state that two models are identical in interior structure and components.

The detail is shown as following table.

Module	Chipset	frequency
SC600T-NA	Qualcomm MSM8953	2.0GHz
SC600Y-NA	Qualcomm SDM450	1.8GHz

According to the difference above, all the test were performed on SC600T-NA, and spot check the worst case Conducted power and RSE on SC600Y-NA, the conducted and RSE data shown in the report is the worst data.. and other data of SC600Y-NA can refer to SC600T-NA.

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3 General Information

3.1 Client Information

Applicant:	Quectel Wireless Solutions Co., Ltd.
Address of Applicant:	7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China
Manufacturer:	Quectel Wireless Solutions Co., Ltd.
Address of Manufacturer:	7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China
Factory:	Quectel Wireless Solutions Co., Ltd.
Address of Factory:	7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China

3.2 Test Location

Company:	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
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3.3 Test Facility

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

• CNAS (No. CNAS L2929)

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 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::	LTE Module
Model No.:	SC600Y-NA, SC600T-NA
Trade Mark:	Quectel
Hardware Version:	R1.0
Software Version:	SC600YNAPAR05A02
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:	5.0dBi
Power Supply	☒ AC/DC Adapter; ☐ Battery ☐ PoE:; ☐ Other:

Operation Frequency of each channel (802.11B/G/N HT20)							
Channel	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**
1	2412MHz	4	2427MHz	7	2442MHz	10	2457MHz
2	2417MHz	5	2432MHz	8	2447MHz	11	2462MHz
3	2422MHz	6	2437MHz	9	2452MHz		

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 5.0dBi.	

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4.2 AC Power Line Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207		
Test Method:	ANSI C63.10: 2013		
Test Frequency Range:	150kHz to 30MHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
	* Decreases with the logarithm of the frequency.		
Test Procedure:	1) The mains terminal disturbance voltage test was conducted in a shielded room. 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded. 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2. 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.		

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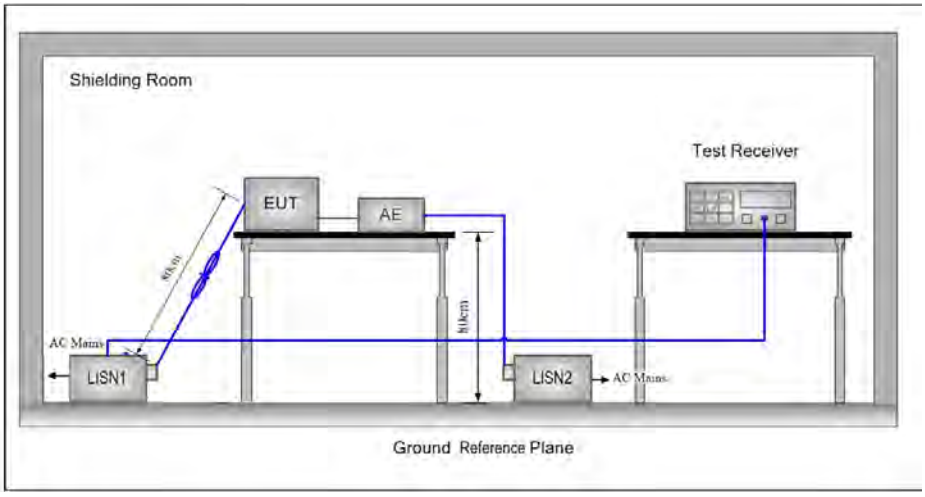
Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates at lowest, middle and highest channel. Charge + Transmitting mode.
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate of 802.11B at lowest channel is the worst case. Charge + Transmitting mode. Only the worst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

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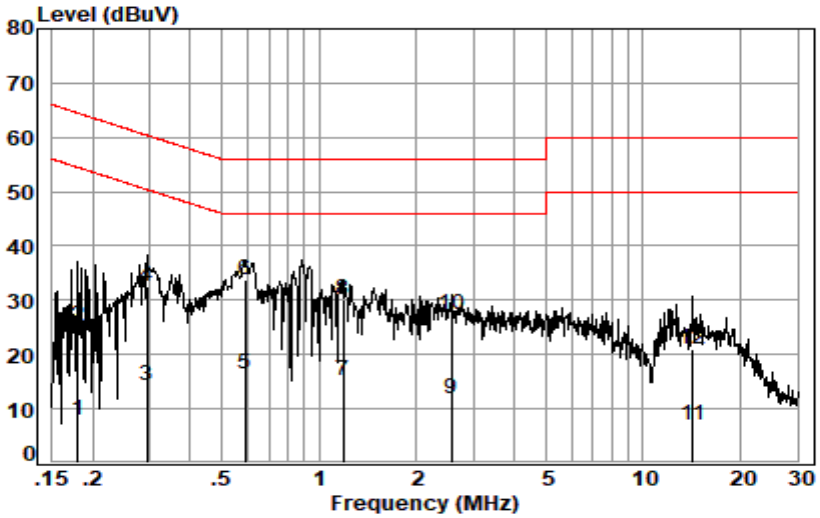
Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Live Line:



Site : Shielding Room
Condition: Line
Job No. : 15593CR
Test mode: d

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1806	0.02	9.66	-1.71	7.97	54.46	-46.49	Average
2	0.1806	0.02	9.66	15.42	25.10	64.46	-39.36	QP
3	0.2940	0.04	9.67	4.53	14.24	50.41	-36.17	Average
4	0.2940	0.04	9.67	22.91	32.62	60.41	-27.79	QP
5	0.5916	0.07	9.67	6.80	16.54	46.00	-29.46	Average
6	0.5916	0.07	9.67	24.07	33.81	56.00	-22.19	QP
7	1.1907	0.11	9.73	5.41	15.25	46.00	-30.75	Average
8	1.1907	0.11	9.73	20.29	30.13	56.00	-25.87	QP
9	2.5671	0.16	9.71	1.96	11.83	46.00	-34.17	Average
10	2.5671	0.16	9.71	17.38	27.25	56.00	-28.75	QP
11	14.2882	0.21	10.29	-3.60	6.90	50.00	-43.10	Average
12	14.2882	0.21	10.29	10.52	21.02	60.00	-38.98	QP

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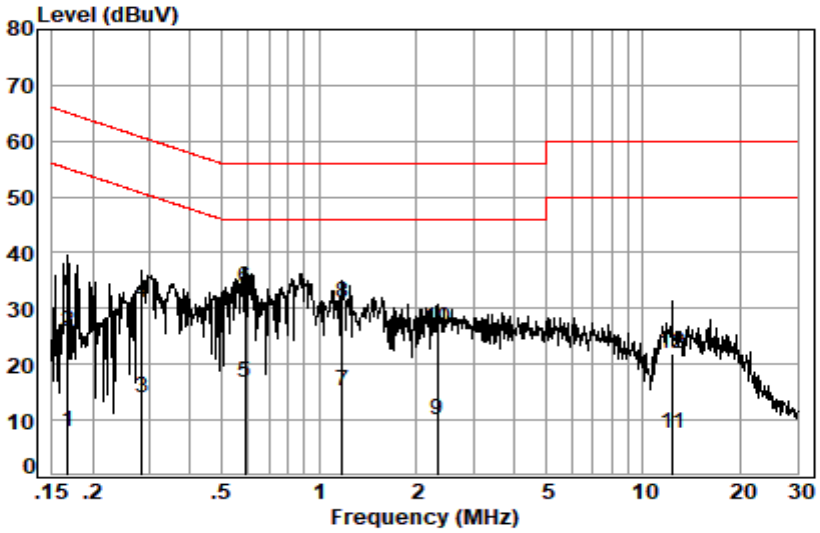
Neutral Line:



Site : Shielding Room
Condition: Neutral
Job No. : 15593CR
Test mode: d

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1677	0.01	9.64	-1.88	7.77	55.08	-47.31	Average
2	0.1677	0.01	9.64	16.08	25.73	65.08	-39.35	QP
3	0.2848	0.04	9.64	4.24	13.92	50.68	-36.76	Average
4	0.2848	0.04	9.64	21.46	31.14	60.68	-29.54	QP
5	0.5916	0.07	9.64	7.05	16.76	46.00	-29.24	Average
6	0.5916	0.07	9.64	24.05	33.76	56.00	-22.24	QP
7	1.1781	0.11	9.70	5.38	15.19	46.00	-30.81	Average
8	1.1781	0.11	9.70	21.10	30.91	56.00	-25.09	QP
9	2.3213	0.16	9.68	0.28	10.12	46.00	-35.88	Average
10	2.3213	0.16	9.68	16.70	26.54	56.00	-29.46	QP
11	12.3182	0.19	10.12	-2.85	7.46	50.00	-42.54	Average
12	12.3182	0.19	10.12	11.64	21.95	60.00	-38.05	QP

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

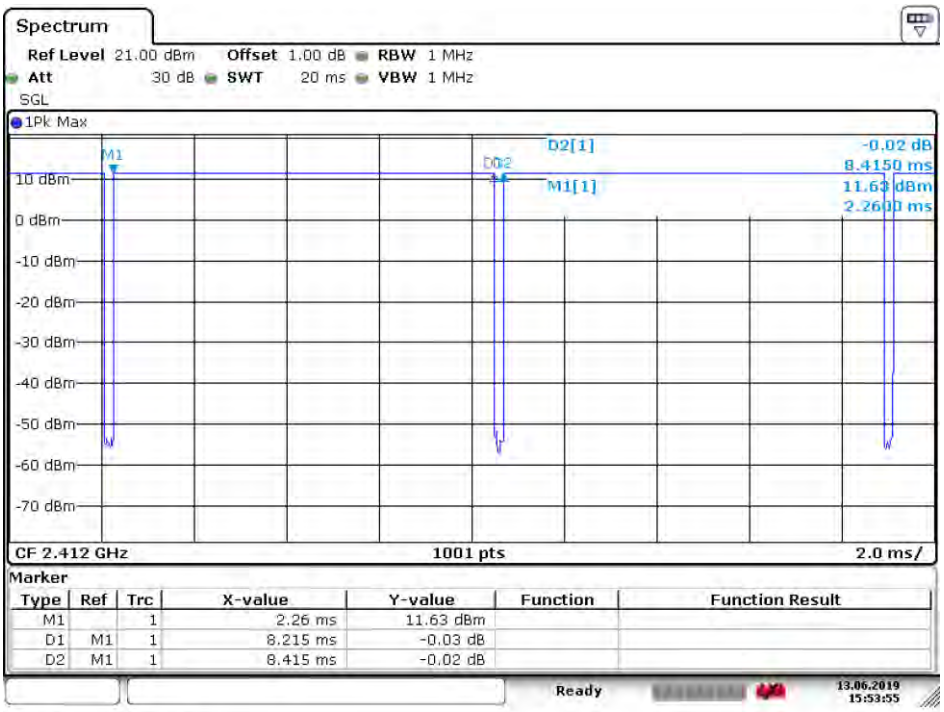
4.3.1 Test Results

Test Mode	TX Freq. [MHz]	Duty cycle [%]
11B	Ant 1: CH1	97.62
11G	Ant 1: CH1	85.99
11N20	Ant 1: CH1	85.81
11N40	Ant 1: CH3	71.26

4.3.1 Test Plots

4.3.1.1 ANT1

4.3.1.1.1 11B



Date: 13.JUN.2019 15:53:55

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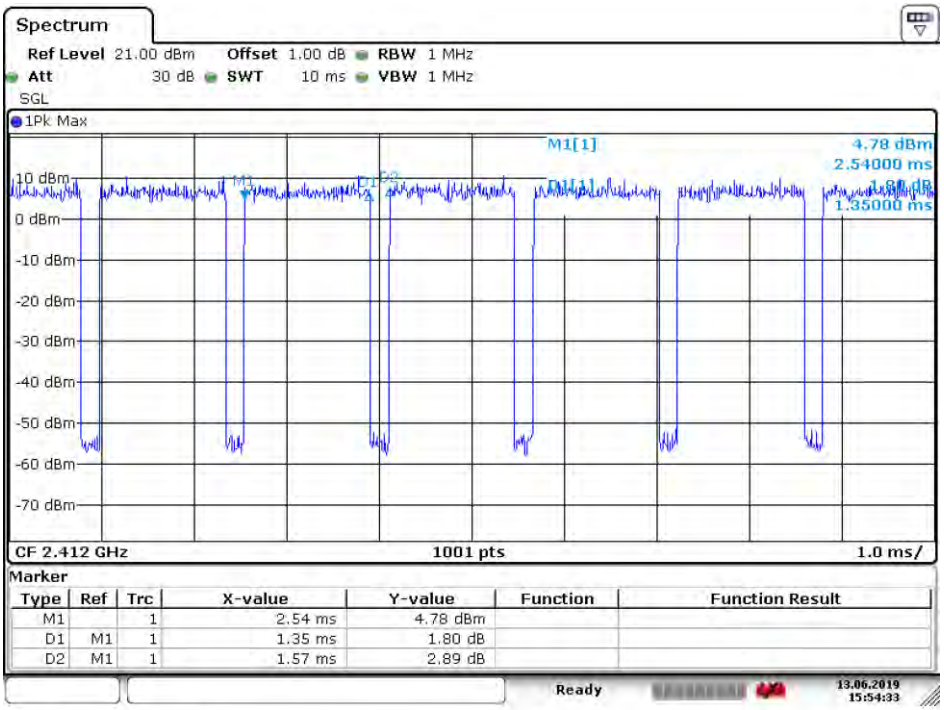
4.3.1.1.2 11G



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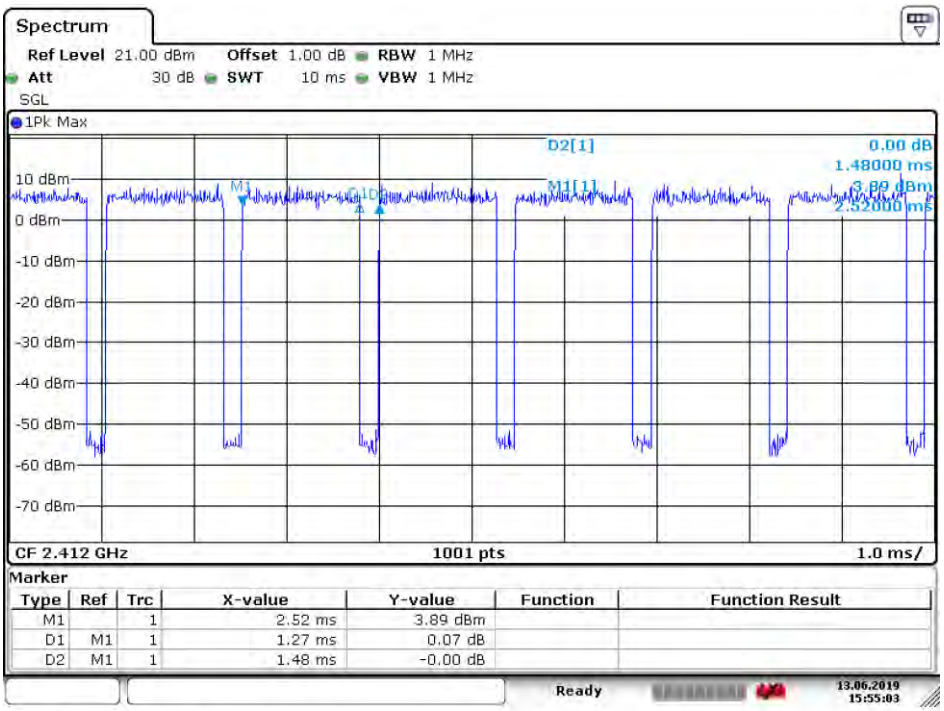
4.3.1.1.3 11N20



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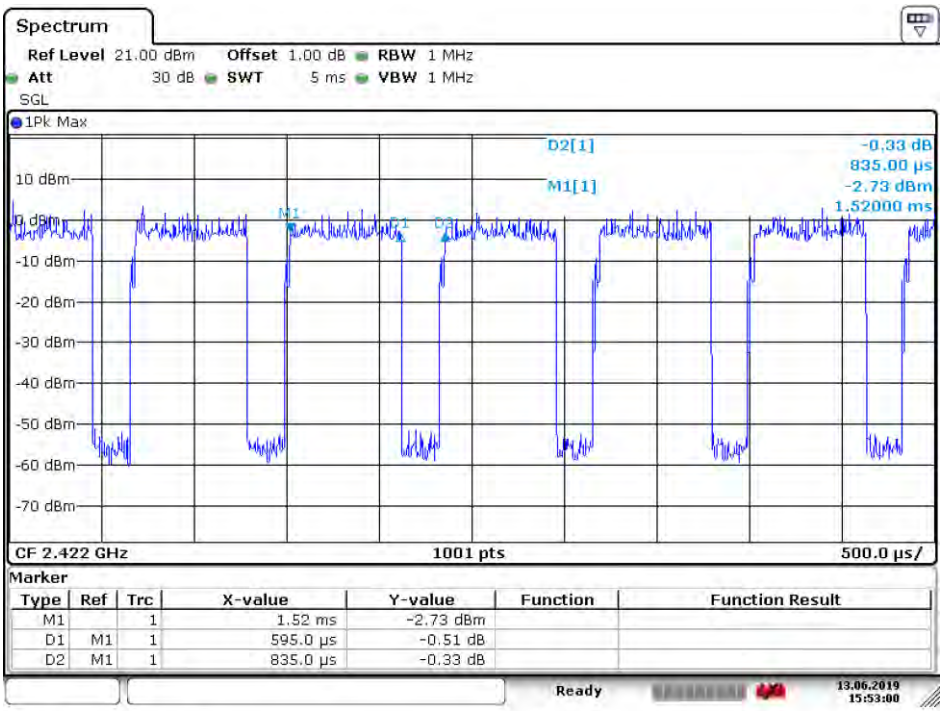
4.3.1.1.4 11N40



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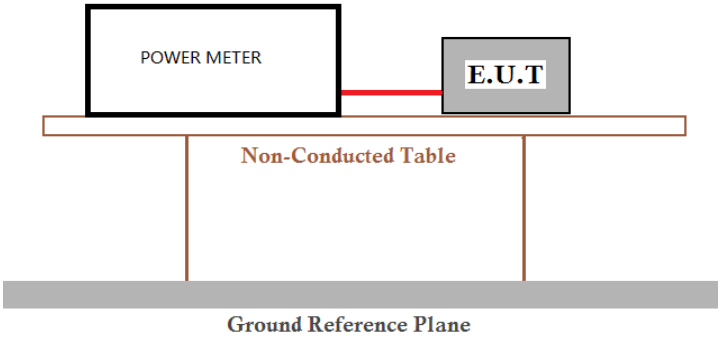
4.4 Conducted Output Power

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 Average Power:

Mode	Test Channel	Average Output Power (dBm)	Result
802.11B	Lowest	17.18	Report purpose only
	Middle	16.65	Report purpose only
	Highest	17.12	Report purpose only
802.11G	Lowest	15.24	Report purpose only
	Middle	14.54	Report purpose only
	Highest	15.03	Report purpose only
802.11N20	Lowest	13.93	Report purpose only
	Middle	13.57	Report purpose only
	Highest	13.65	Report purpose only
802.11N40	Lowest	12.86	Report purpose only
	Middle	12.78	Report purpose only
	Highest	12.19	Report purpose only

Measurement Data of Peak Power:

Mode	Test Channel	Peak Output Power (dBm)	Limit (dBm)	Result
802.11B	Lowest	21.34	30.00	Pass
	Middle	20.55	30.00	Pass
	Highest	21.03	30.00	Pass
802.11G	Lowest	22.99	30.00	Pass
	Middle	22.09	30.00	Pass
	Highest	22.98	30.00	Pass
802.11N20	Lowest	22.07	30.00	Pass
	Middle	21.23	30.00	Pass
	Highest	21.55	30.00	Pass
802.11N40	Lowest	21.25	30.00	Pass
	Middle	21.39	30.00	Pass
	Highest	20.88	30.00	Pass

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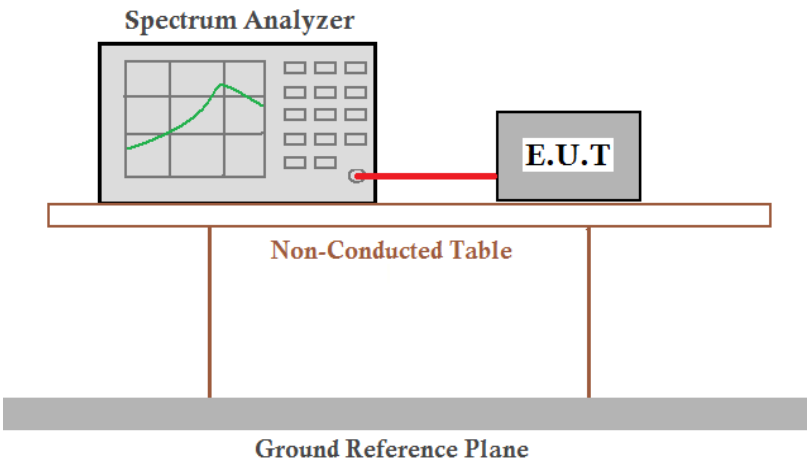
4.5 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth

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

4.5.1 Test Results

Mode	Test Channel	Occupied Bandwidth (MHz)	6dB Emission Bandwidth (MHz)	Limit (kHz)	Result
802.11B	Lowest	12.71	7.15	≥500	Pass
	Middle	12.55	7.59	≥500	Pass
	Highest	12.63	7.15	≥500	Pass
802.11G	Lowest	17.42	16.38	≥500	Pass
	Middle	17.42	16.42	≥500	Pass
	Highest	17.46	16.34	≥500	Pass
802.11N20	Lowest	18.18	17.58	≥500	Pass
	Middle	18.30	17.70	≥500	Pass
	Highest	18.26	17.62	≥500	Pass
802.11N40	Lowest	36.36	35.25	≥500	Pass
	Middle	36.60	35.25	≥500	Pass
	Highest	36.36	35.33	≥500	Pass

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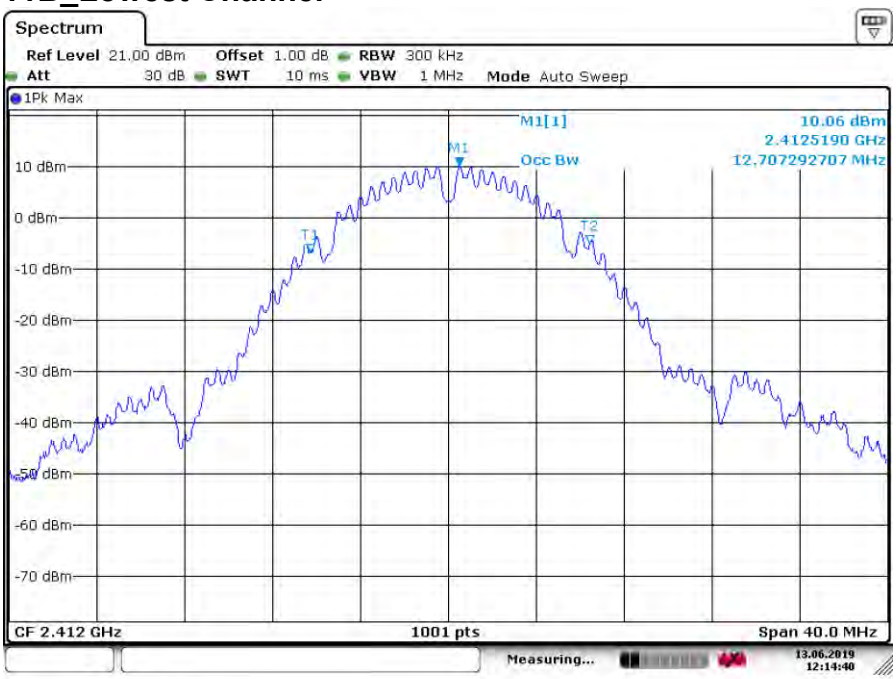
4.5.2 Test plots

4.5.2.1 ANT1

4.5.2.1.1 802.11B_Lowest Channel



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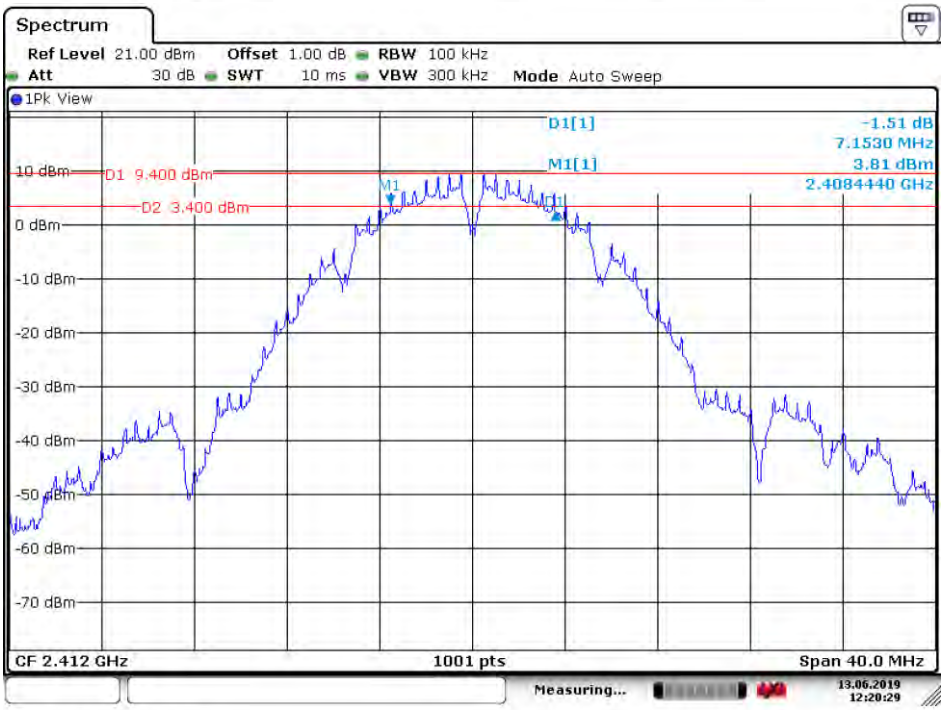

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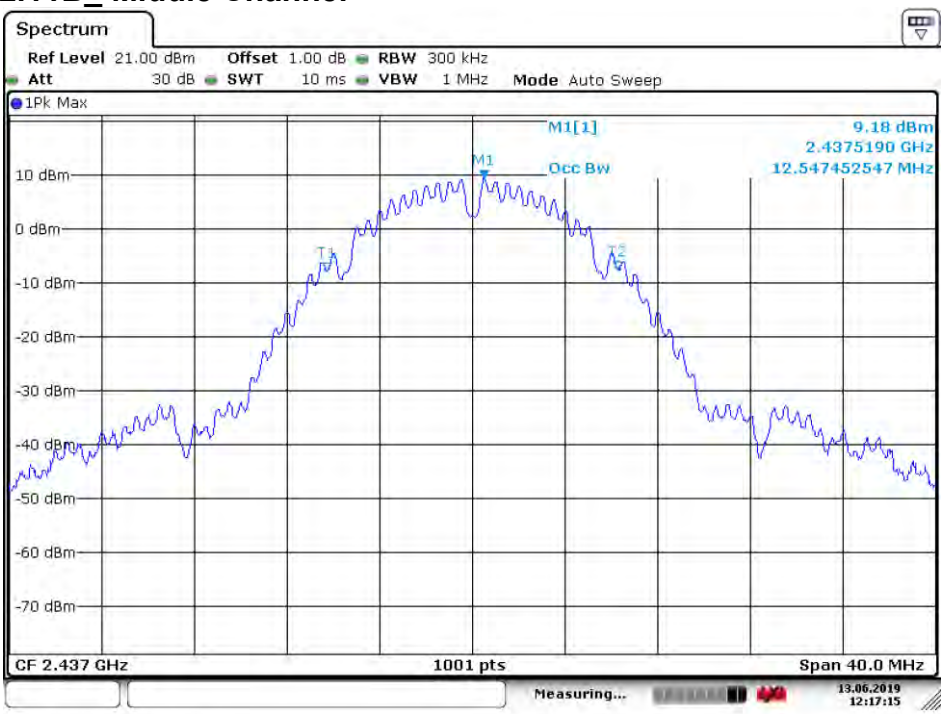
4.5.2.1.2 802.11B_ Middle Channel



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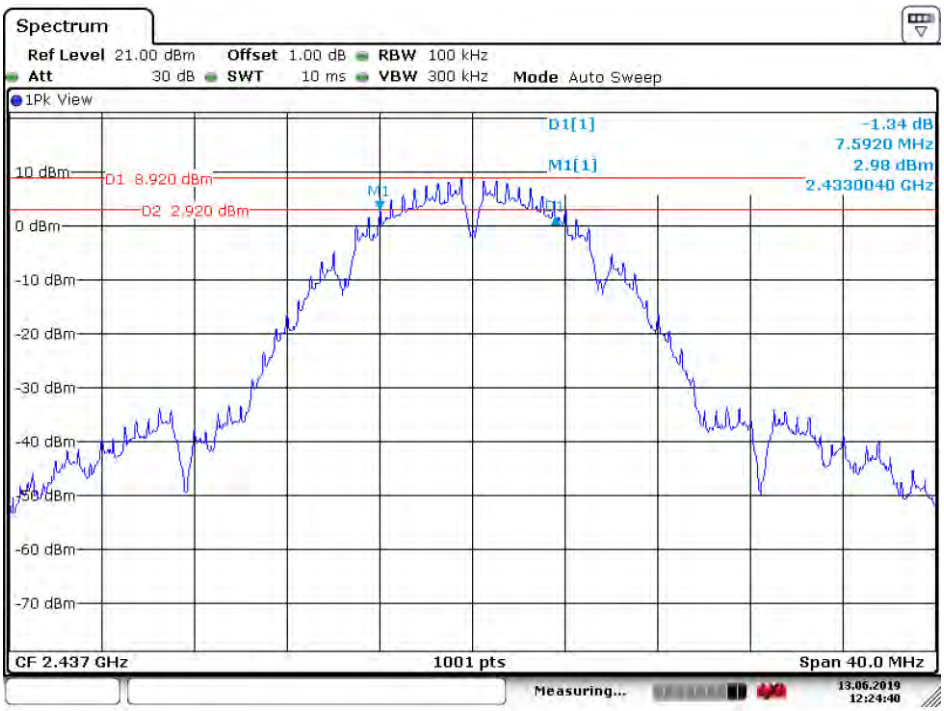

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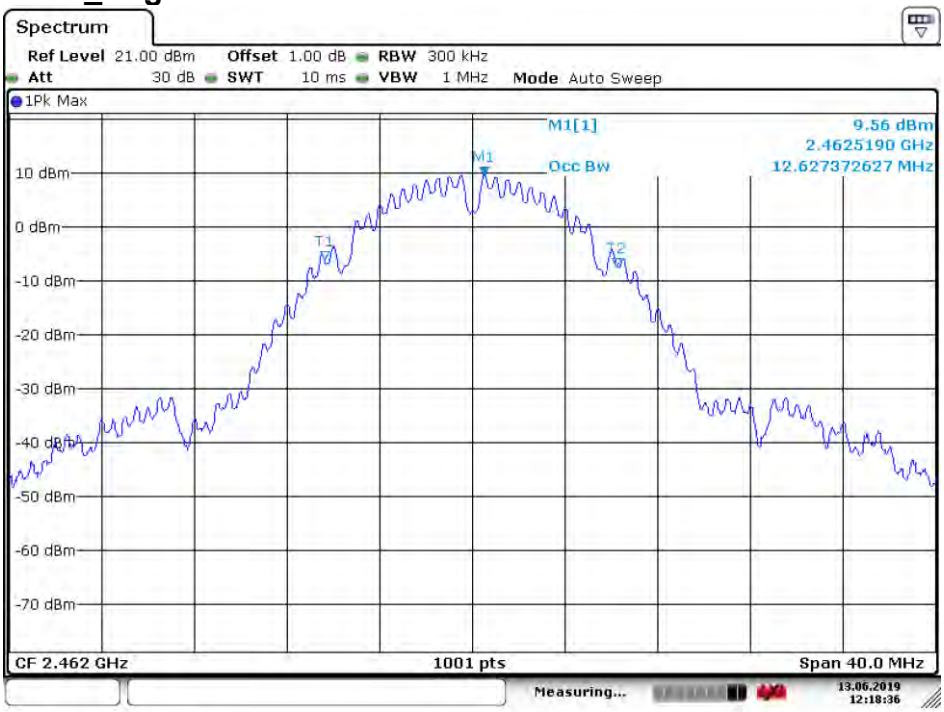
4.5.2.1.3 802.11B_ Highest Channel



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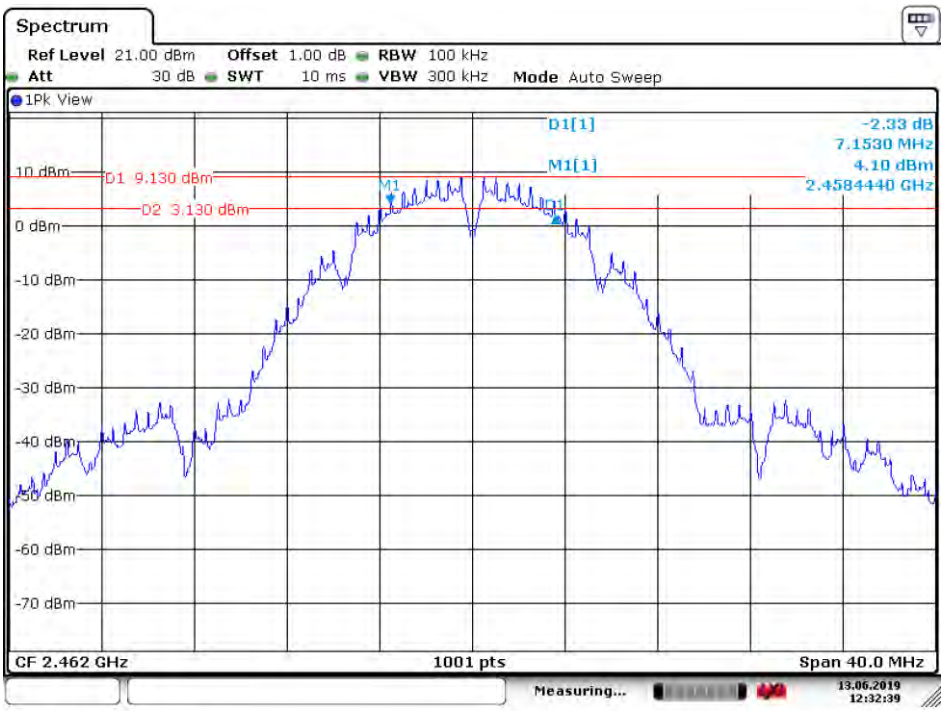

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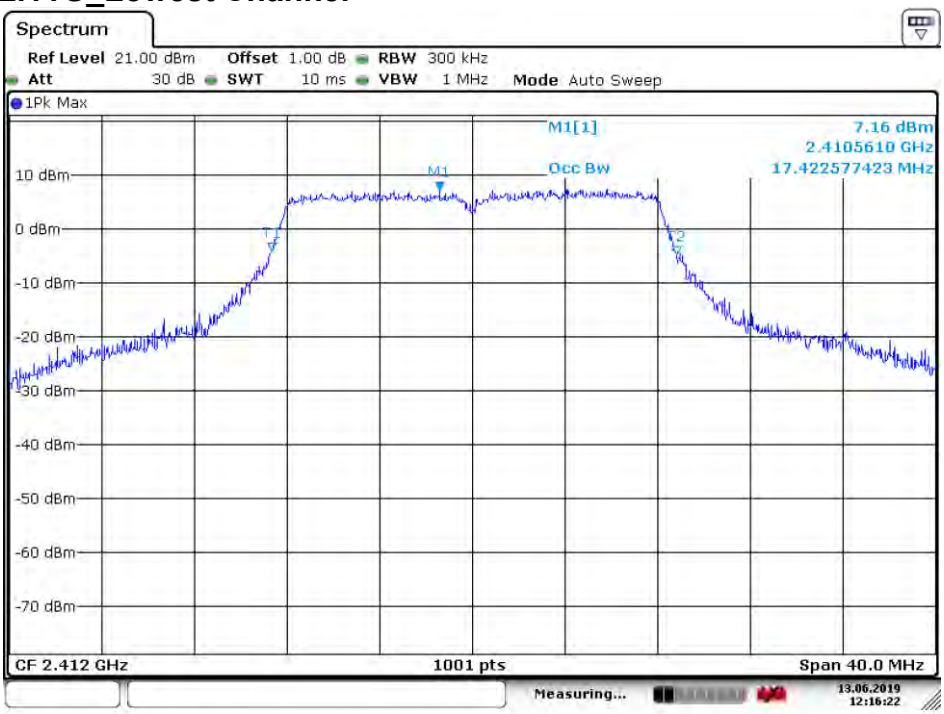
4.5.2.1.4 802.11G_Lowest Channel



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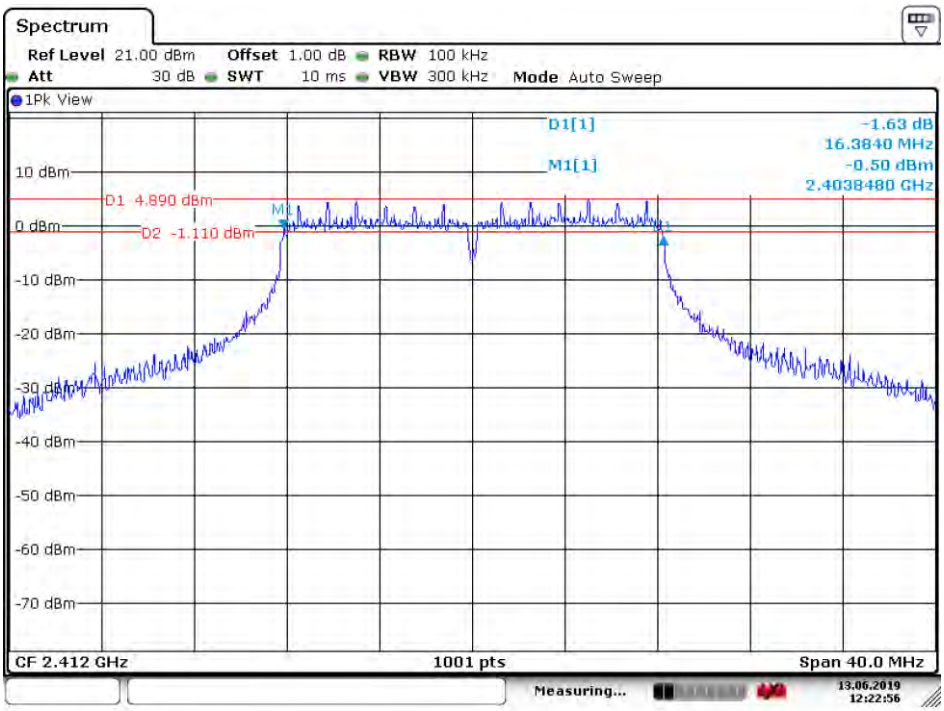

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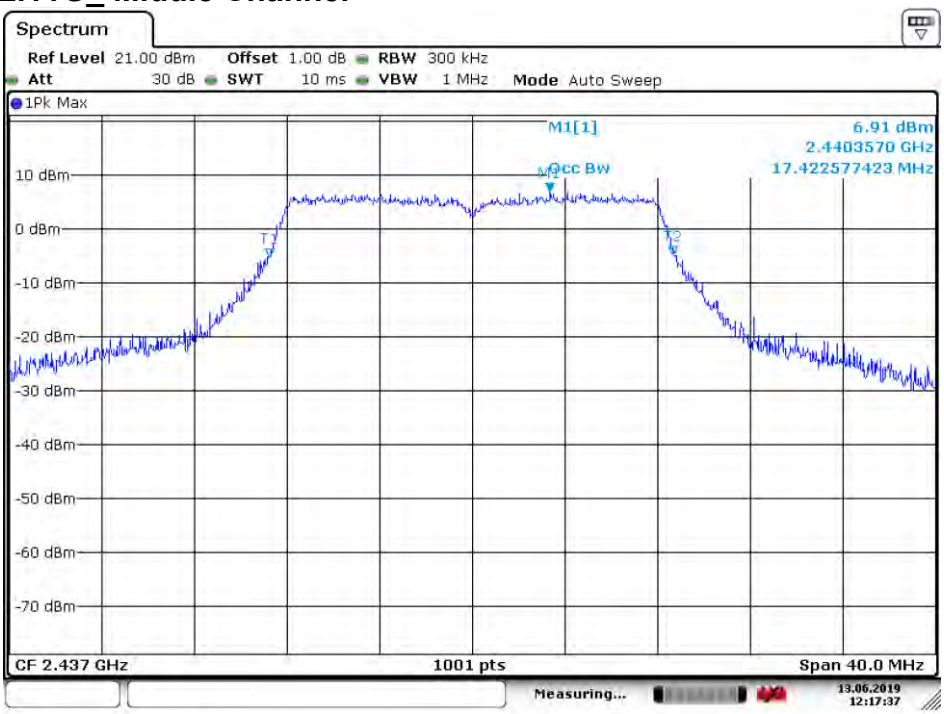
4.5.2.1.5 802.11G_ Middle Channel



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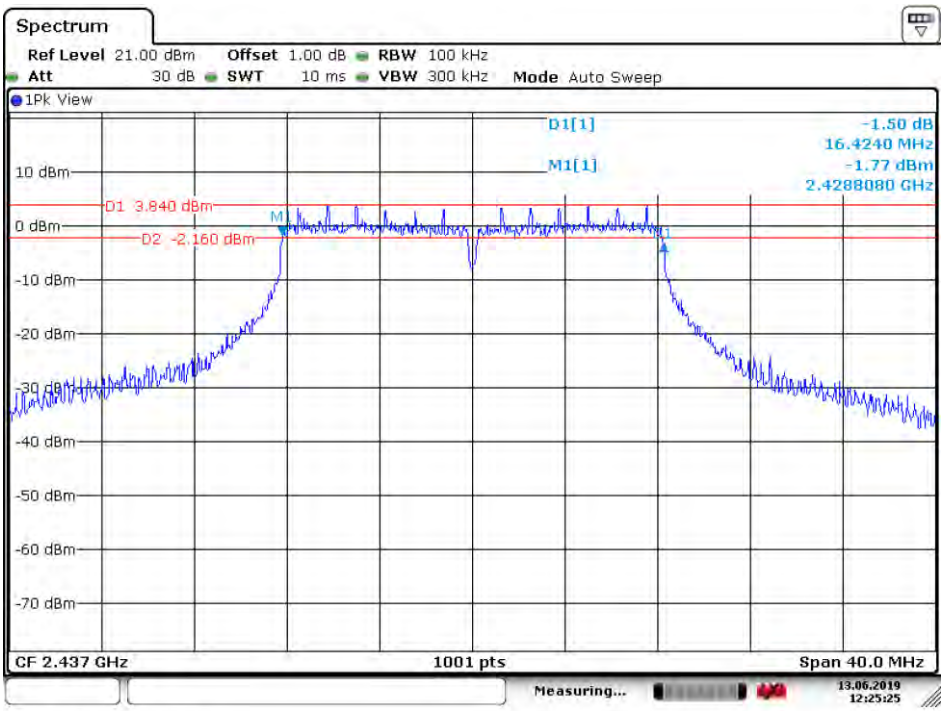

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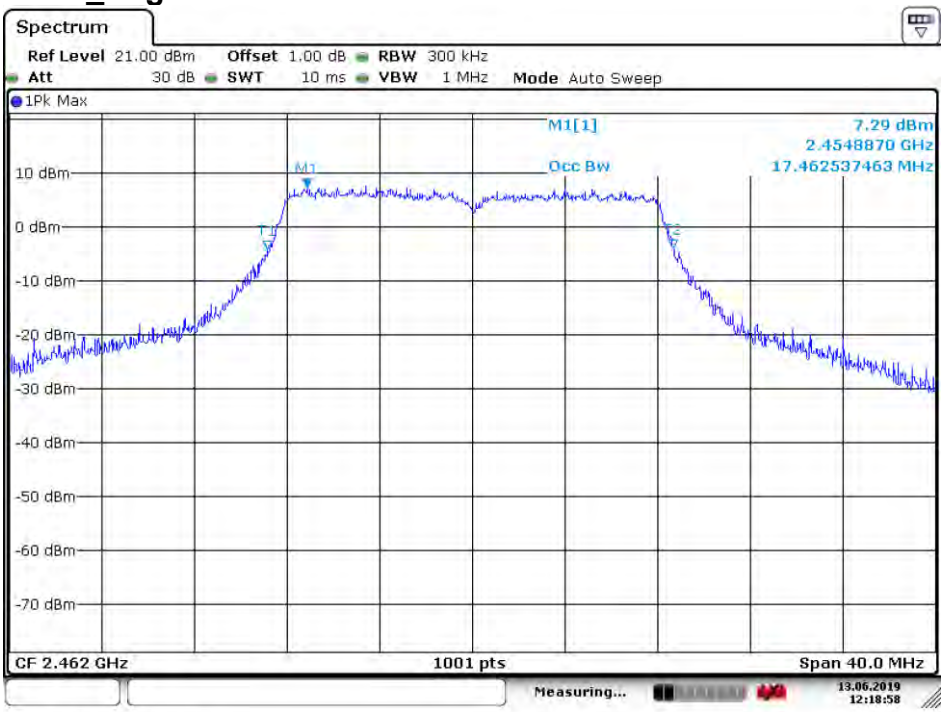
4.5.2.1.6 802.11G_ Highest Channel



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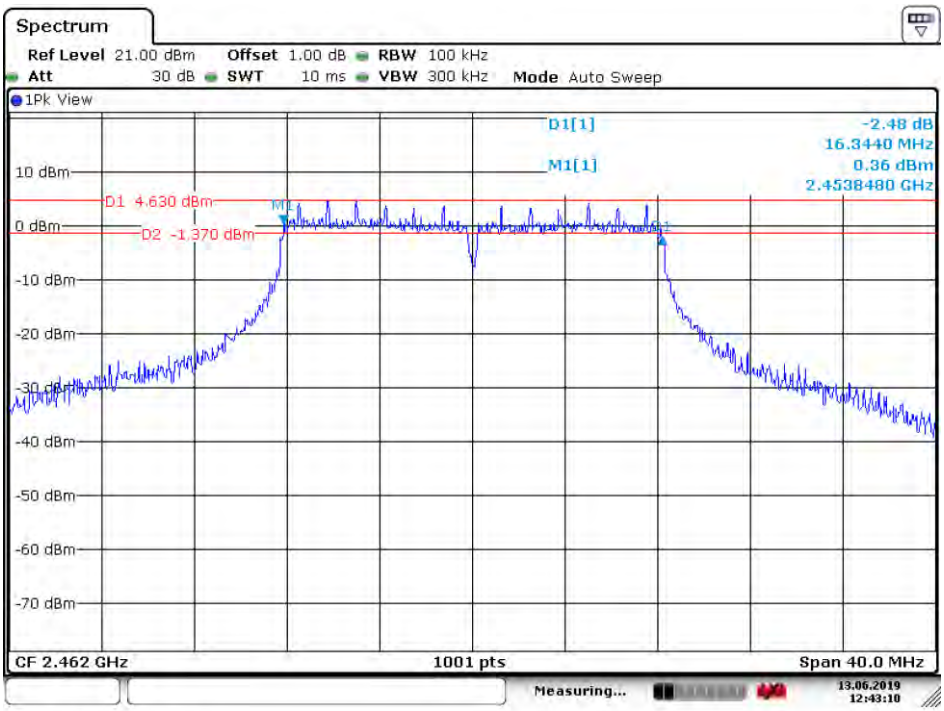

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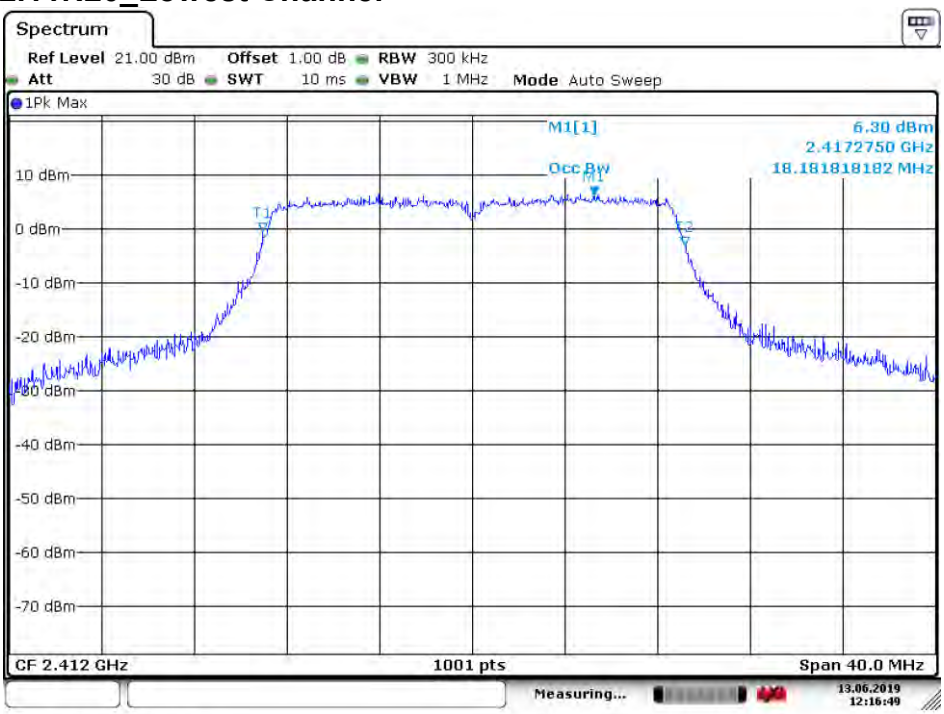
4.5.2.1.7 802.11N20_Lowest Channel



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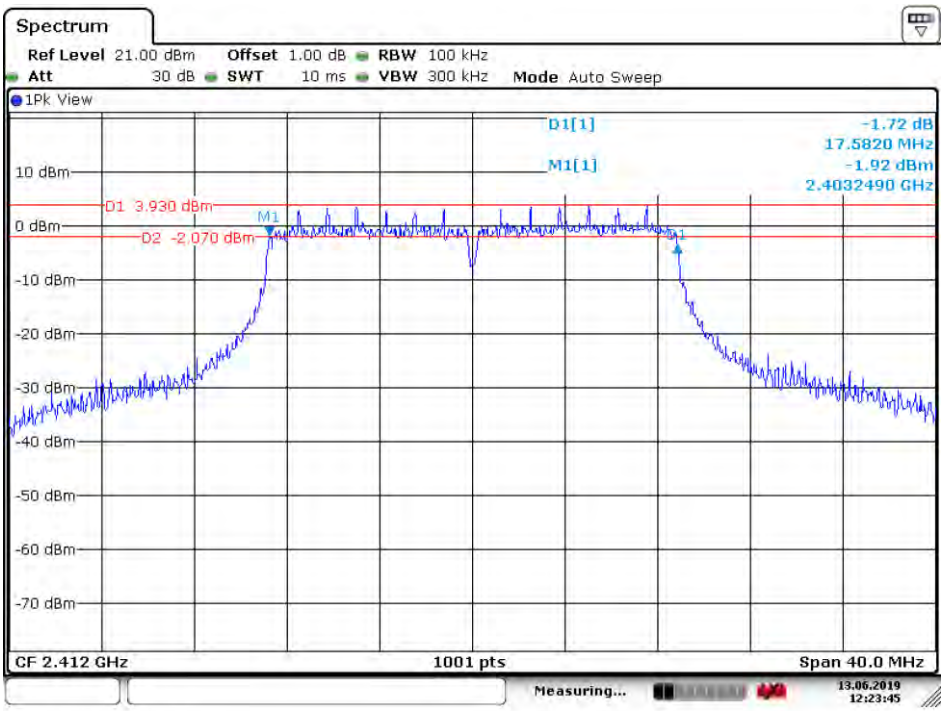

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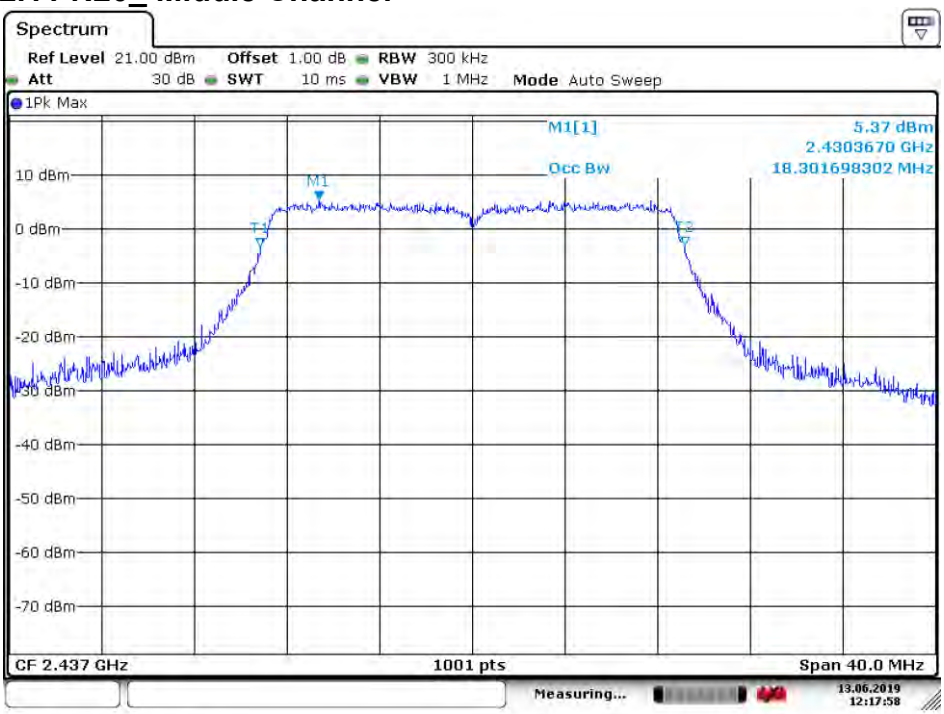
4.5.2.1.8 802.11 N20_ Middle Channel



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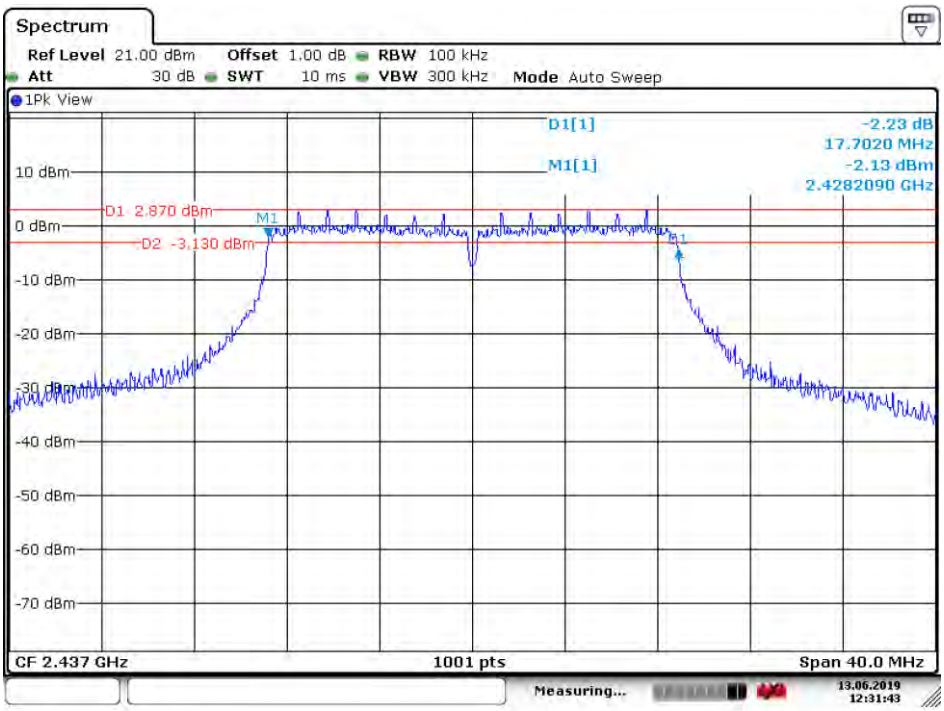

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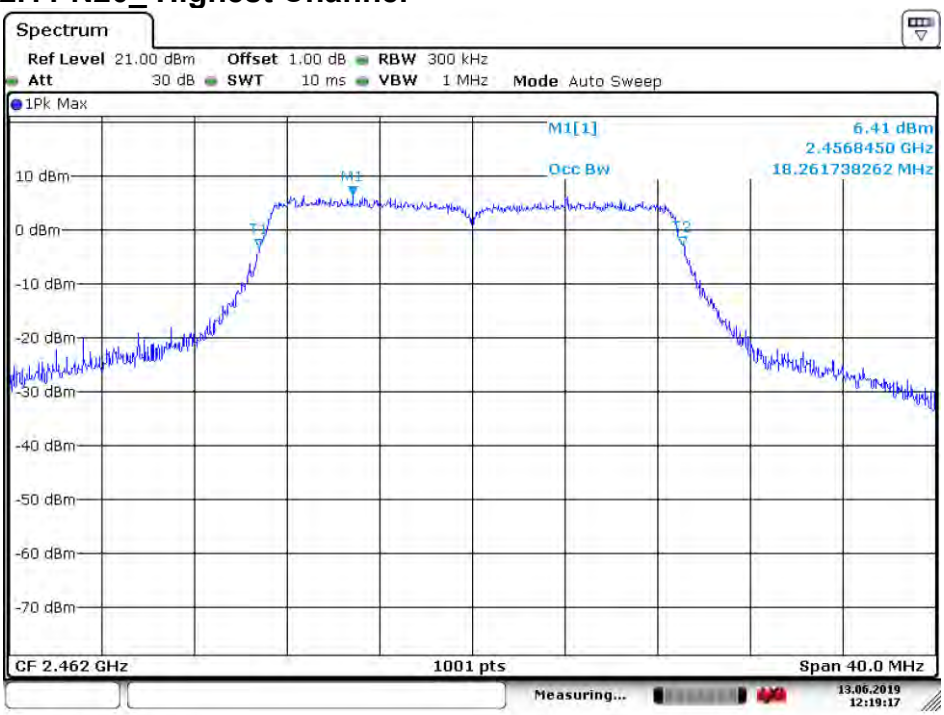
4.5.2.1.9 802.11 N20_ Highest Channel



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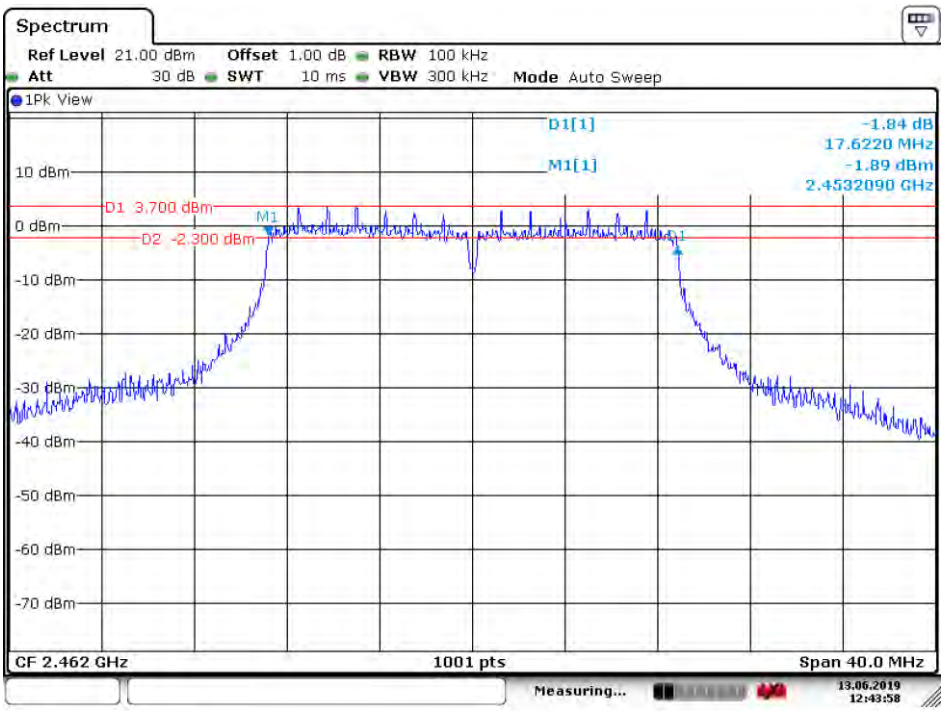

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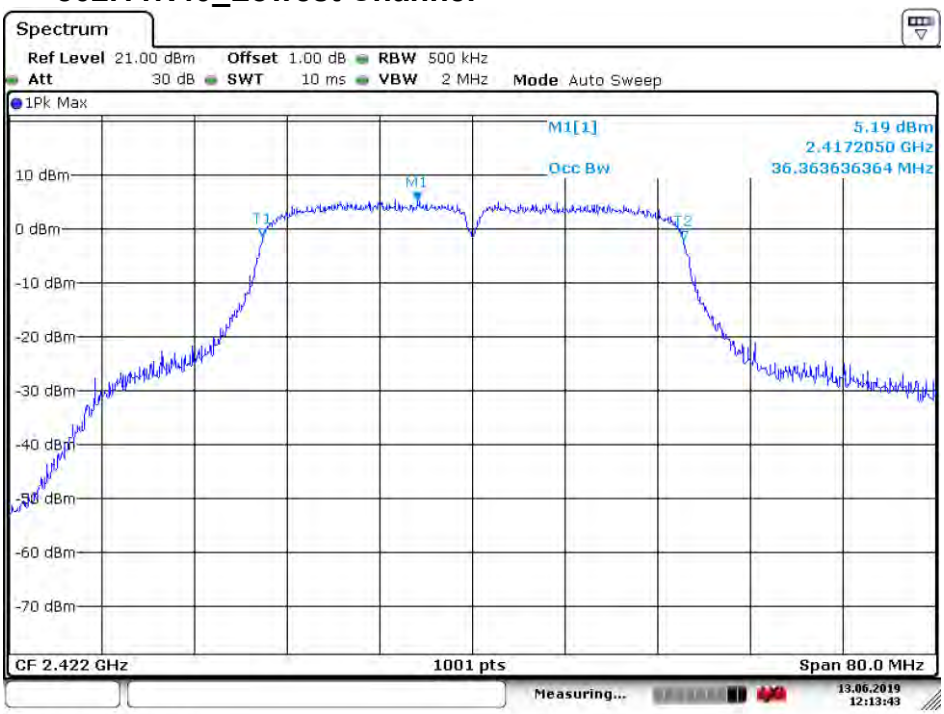
4.5.2.1.10 802.11N40_Lowest Channel



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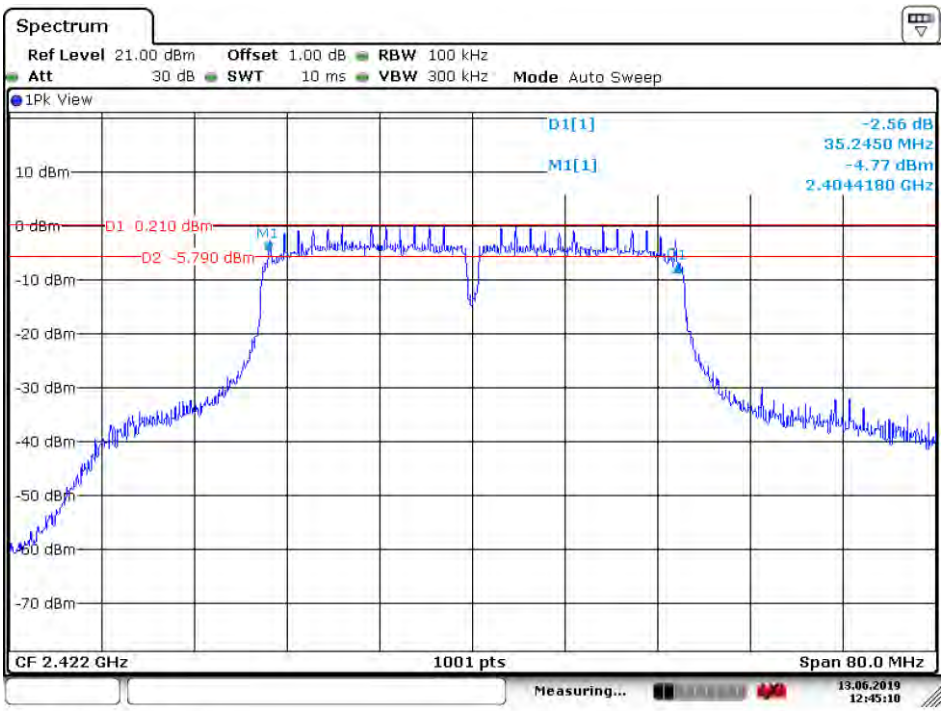

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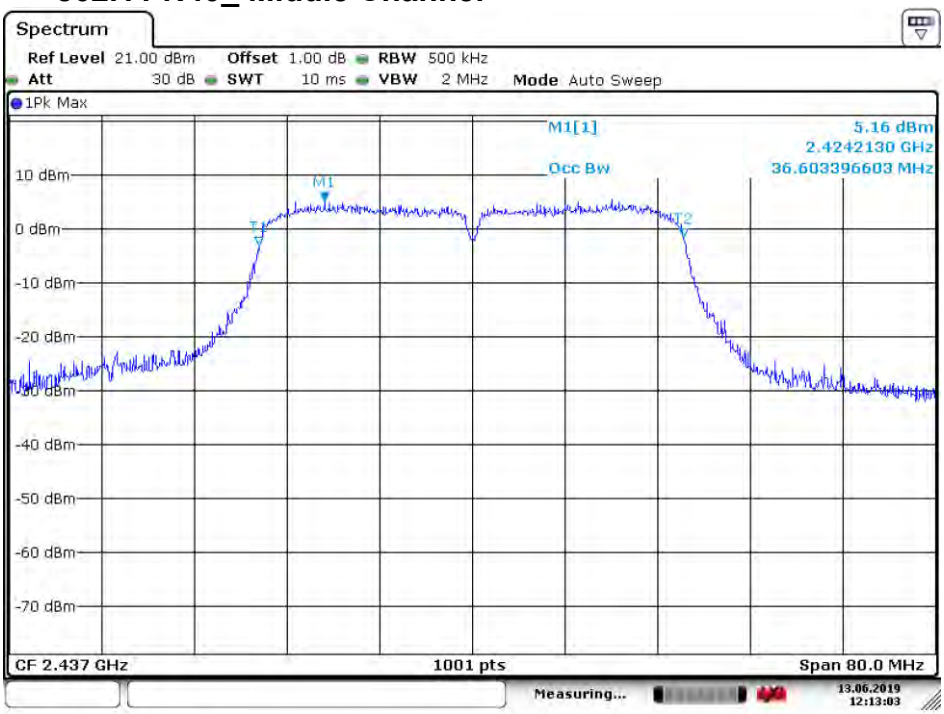
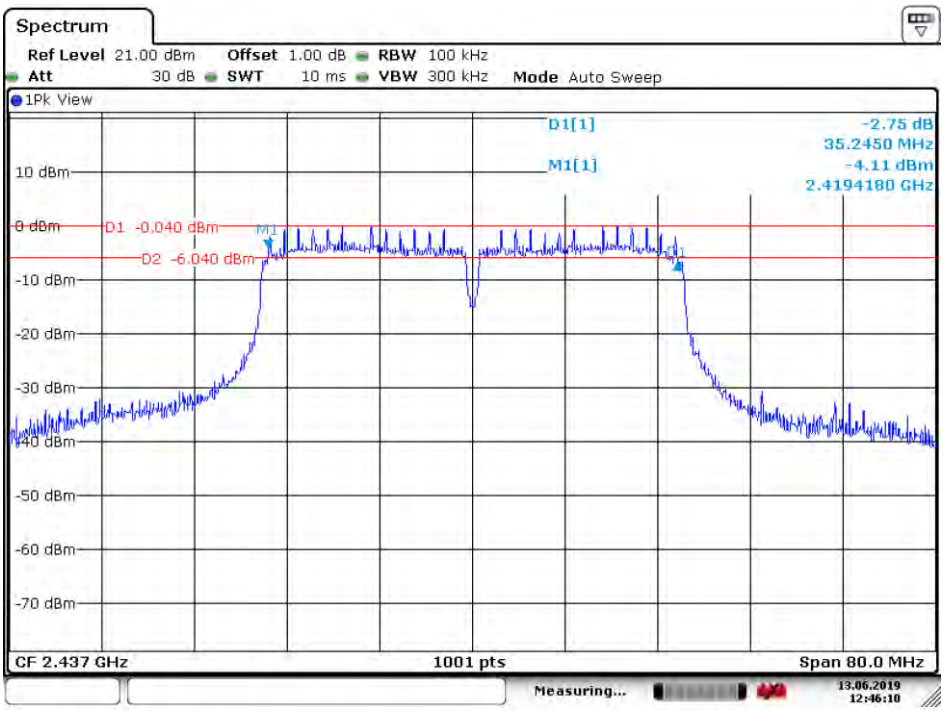
4.5.2.1.11 802.11 N40_ Middle Channel



Date: 13.JUN.2019 12:13:04



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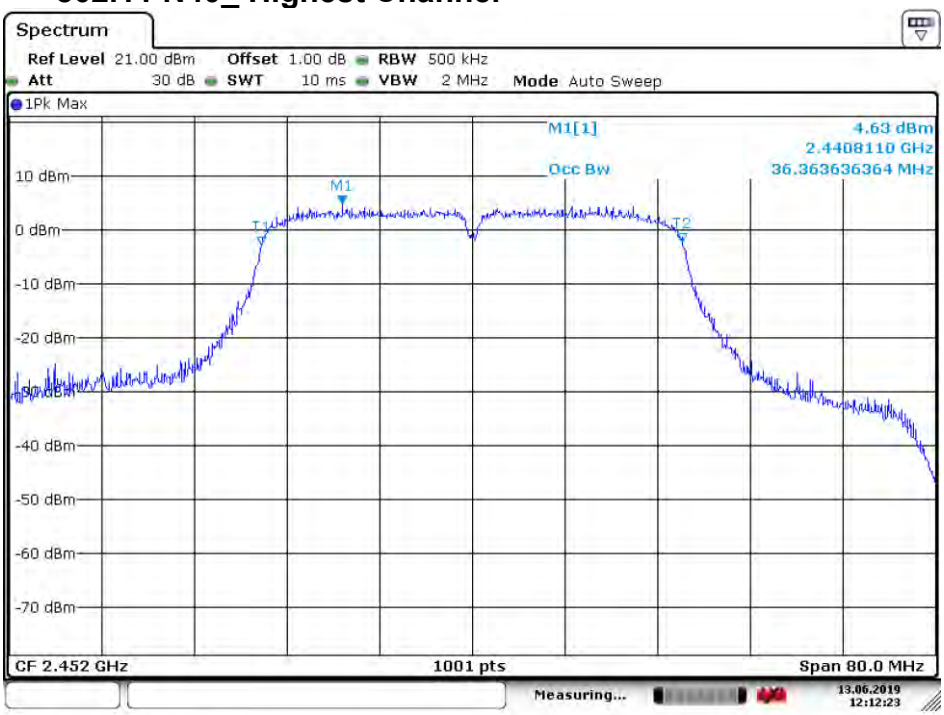
4.5.2.1.12 802.11 N40_ Highest Channel



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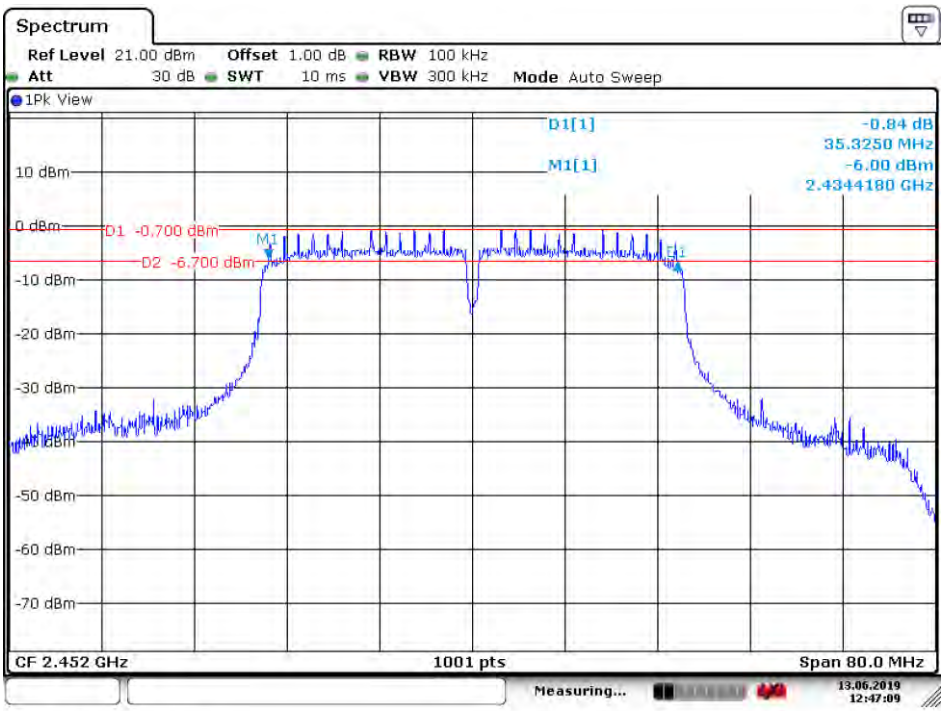

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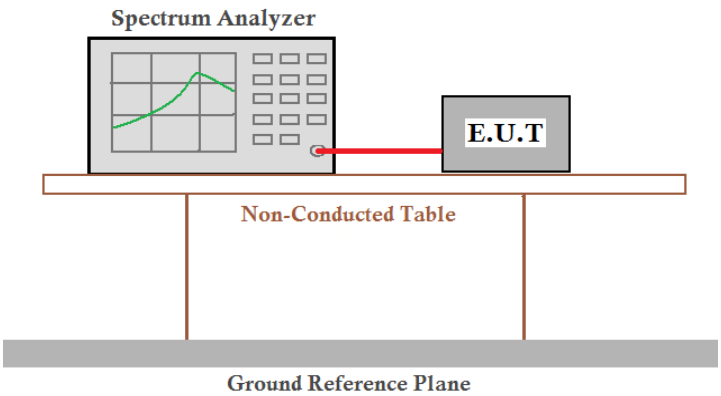
4.6 Power Spectral Density

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

4.6.1 Test Results

Mode	Test Channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
802.11B	Lowest	-3.27	≤8.00	Pass
	Middle	-4.41	≤8.00	Pass
	Highest	-3.73	≤8.00	Pass
802.11G	Lowest	-7.79	≤8.00	Pass
	Middle	-9.85	≤8.00	Pass
	Highest	-8.46	≤8.00	Pass
802.11N20	Lowest	-9.31	≤8.00	Pass
	Middle	-11.25	≤8.00	Pass
	Highest	-10.09	≤8.00	Pass
802.11N40	Lowest	-13.60	≤8.00	Pass
	Middle	-13.92	≤8.00	Pass
	Highest	-12.72	≤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

Date: 13.JUN.2019 12:51:36

4.6.2.1.2 802.11B_ Middle Channel

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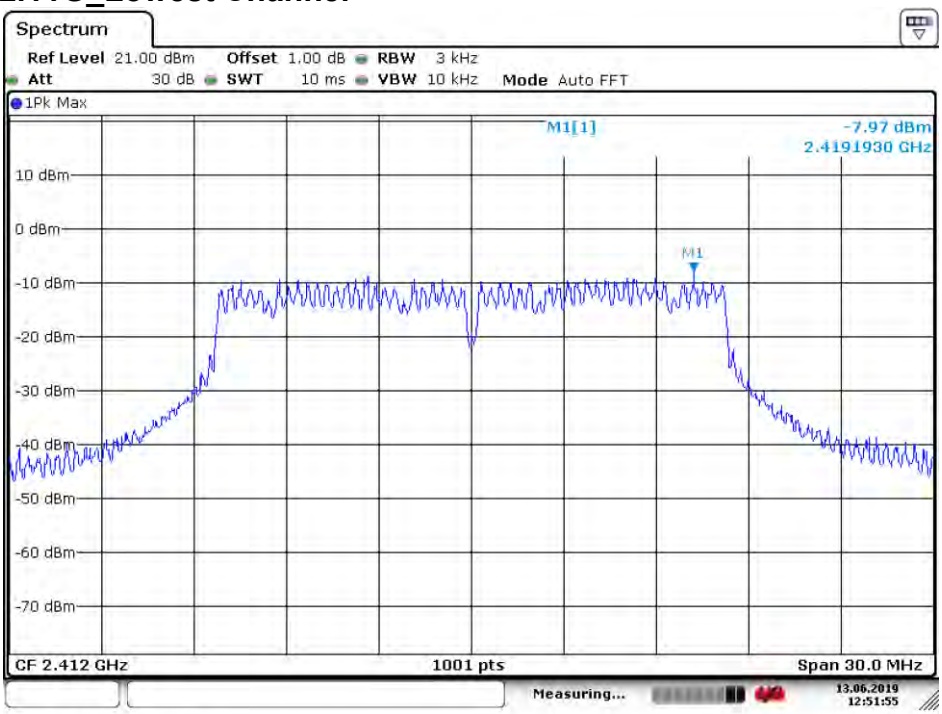
4.6.2.1.3 802.11B_ Highest Channel

Date: 13.JUN.2019 12:56:00

4.6.2.1.4 802.11G_Lowest Channel



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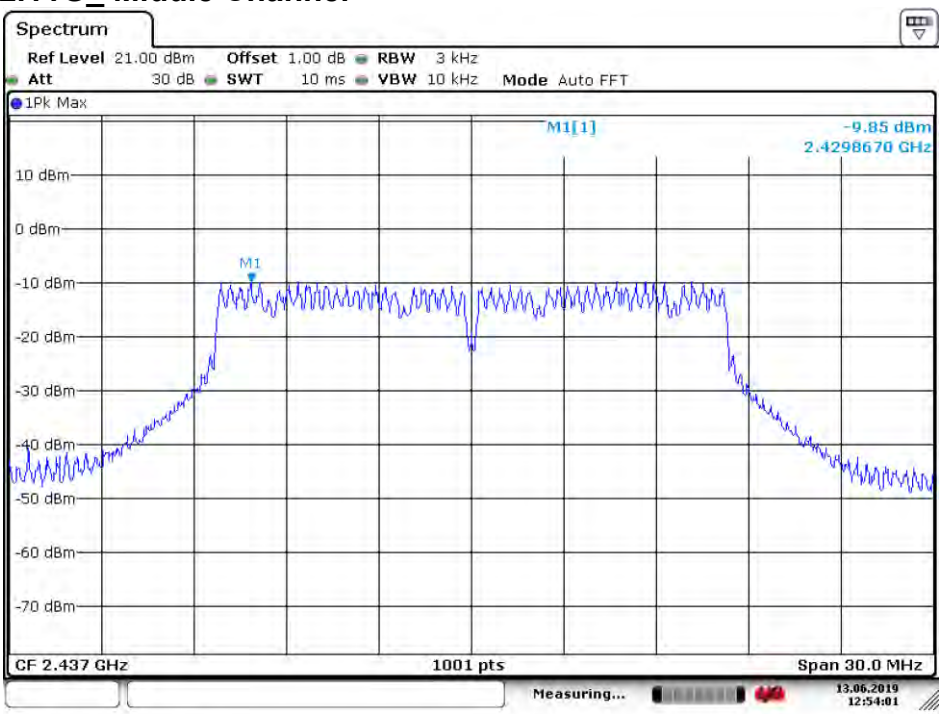
4.6.2.1.5 802.11G_ Middle Channel



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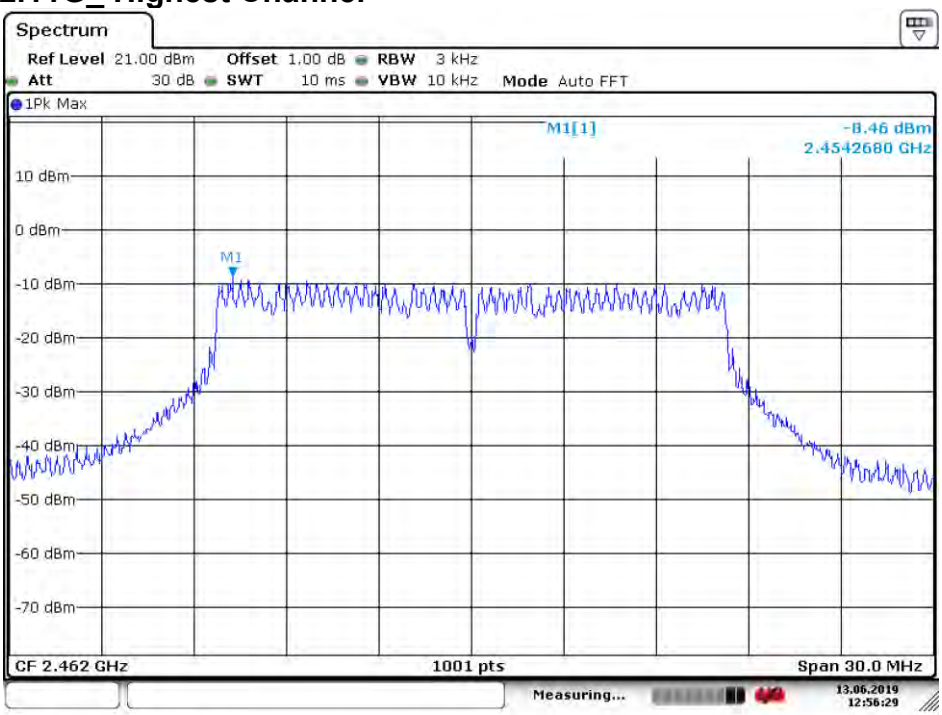
4.6.2.1.6 802.11G_ Highest Channel



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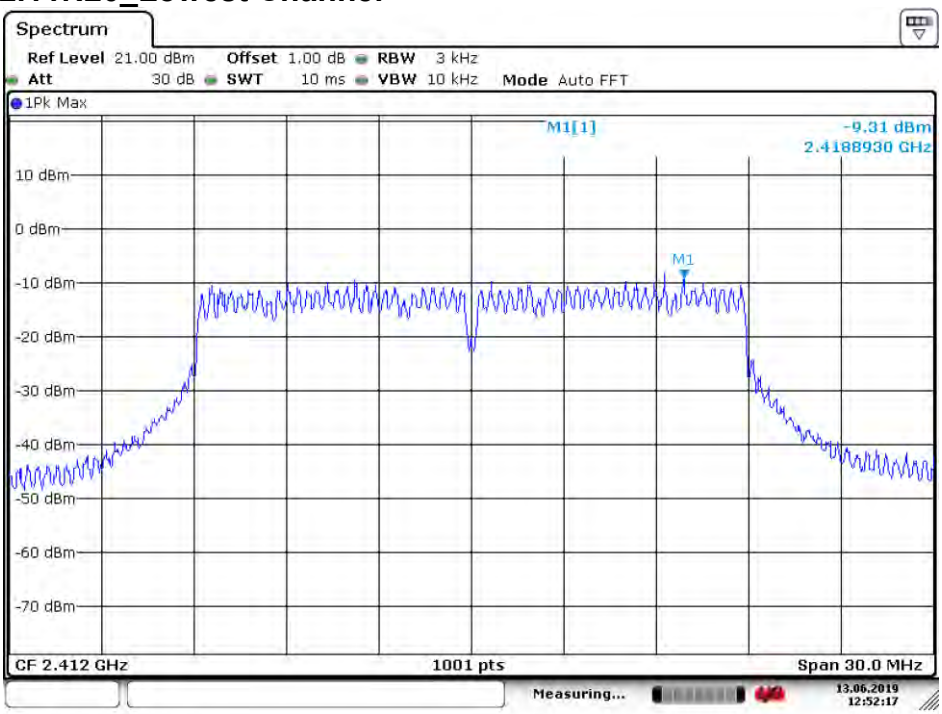
4.6.2.1.7 802.11N20_Lowest Channel



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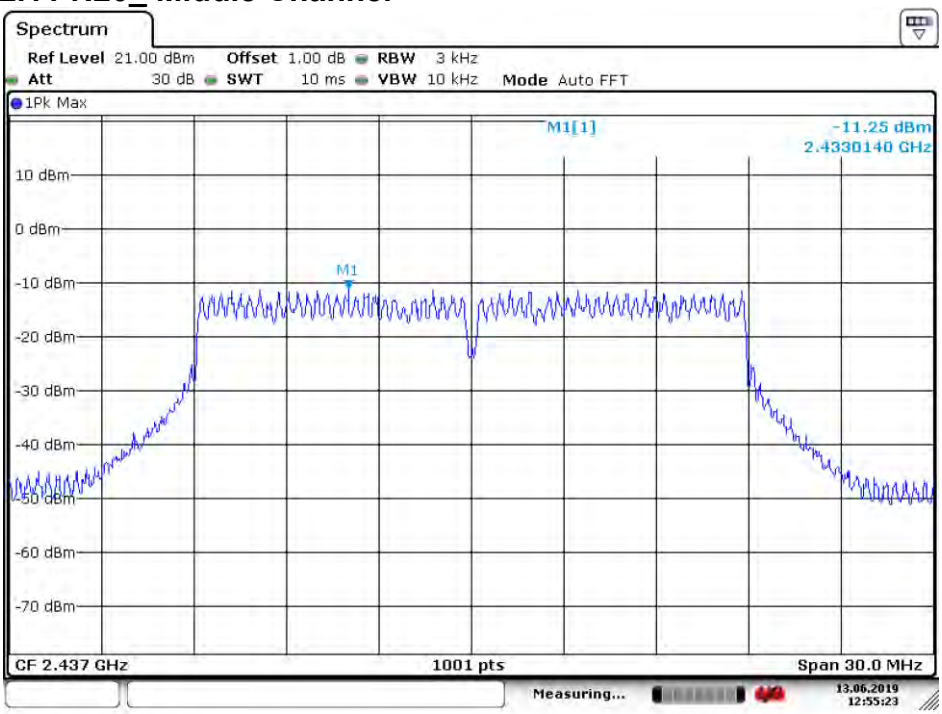
4.6.2.1.8 802.11 N20_ Middle Channel



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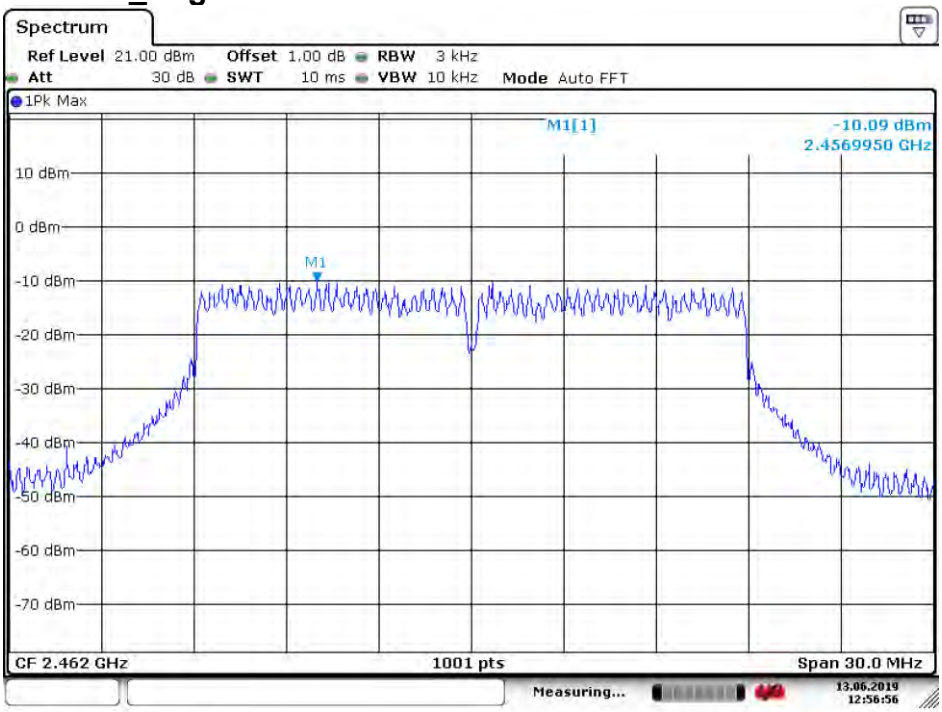
4.6.2.1.9 802.11 N20_ Highest Channel



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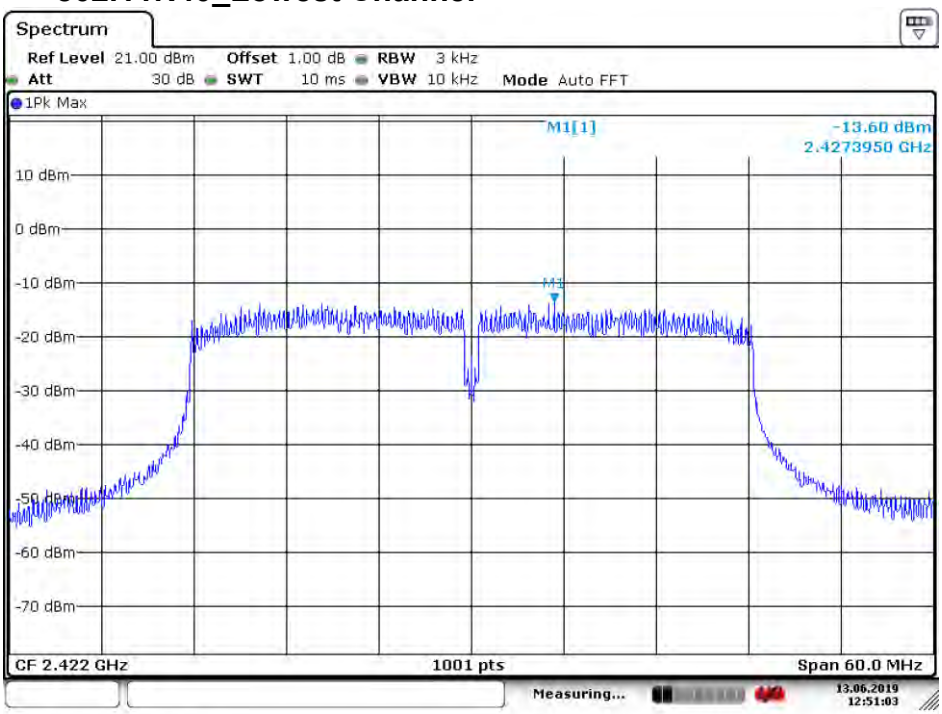
4.6.2.1.10 802.11N40_Lowest Channel



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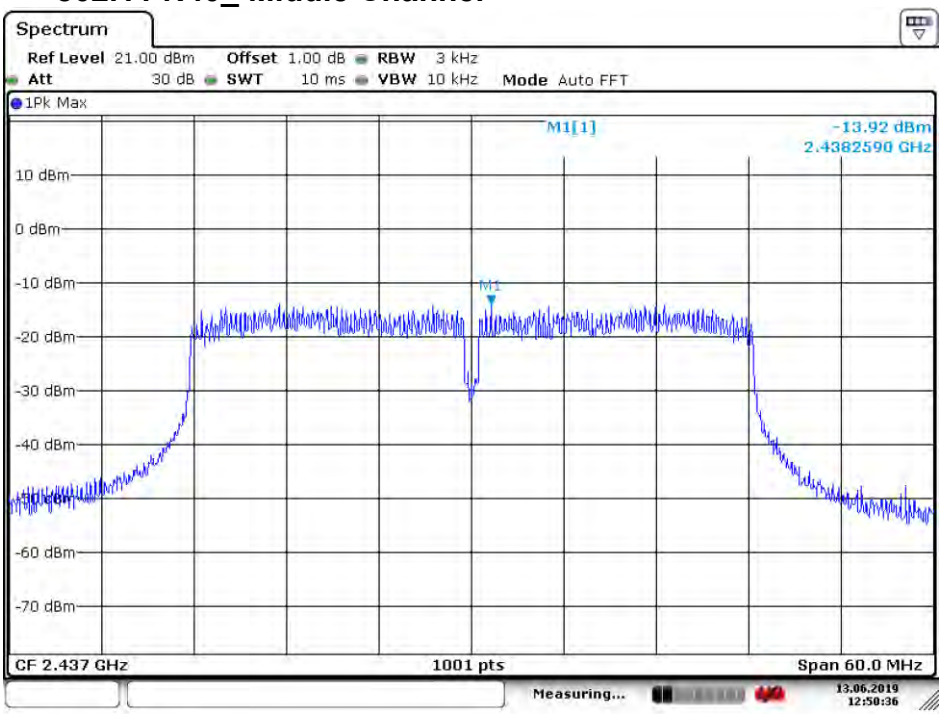
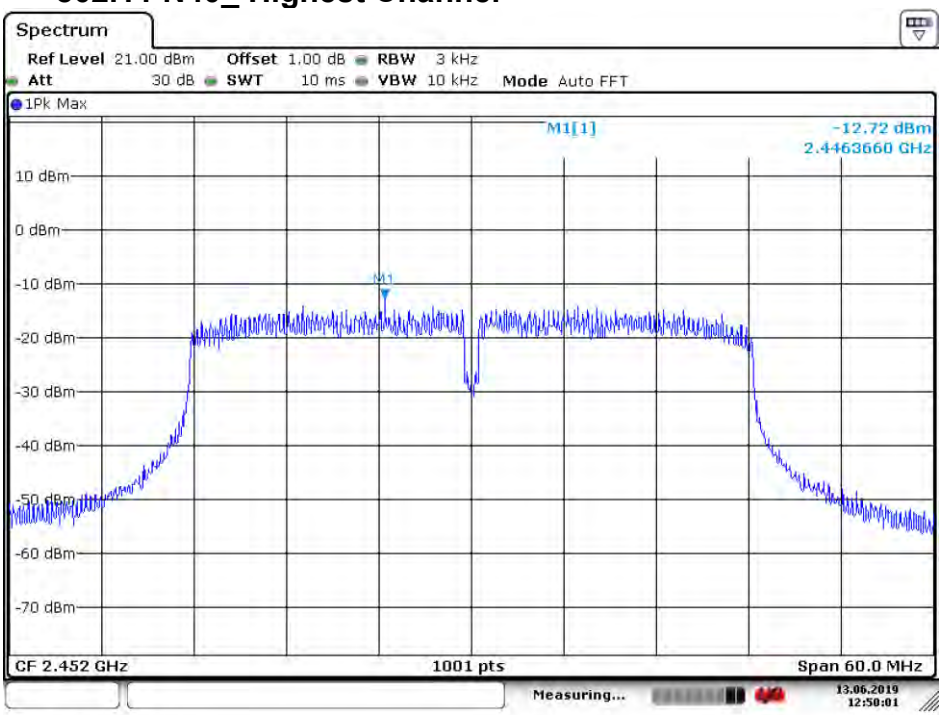
4.6.2.1.11 802.11 N40_ Middle Channel



Date: 13.JUN.2019 12:50:36

4.6.2.1.12 802.11 N40_ Highest Channel



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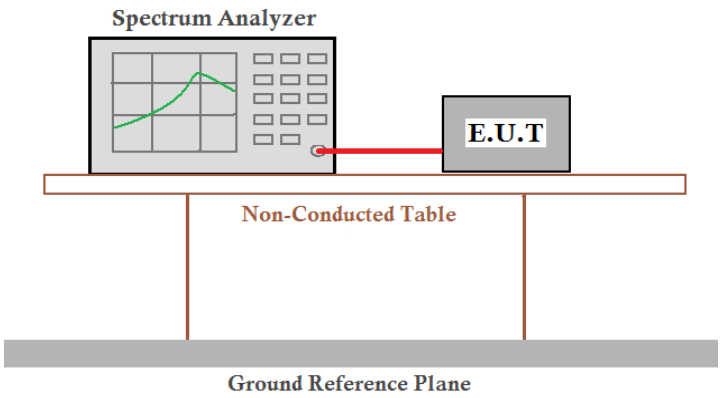
4.7 Band-edge for RF Conducted Emissions

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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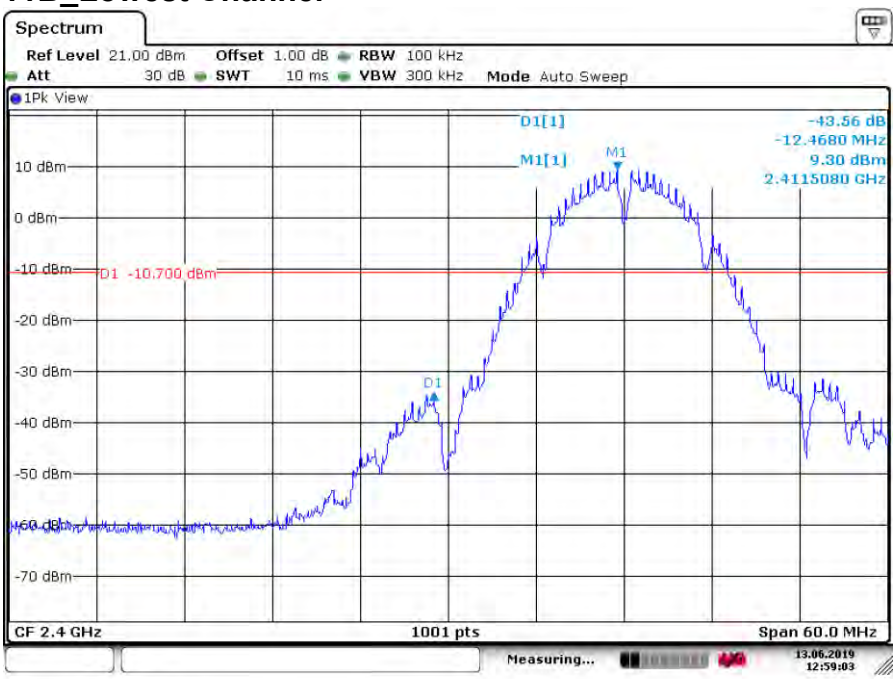
4.7.1 Test plots

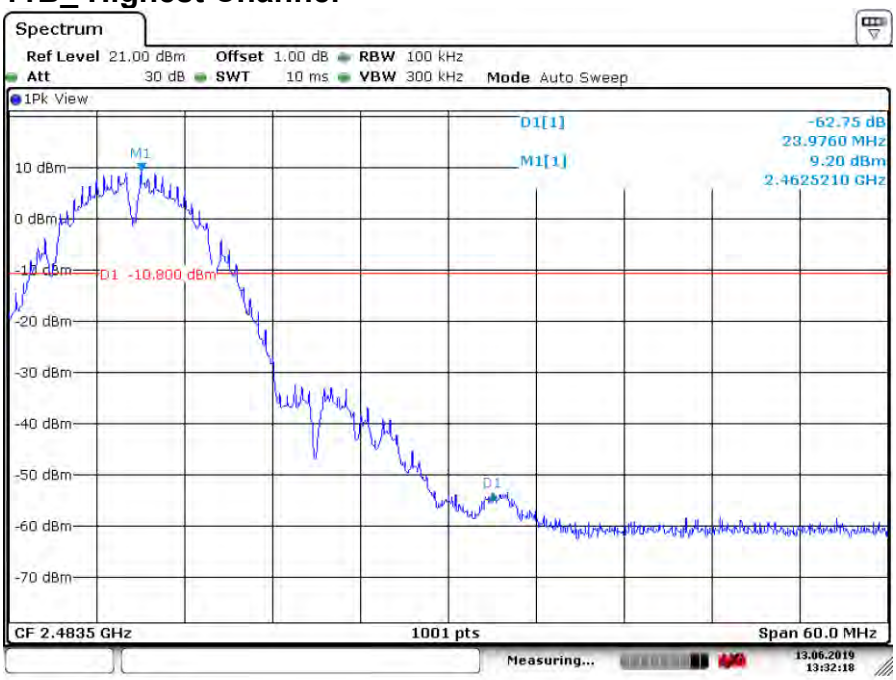
4.7.1.1 ANT1

4.7.1.1.1 802.11B_Lowest Channel



Date: 13.JUN.2019 12:59:02

4.7.1.1.2 802.11B_ Highest Channel



Date: 13.JUN.2019 13:32:19

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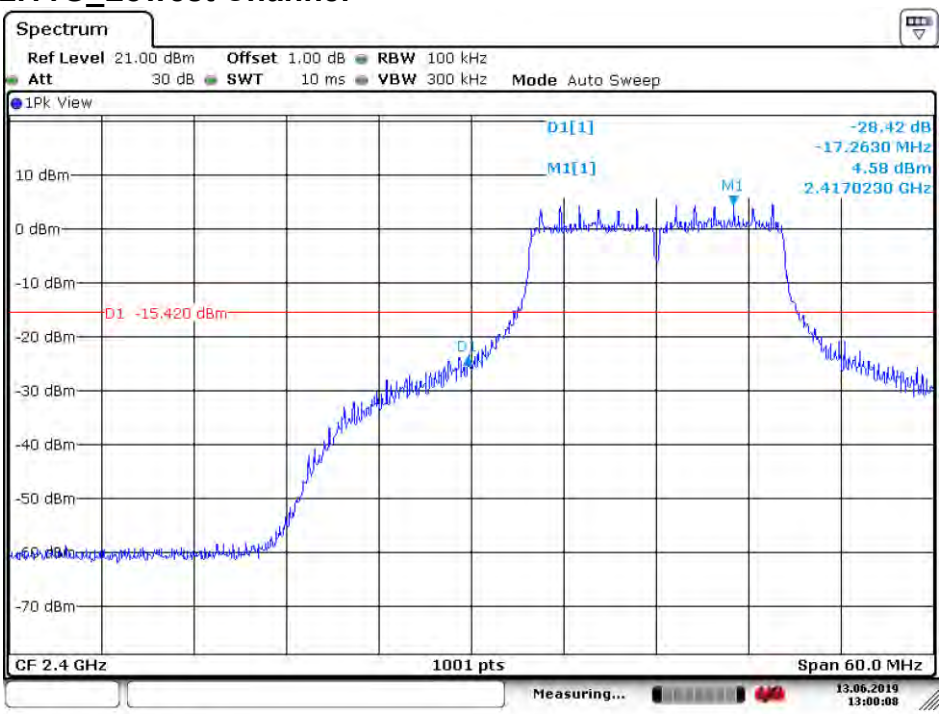
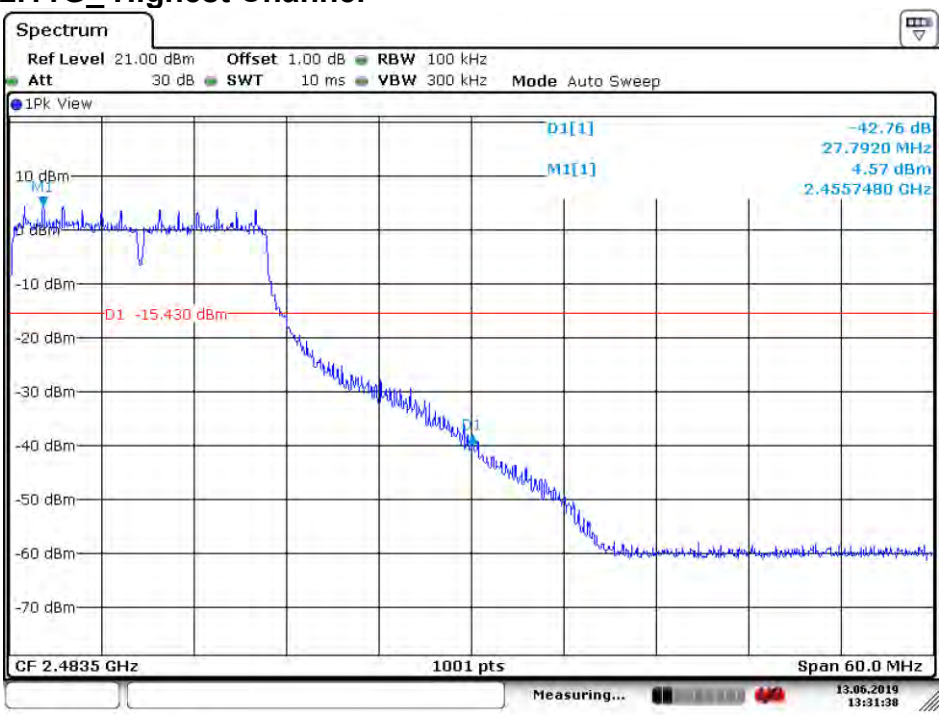
4.7.1.1.3 802.11G_Lowest Channel



Date: 13.JUN.2019 13:00:09

4.7.1.1.4 802.11G_ Highest Channel



Date: 13.JUN.2019 13:31:38

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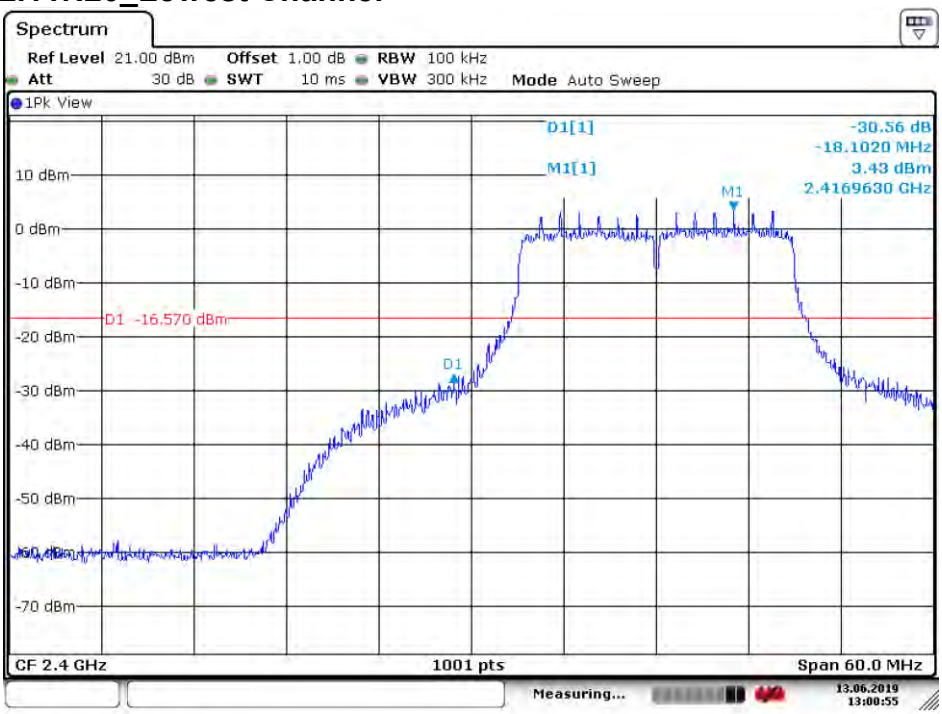
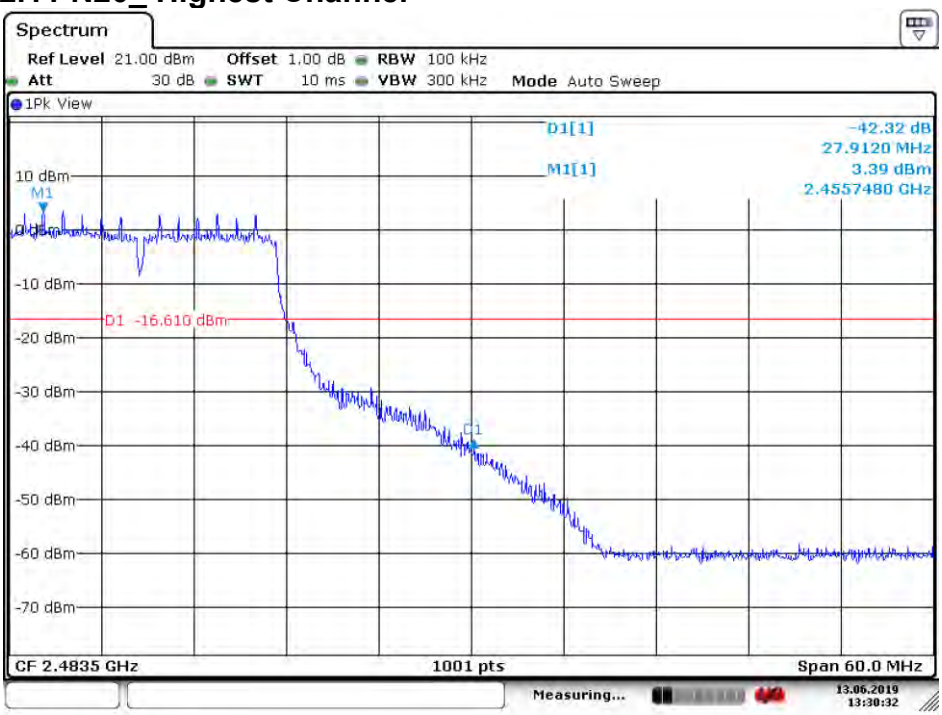
4.7.1.1.5 802.11N20_Lowest Channel



Date: 13.JUN.2019 13:00:56

4.7.1.1.6 802.11 N20_ Highest Channel



Date: 13.JUN.2019 13:30:32

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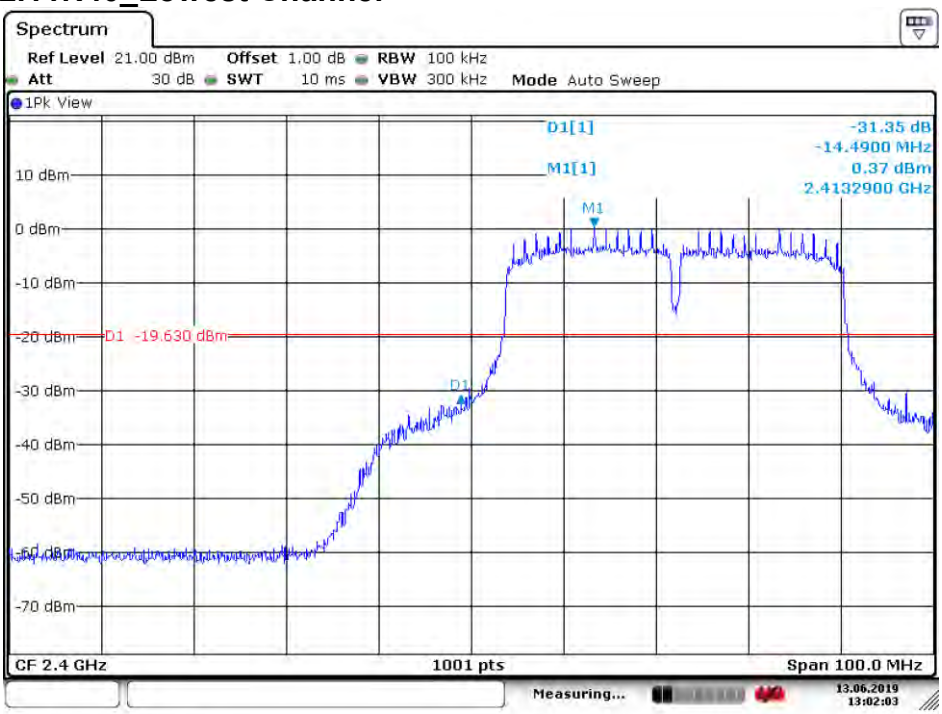
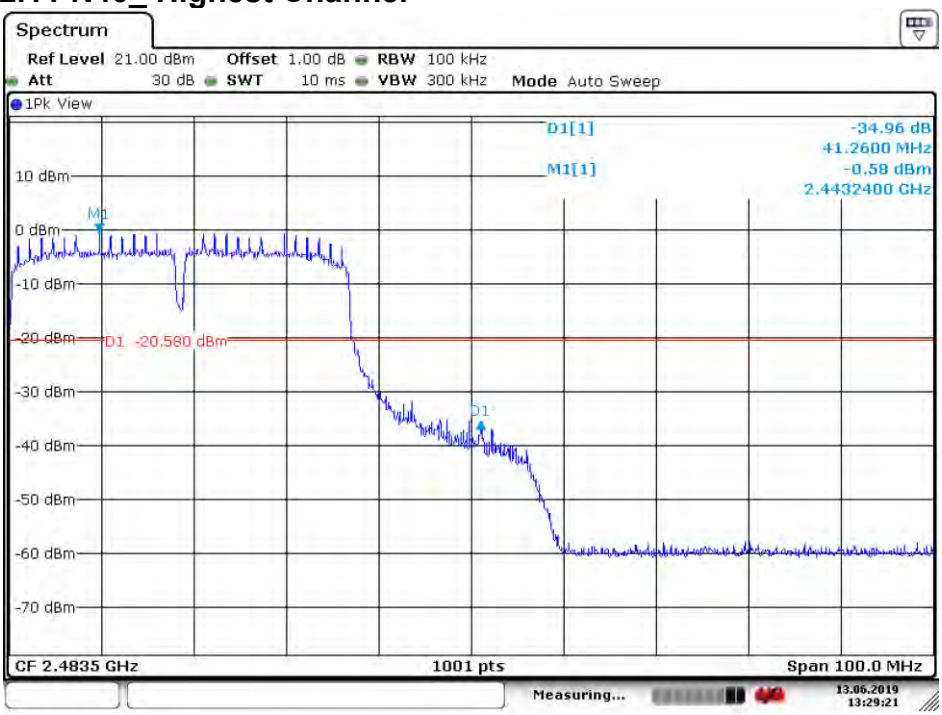
4.7.1.1.7 802.11N40_Lowest Channel



Date: 13.JUN.2019 13:02:03

4.7.1.1.8 802.11 N40_ Highest Channel



Date: 13.JUN.2019 13:29:21

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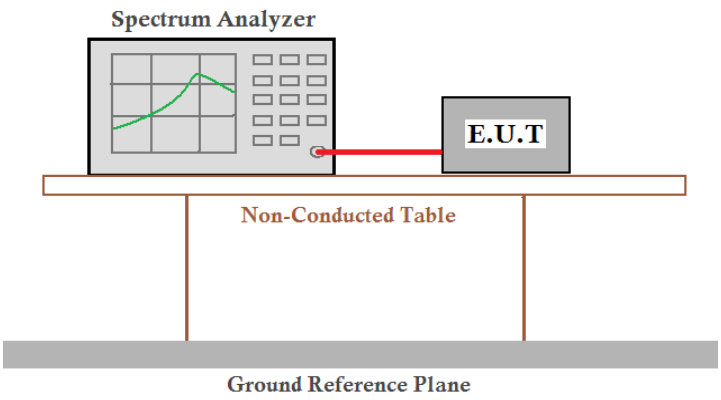
4.8 RF Conducted Spurious Emissions

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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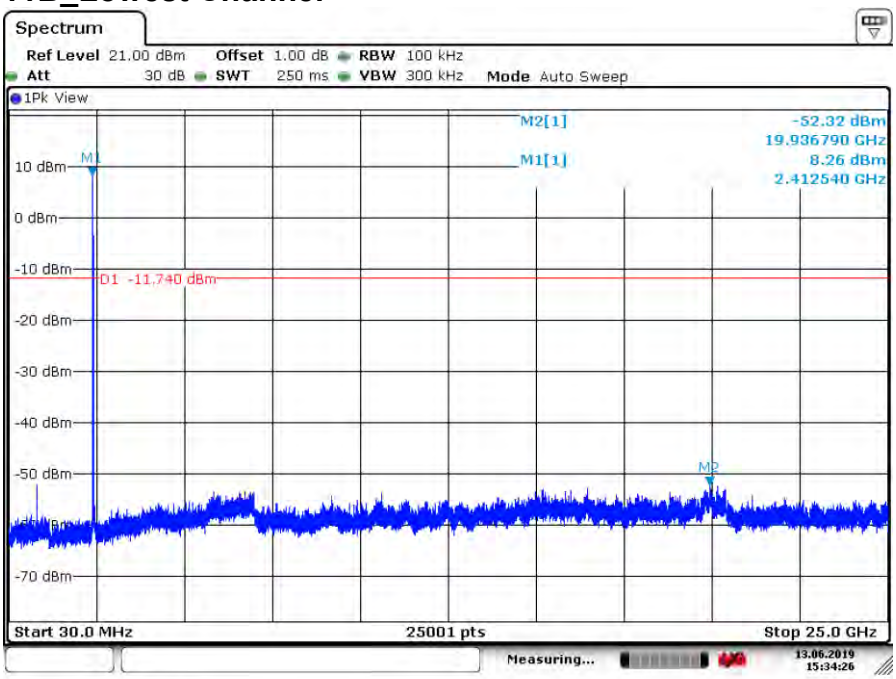
4.8.1 Test plots

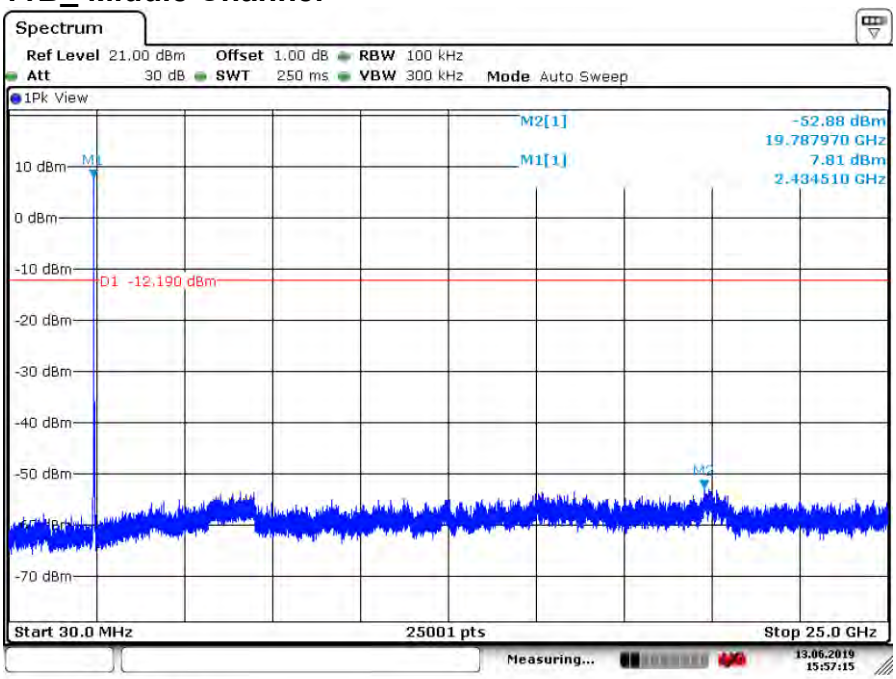
4.8.1.1 ANT1

4.8.1.1.1 802.11B_Lowest Channel



Date: 13.JUN.2019 15:34:27

4.8.1.1.2 802.11B_ Middle Channel



Date: 13.JUN.2019 15:57:15

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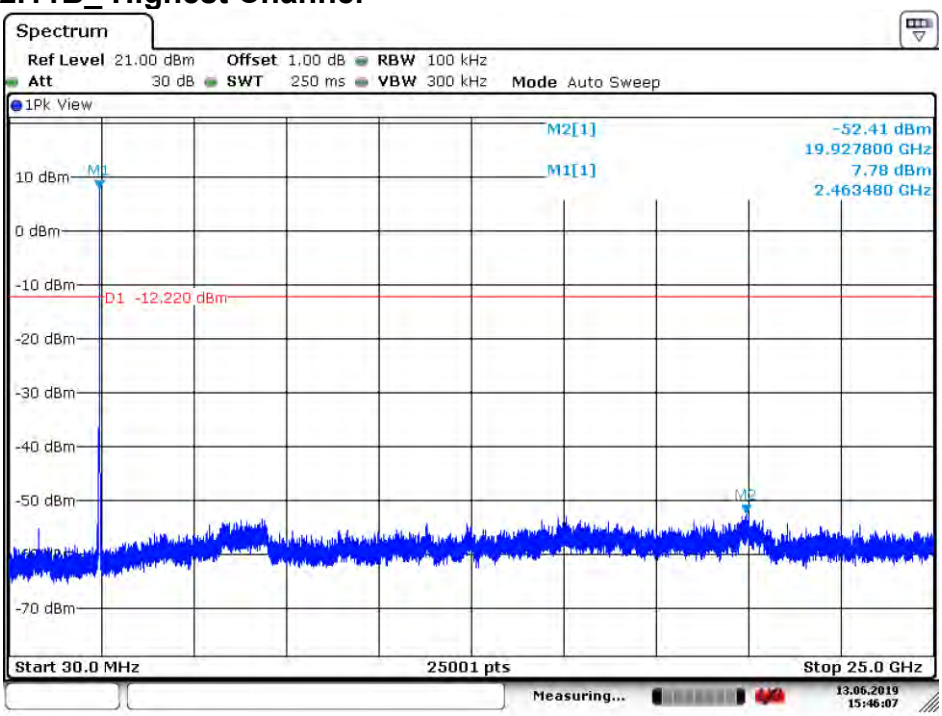
4.8.1.1.3 802.11B_ Highest Channel



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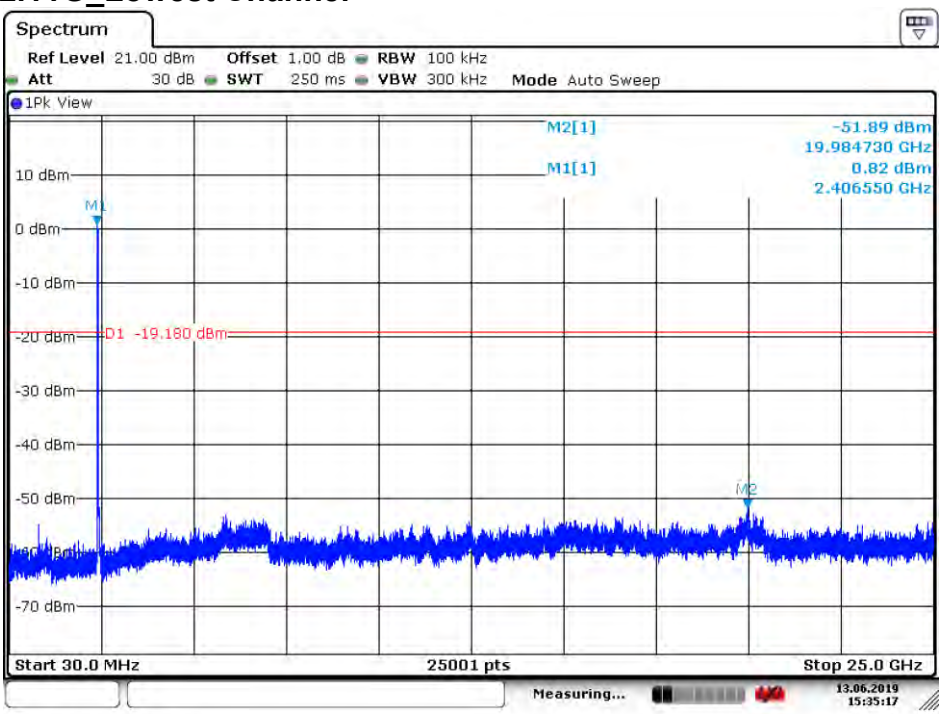
4.8.1.1.4 802.11G_Lowest Channel



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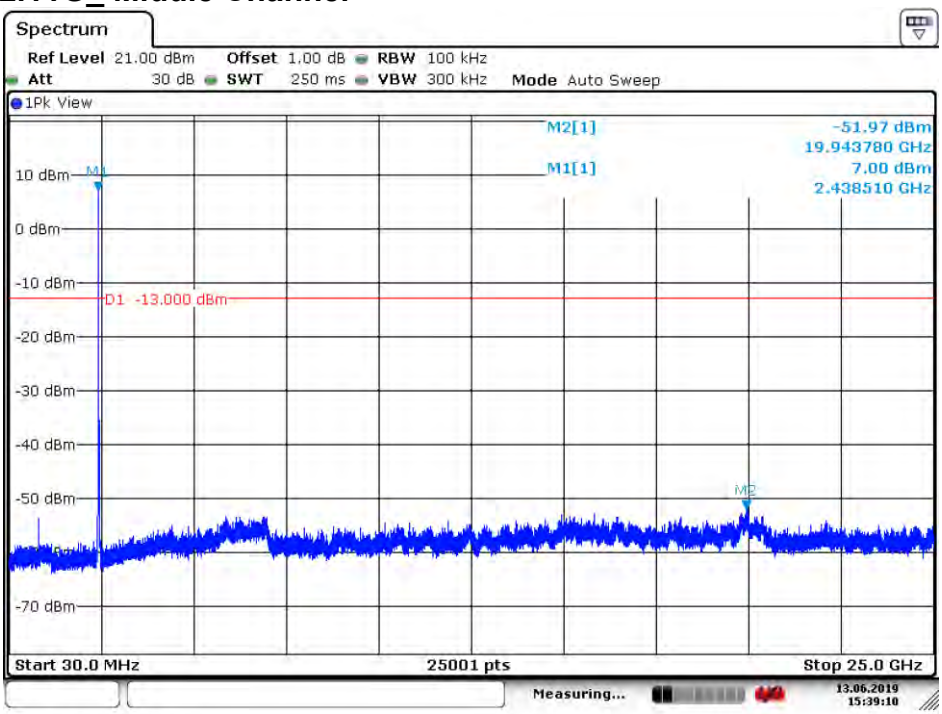
4.8.1.1.5 802.11G_ Middle Channel



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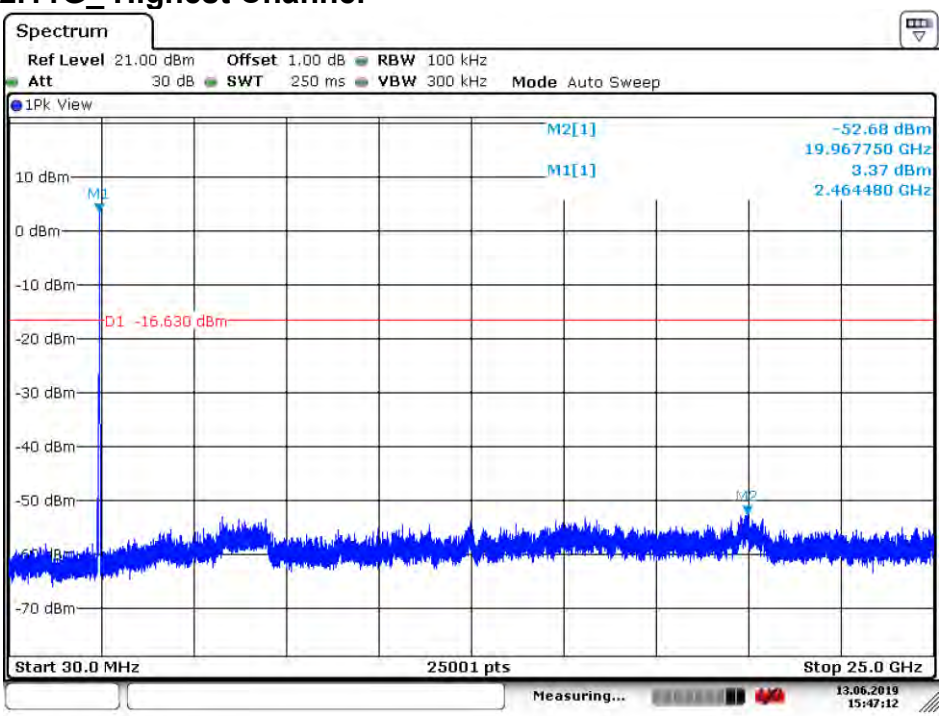
4.8.1.1.6 802.11G_ Highest Channel



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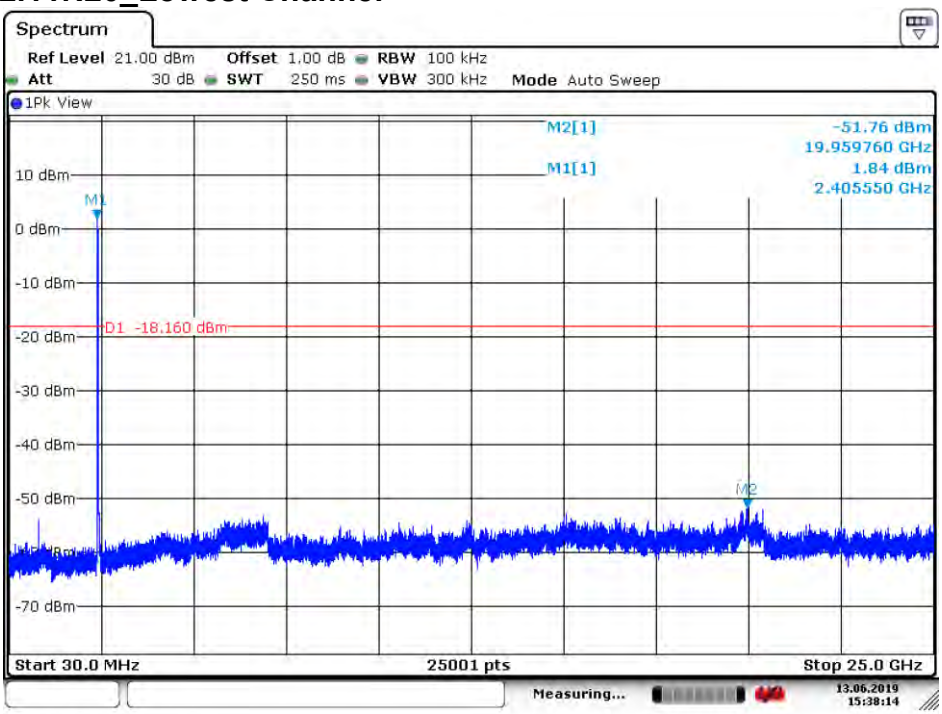
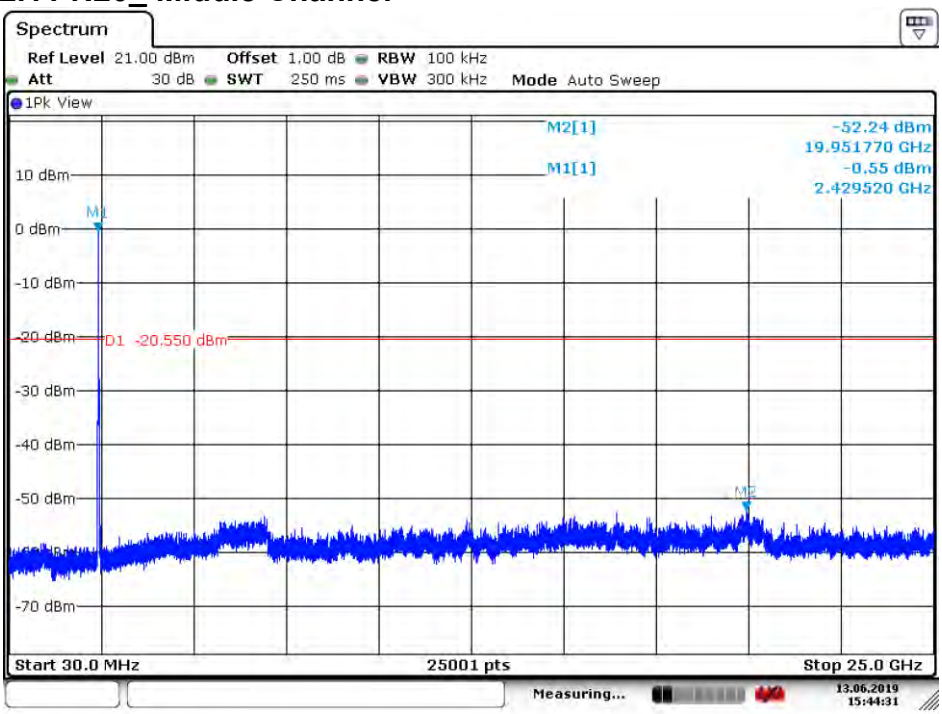
4.8.1.1.7 802.11N20_Lowest Channel



Date: 13.JUN.2019 15:38:14

4.8.1.1.8 802.11 N20_ Middle Channel



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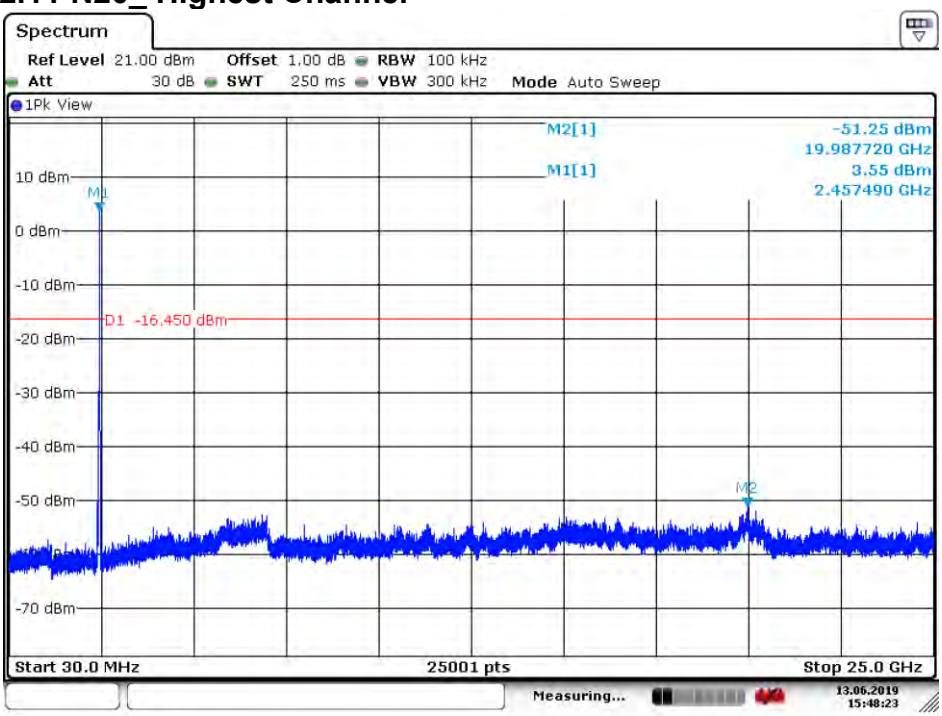
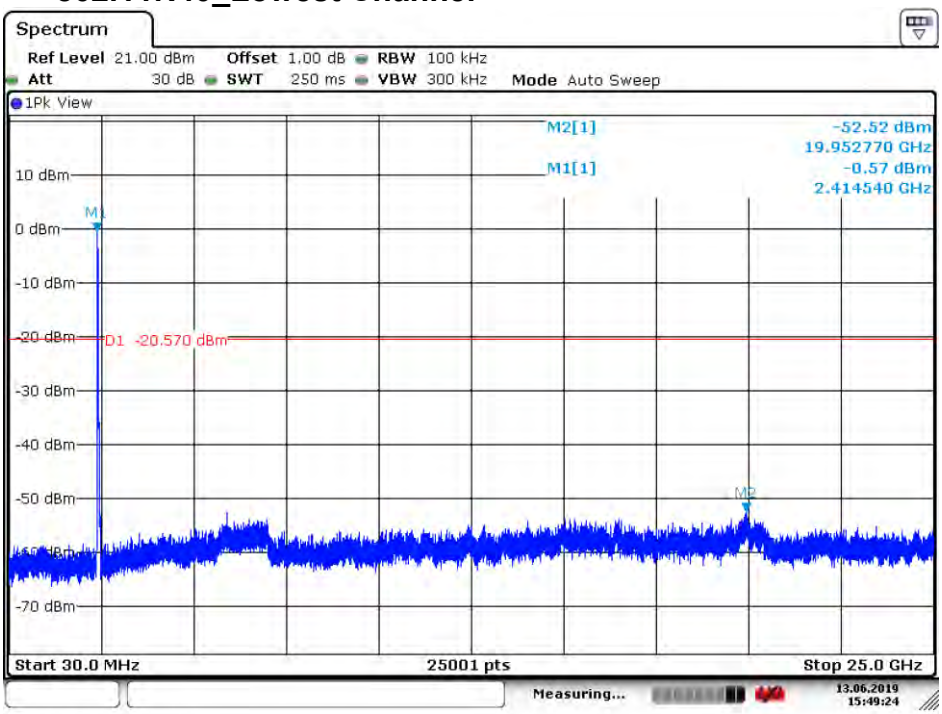
4.8.1.1.9 802.11 N20_ Highest Channel



Date: 13.JUN.2019 15:48:24

4.8.1.1.10 802.11N40_Lowest Channel



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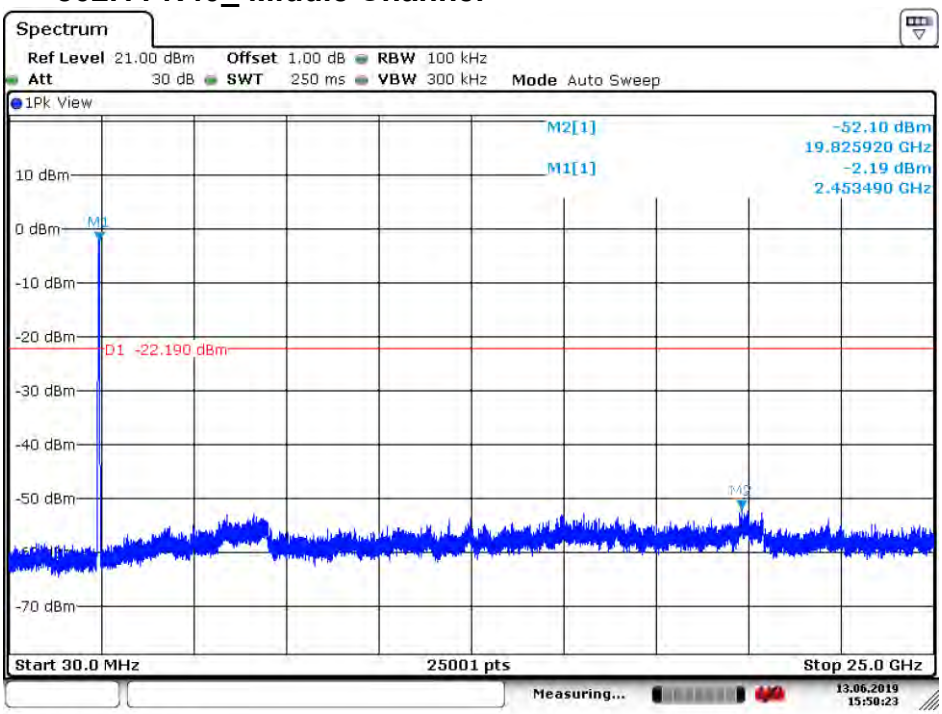
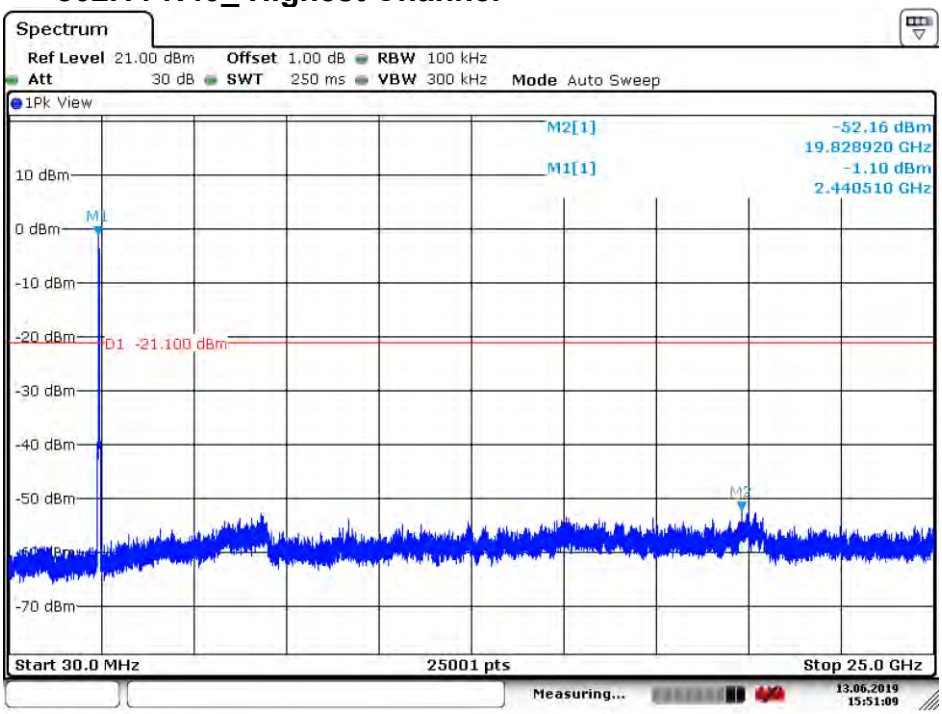
4.8.1.1.11 802.11 N40_ Middle Channel



Date: 13.JUN.2019 15:50:23

4.8.1.1.12 802.11 N40_ Highest Channel



Date: 13.JUN.2019 15:51:10

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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.

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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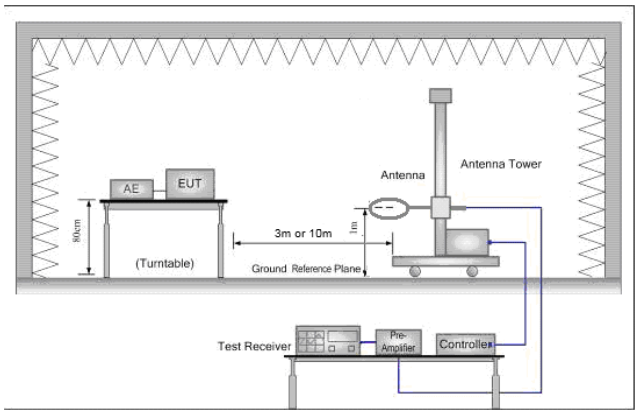

Figure 1. Below 30MHz

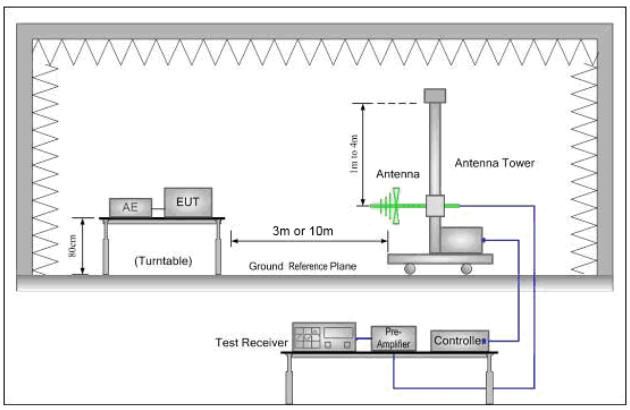

Figure 2. 30MHz to 1GHz

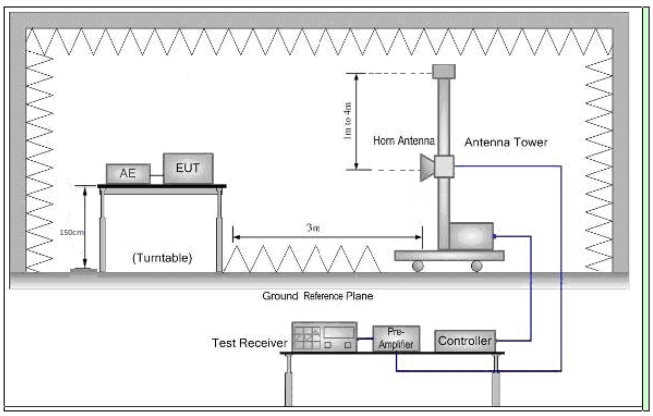

Figure 3. Above 1 GHz

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. 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. f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. g. 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

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	re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. h. Test the EUT in the lowest channel, the middle 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) For below 1GHz, through Pre-scan, find the 1Mbps of rate of 802.11B at lowest channel is the worst case. Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

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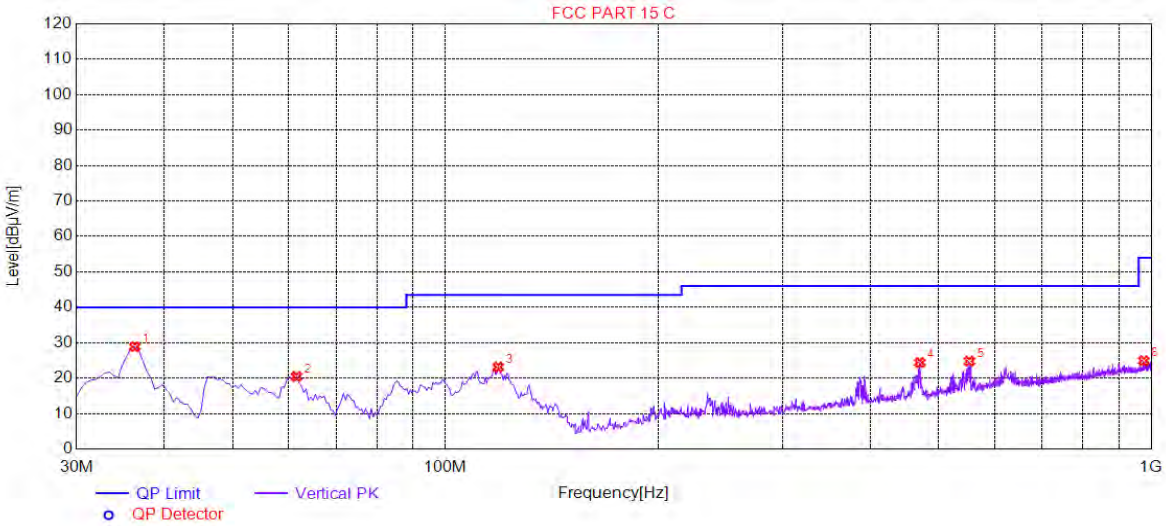
4.9.1 Radiated emission below 1GHz

4.9.1.1 Charge + Transmitting, Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	36.3082	28.89	-32.34	40.00	11.11	100	137	Vertical
2	61.5408	20.44	-32.04	40.00	19.56	100	249	Vertical
3	118.7994	23.12	-33.07	43.50	20.38	100	137	Vertical
4	470.1151	24.38	-23.42	46.00	21.62	200	255	Vertical
5	552.6063	24.78	-21.38	46.00	21.22	100	262	Vertical
6	975.7379	24.91	-14.16	54.00	29.09	200	304	Vertical

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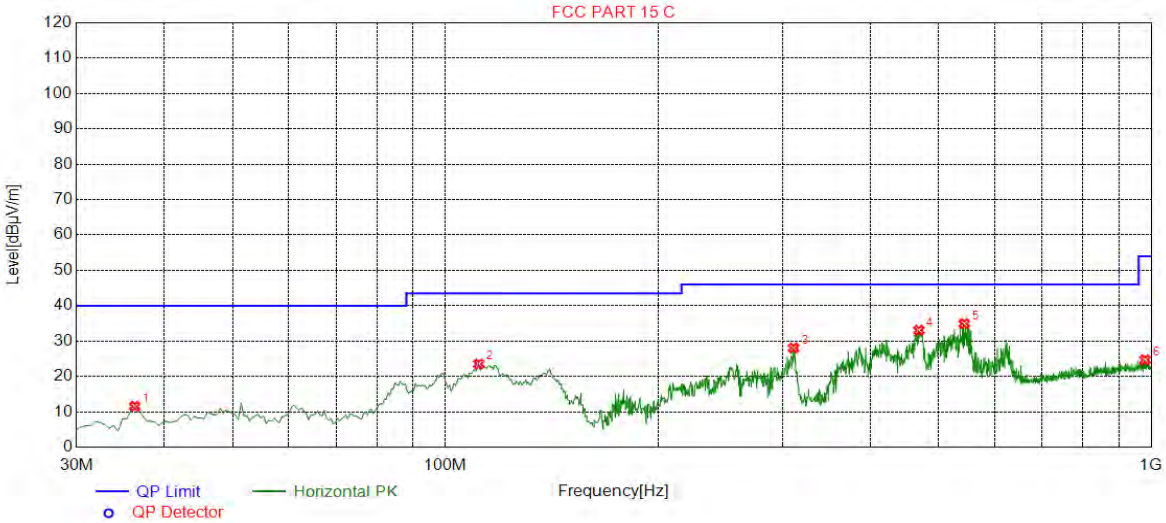
4.9.1.2 Charge + Transmitting, Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	36.3082	11.54	-32.34	40.00	28.46	200	232	Horizontal
2	111.5208	23.53	-31.93	43.50	19.97	200	238	Horizontal
3	311.4407	28.06	-27.52	46.00	17.94	100	171	Horizontal
4	468.6593	33.07	-23.45	46.00	12.93	100	212	Horizontal
5	543.3867	34.93	-21.61	46.00	11.07	200	8	Horizontal
6	980.1051	24.70	-14.11	54.00	29.30	100	336	Horizontal

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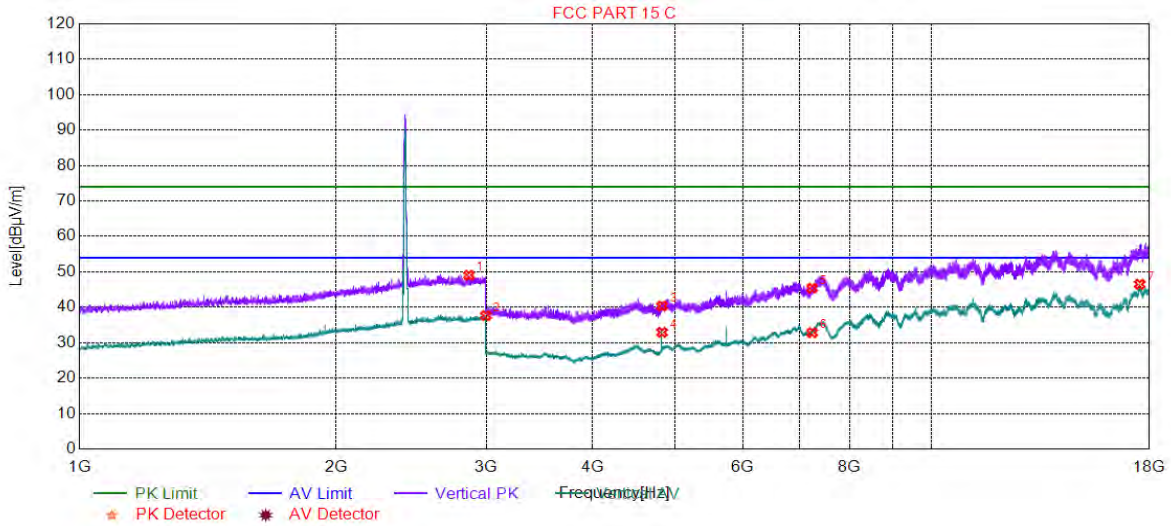
4.9.2 Transmitter emission above 1GHz

4.9.2.1 ANT1

4.9.2.1.1 802.11B_Lowest Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2863.46	49.02	2.22	74.00	24.98	150	228	Vertical
2	2997.49	37.67	2.33	54.00	16.33	150	360	Vertical
3	4824.00	40.35	-20.09	74.00	33.65	150	196	Vertical
4	4824.00	32.94	-20.09	54.00	21.06	150	131	Vertical
5	7236.00	45.40	-12.40	74.00	28.60	150	293	Vertical
6	7236.00	32.85	-12.40	54.00	21.15	150	18	Vertical
7	17530.9	46.51	0.75	54.00	7.49	150	86	Vertical

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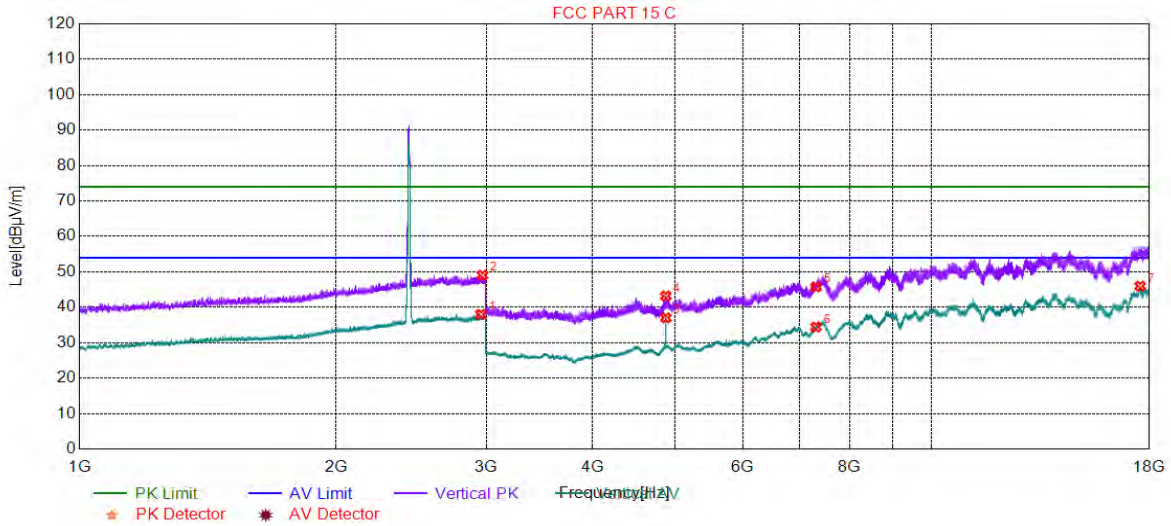
4.9.2.1.2 802.11B_ Middle Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2956.48	37.99	2.30	54.00	16.01	150	359	Vertical
2	2969.49	49.05	2.31	74.00	24.95	150	154	Vertical
3	4874.00	37.01	-19.37	54.00	16.99	150	138	Vertical
4	4874.00	43.19	-19.37	74.00	30.81	150	138	Vertical
5	7311.00	45.75	-11.50	74.00	28.25	150	350	Vertical
6	7311.00	34.45	-11.50	54.00	19.55	150	18	Vertical
7	17550.4	45.98	1.00	54.00	8.02	150	226	Vertical

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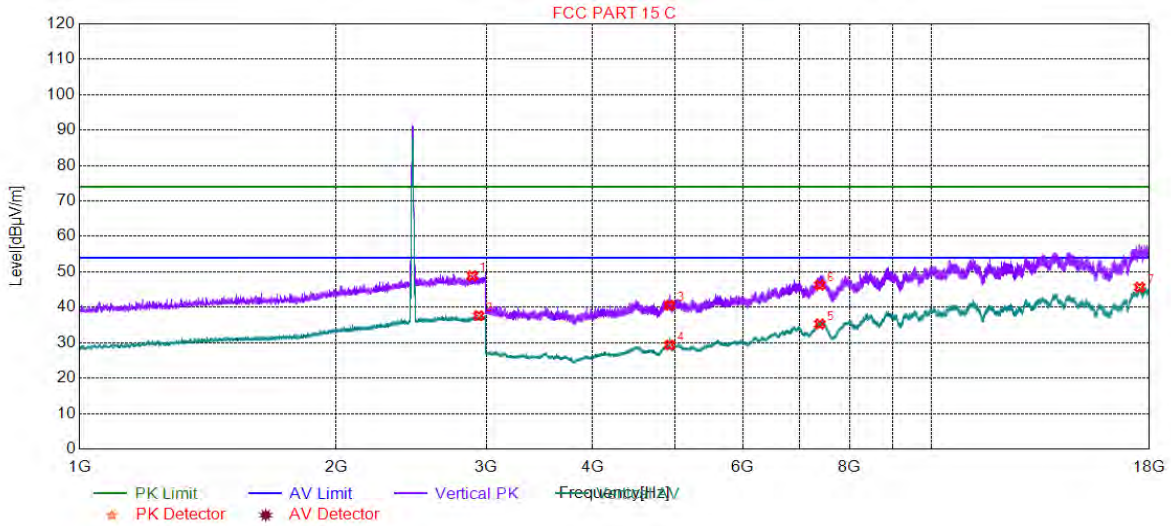
4.9.2.1.3 802.11B_ Highest Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2889.47	48.86	2.25	74.00	25.14	150	249	Vertical
2	2939.48	37.63	2.29	54.00	16.37	150	69	Vertical
3	4924.00	40.56	-18.87	74.00	33.44	150	261	Vertical
4	4924.00	29.34	-18.87	54.00	24.66	150	82	Vertical
5	7386.00	35.28	-10.72	54.00	18.72	150	212	Vertical
6	7386.00	46.24	-10.72	74.00	27.76	150	50	Vertical
7	17528.9	45.65	0.72	54.00	8.35	150	284	Vertical

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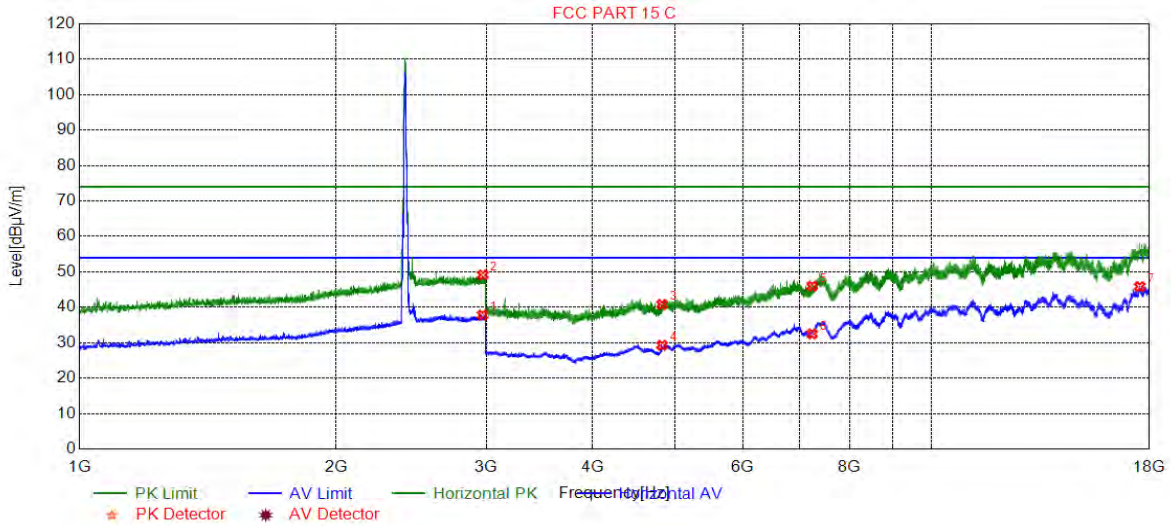
4.9.2.1.4 802.11B_Lowest Channel_ Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2969.49	37.79	2.31	54.00	16.21	150	23	Horizontal
2	2972.99	49.14	2.31	74.00	24.86	150	31	Horizontal
3	4824.00	40.79	-20.09	74.00	33.21	150	117	Horizontal
4	4824.00	29.28	-20.09	54.00	24.72	150	133	Horizontal
5	7236.00	45.97	-12.40	74.00	28.03	150	149	Horizontal
6	7236.00	32.49	-12.40	54.00	21.51	150	262	Horizontal
7	17532.4	45.85	0.77	54.00	8.15	150	114	Horizontal

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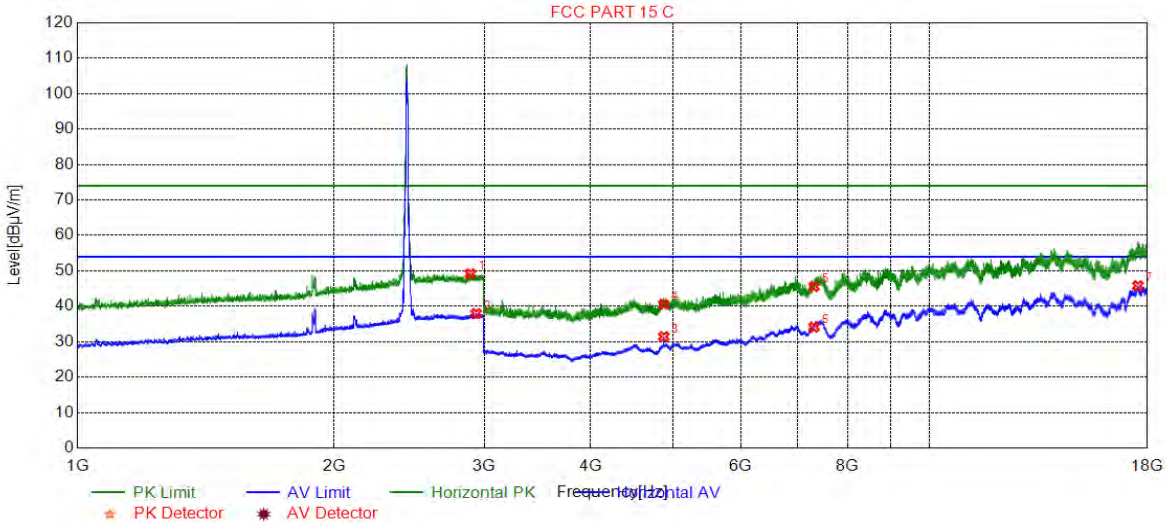
4.9.2.1.5 802.11B_ Middle Channel_ Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2890.47	49.18	2.25	74.00	24.82	150	1	Horizontal
2	2935.98	37.95	2.29	54.00	16.05	150	1	Horizontal
3	4874.00	31.43	-19.37	54.00	22.57	150	120	Horizontal
4	4874.00	40.55	-19.37	74.00	33.45	150	67	Horizontal
5	7311.00	45.57	-11.50	74.00	28.43	150	327	Horizontal
6	7311.00	34.10	-11.50	54.00	19.90	150	51	Horizontal
7	17540.4	45.80	0.87	54.00	8.20	150	18	Horizontal

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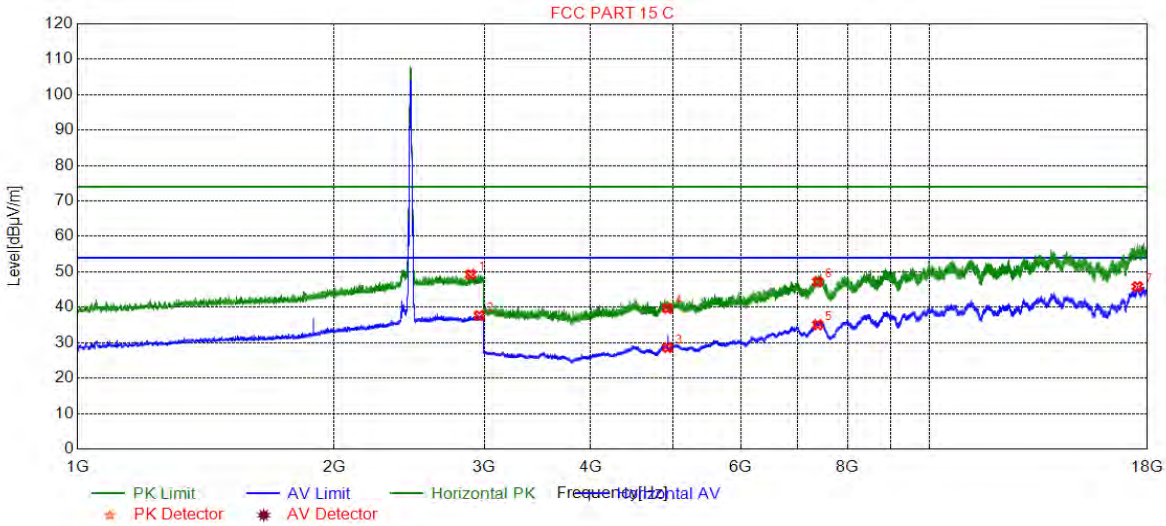
4.9.2.1.6 802.11B_ Highest Channel_ Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2891.47	49.25	2.25	74.00	24.75	150	33	Horizontal
2	2960.49	37.67	2.30	54.00	16.33	150	158	Horizontal
3	4924.00	28.64	-18.87	54.00	25.36	150	18	Horizontal
4	4924.00	39.68	-18.87	74.00	34.32	150	179	Horizontal
5	7386.00	35.07	-10.72	54.00	18.93	150	18	Horizontal
6	7386.00	47.21	-10.72	74.00	26.79	150	343	Horizontal
7	17517.4	45.85	0.57	54.00	8.15	150	256	Horizontal

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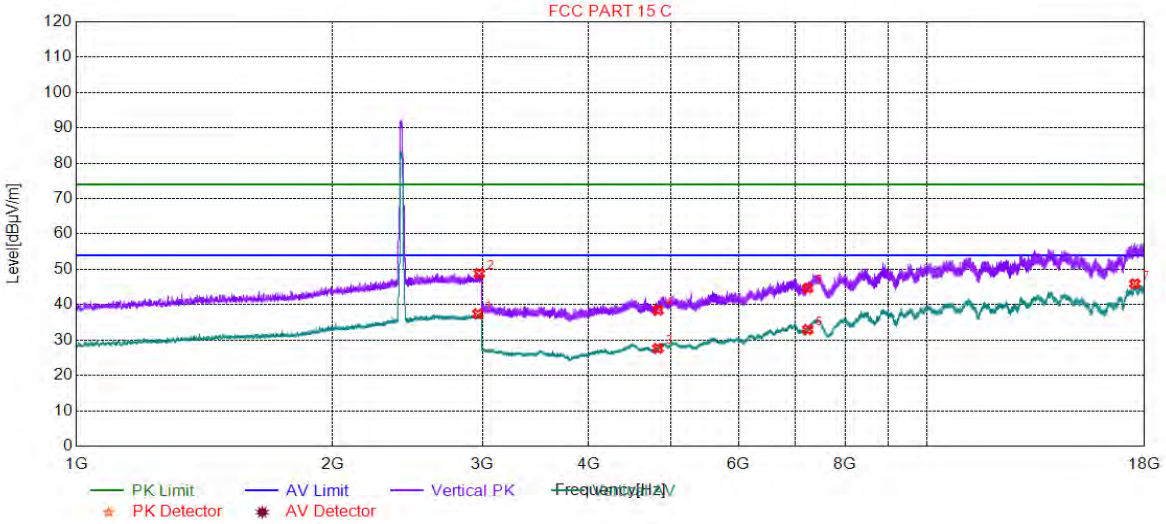
4.9.2.1.7 802.11G_Lowest Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2963.99	37.43	2.30	54.00	16.57	150	124	Vertical
2	2973.99	48.82	2.31	74.00	25.18	150	15	Vertical
3	4824.00	27.65	-20.09	54.00	26.35	150	34	Vertical
4	4824.00	38.46	-20.09	74.00	35.54	150	277	Vertical
5	7236.00	44.70	-12.40	74.00	29.30	150	245	Vertical
6	7236.00	32.99	-12.40	54.00	21.01	150	212	Vertical
7	17531.9	45.94	0.76	54.00	8.06	150	228	Vertical

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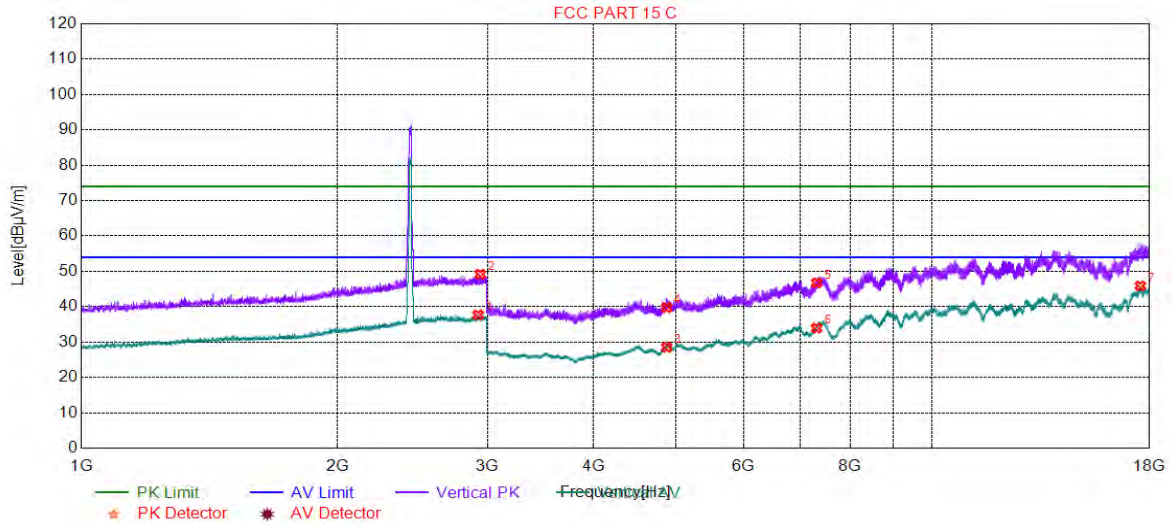
4.9.2.1.8 802.11G_ Middle Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2925.98	37.70	2.28	54.00	16.30	150	186	Vertical
2	2942.48	49.21	2.29	74.00	24.79	150	265	Vertical
3	4874.00	28.53	-19.37	54.00	25.47	150	313	Vertical
4	4874.00	39.74	-19.37	74.00	34.26	150	166	Vertical
5	7311.00	46.74	-11.50	74.00	27.26	150	263	Vertical
6	7311.00	33.95	-11.50	54.00	20.05	150	183	Vertical
7	17551.9	45.90	1.02	54.00	8.10	150	198	Vertical

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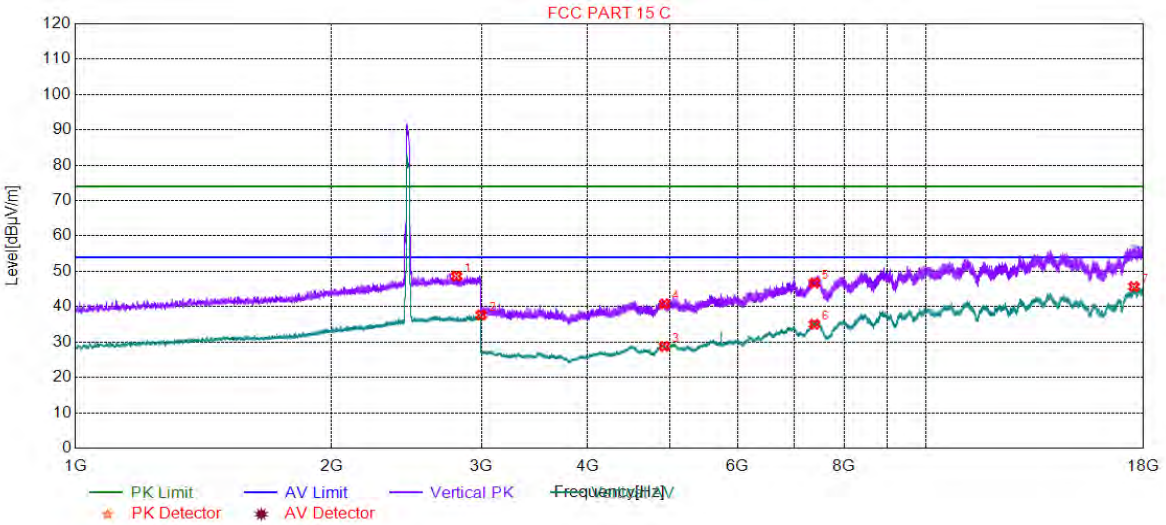
4.9.2.1.9 802.11G_ Highest Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2804.95	48.65	2.15	74.00	25.35	150	280	Vertical
2	2998.49	37.67	2.33	54.00	16.33	150	280	Vertical
3	4924.00	28.78	-18.87	54.00	25.22	150	131	Vertical
4	4924.00	40.82	-18.87	74.00	33.18	150	308	Vertical
5	7386.00	46.69	-10.72	74.00	27.31	150	18	Vertical
6	7386.00	35.03	-10.72	54.00	18.97	150	260	Vertical
7	17537.4	45.66	0.83	54.00	8.34	150	112	Vertical

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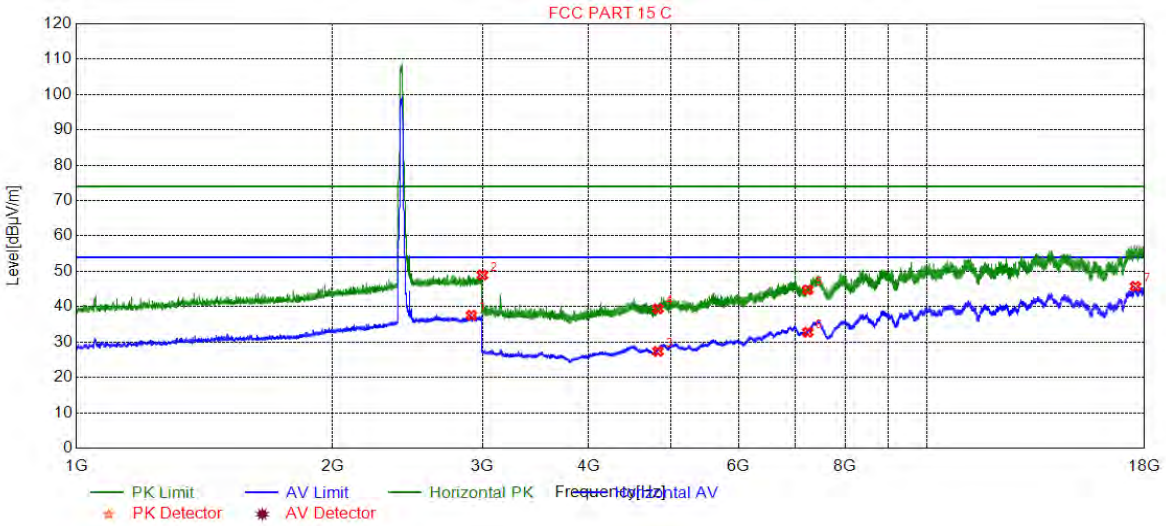
4.9.2.1.10 802.11G_Lowest Channel_ Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2912.47	37.56	2.27	54.00	16.44	150	80	Horizontal
2	2999.49	48.95	2.33	74.00	25.05	150	353	Horizontal
3	4824.00	27.37	-20.09	54.00	26.63	150	197	Horizontal
4	4824.00	39.42	-20.09	74.00	34.58	150	246	Horizontal
5	7236.00	44.78	-12.40	74.00	29.22	150	52	Horizontal
6	7236.00	32.81	-12.40	54.00	21.19	150	84	Horizontal
7	17553.4	45.74	1.03	54.00	8.26	150	227	Horizontal

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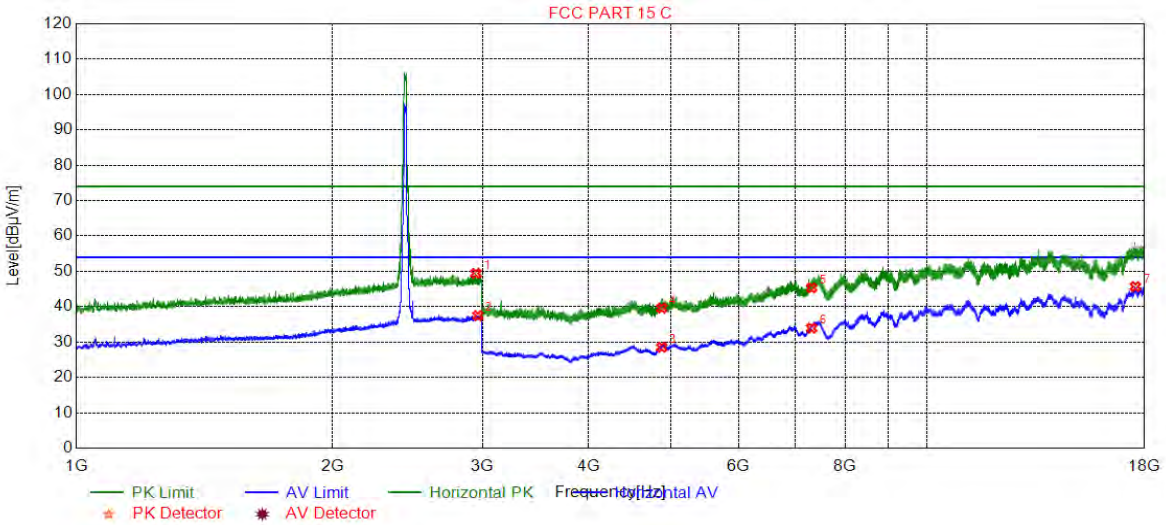
4.9.2.1.11 802.11G_ Middle Channel_ Horizontal



NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2947.98	49.41	2.29	74.00	24.59	150	183	Horizontal
2	2963.99	37.48	2.30	54.00	16.52	150	150	Horizontal
3	4874.00	28.53	-19.37	54.00	25.47	150	181	Horizontal
4	4874.00	39.62	-19.37	74.00	34.38	150	34	Horizontal
5	7311.00	45.31	-11.50	74.00	28.69	150	18	Horizontal
6	7311.00	33.95	-11.50	54.00	20.05	150	131	Horizontal
7	17556.9	45.69	1.08	54.00	8.31	150	113	Horizontal

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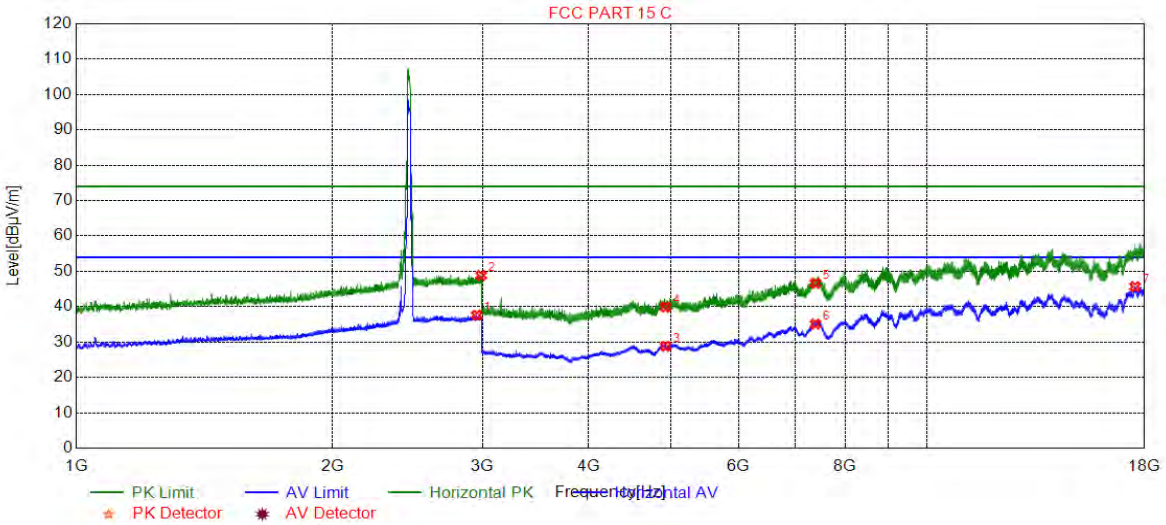
4.9.2.1.12 802.11G_ Highest Channel_ Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2954.98	37.60	2.30	54.00	16.40	150	229	Horizontal
2	2989.49	48.84	2.32	74.00	25.16	150	103	Horizontal
3	4924.00	28.82	-18.87	54.00	25.18	150	52	Horizontal
4	4924.00	39.93	-18.87	74.00	34.07	150	265	Horizontal
5	7386.00	46.63	-10.72	74.00	27.37	150	18	Horizontal
6	7386.00	35.11	-10.72	54.00	18.89	150	34	Horizontal
7	17537.4	45.68	0.83	54.00	8.32	150	285	Horizontal

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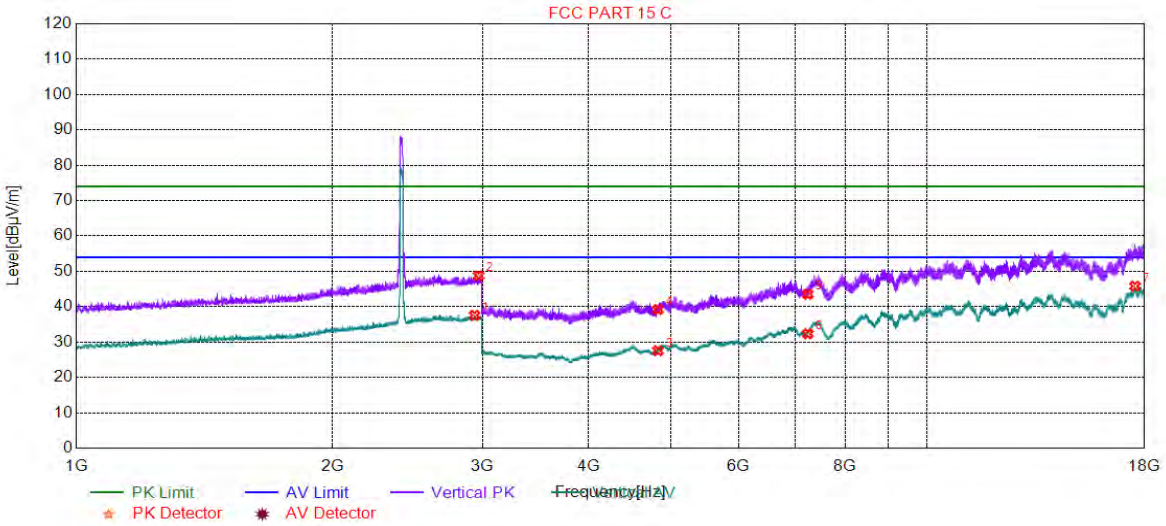
4.9.2.1.13 802.11N20_Lowest Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2937.48	37.59	2.29	54.00	16.41	150	203	Vertical
2	2968.99	48.77	2.31	74.00	25.23	150	327	Vertical
3	4824.00	27.56	-20.09	54.00	26.44	150	260	Vertical
4	4824.00	39.22	-20.09	74.00	34.78	150	293	Vertical
5	7236.00	43.52	-12.40	74.00	30.48	150	18	Vertical
6	7236.00	32.34	-12.40	54.00	21.66	150	309	Vertical
7	17534.9	45.83	0.80	54.00	8.17	150	253	Vertical

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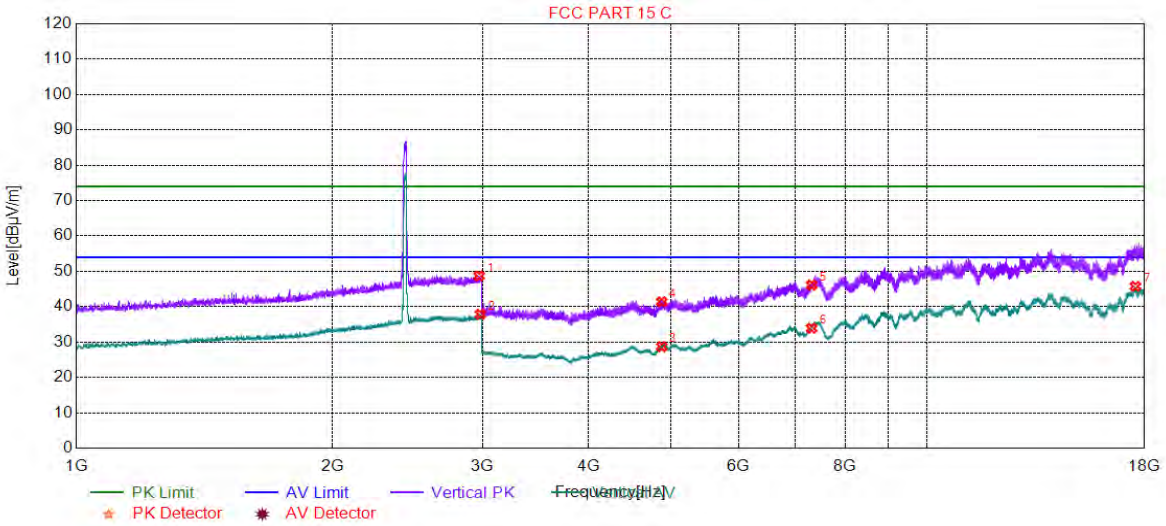
4.9.2.1.14 802.11N20_ Middle Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2973.49	48.71	2.31	74.00	25.29	150	60	Vertical
2	2983.99	37.87	2.32	54.00	16.13	150	107	Vertical
3	4874.00	28.70	-19.37	54.00	25.30	150	261	Vertical
4	4874.00	41.39	-19.37	74.00	32.61	150	132	Vertical
5	7311.00	46.14	-11.50	74.00	27.86	150	197	Vertical
6	7311.00	33.92	-11.50	54.00	20.08	150	277	Vertical
7	17553.9	45.76	1.04	54.00	8.24	150	26	Vertical

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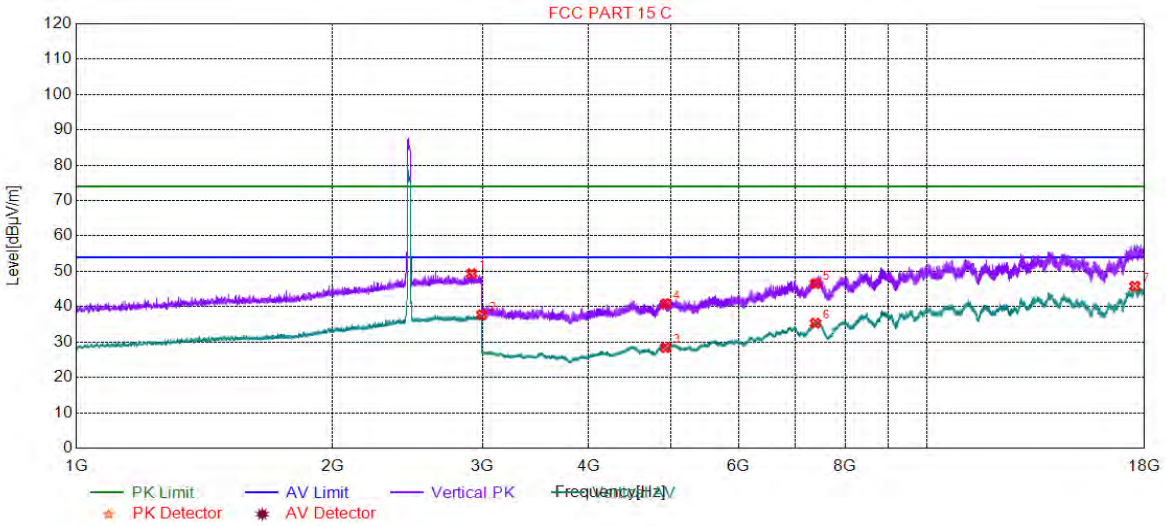
4.9.2.1.15 802.11N20_ Highest Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2913.97	49.35	2.27	74.00	24.65	150	288	Vertical
2	2995.99	37.71	2.33	54.00	16.29	150	334	Vertical
3	4924.00	28.43	-18.87	54.00	25.57	150	277	Vertical
4	4924.00	40.83	-18.87	74.00	33.17	150	67	Vertical
5	7386.00	46.51	-10.72	74.00	27.49	150	180	Vertical
6	7386.00	35.32	-10.72	54.00	18.68	150	180	Vertical
7	17528.9	45.80	0.72	54.00	8.20	150	199	Vertical

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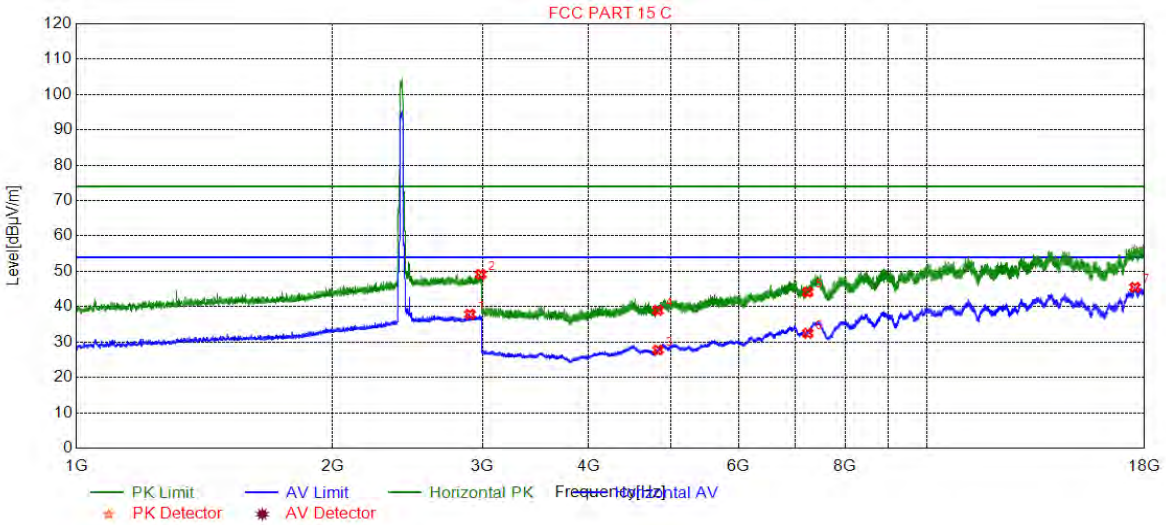
4.9.2.1.16 802.11N20_Lowest Channel_ Horizontal



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2901.47	37.86	2.26	54.00	16.14	150	48	Horizontal
2	2986.49	49.13	2.32	74.00	24.87	150	189	Horizontal
3	4824.00	27.77	-20.09	54.00	26.23	150	281	Horizontal
4	4824.00	38.96	-20.09	74.00	35.04	150	249	Horizontal
5	7236.00	44.11	-12.40	74.00	29.89	150	34	Horizontal
6	7236.00	32.51	-12.40	54.00	21.49	150	297	Horizontal
7	17537.4	45.49	0.83	54.00	8.51	150	285	Horizontal

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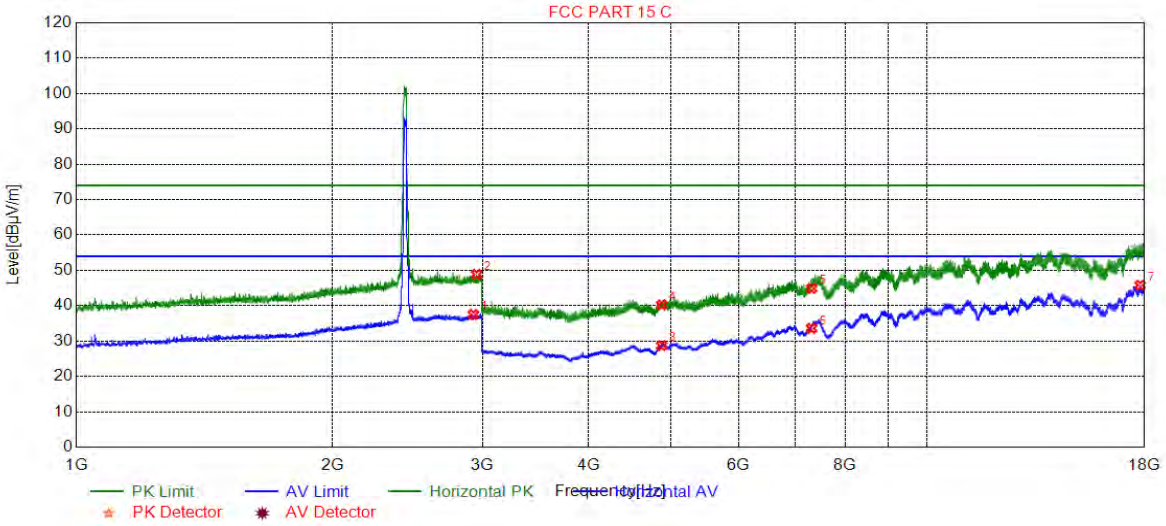
4.9.2.1.17 802.11N20_ Middle Channel_ Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2926.98	37.51	2.28	54.00	16.49	150	142	Horizontal
2	2953.48	48.86	2.30	74.00	25.14	150	56	Horizontal
3	4874.00	28.72	-19.37	54.00	25.28	150	268	Horizontal
4	4874.00	40.24	-19.37	74.00	33.76	150	252	Horizontal
5	7311.00	44.91	-11.50	74.00	29.09	150	18	Horizontal
6	7311.00	33.60	-11.50	54.00	20.40	150	268	Horizontal
7	17786.9	45.79	-0.80	54.00	8.21	150	199	Horizontal

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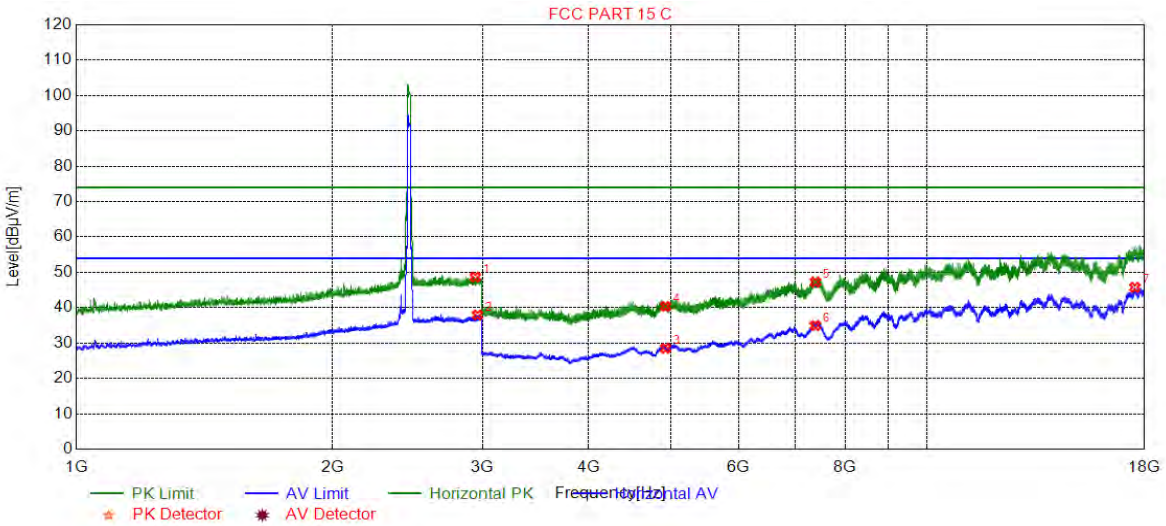
4.9.2.1.18 802.11N20_ Highest Channel_ Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2942.48	48.67	2.29	74.00	25.33	150	359	Horizontal
2	2960.99	37.94	2.30	54.00	16.06	150	341	Horizontal
3	4924.00	28.53	-18.87	54.00	25.47	150	360	Horizontal
4	4924.00	40.37	-18.87	74.00	33.63	150	176	Horizontal
5	7386.00	47.25	-10.72	74.00	26.75	150	225	Horizontal
6	7386.00	34.96	-10.72	54.00	19.04	150	72	Horizontal
7	17532.9	45.74	0.77	54.00	8.26	150	2	Horizontal

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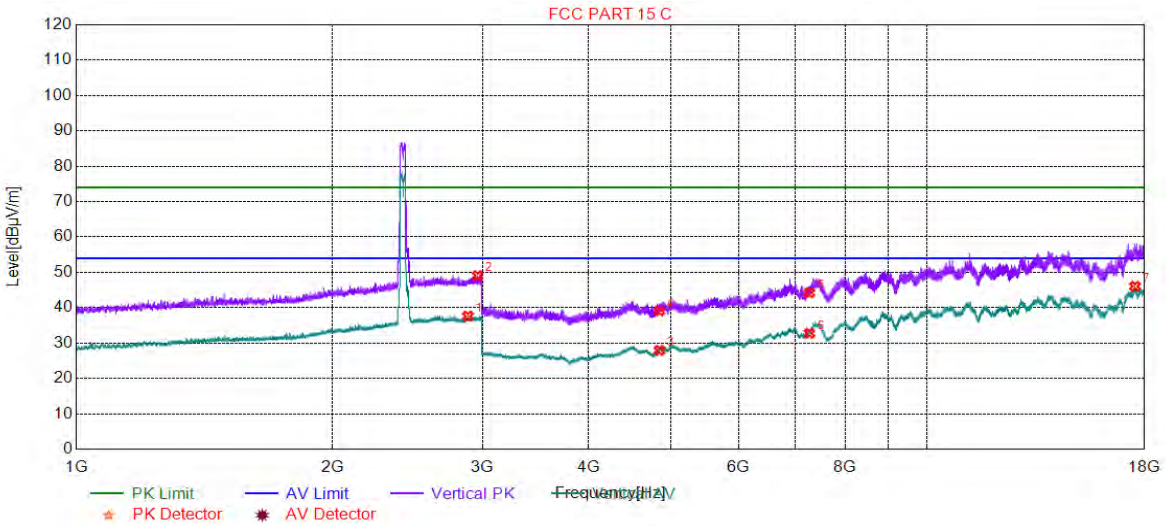
4.9.2.1.19 802.11N40_Lowest Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2884.97	37.64	2.24	54.00	16.36	150	257	Vertical
2	2961.99	49.06	2.30	74.00	24.94	150	117	Vertical
3	4844.00	27.95	-19.80	54.00	26.05	150	356	Vertical
4	4844.00	39.11	-19.80	74.00	34.89	150	115	Vertical
5	7266.00	44.21	-12.03	74.00	29.79	150	82	Vertical
6	7266.00	32.77	-12.03	54.00	21.23	150	292	Vertical
7	17538.4	46.05	0.84	54.00	7.95	150	104	Vertical

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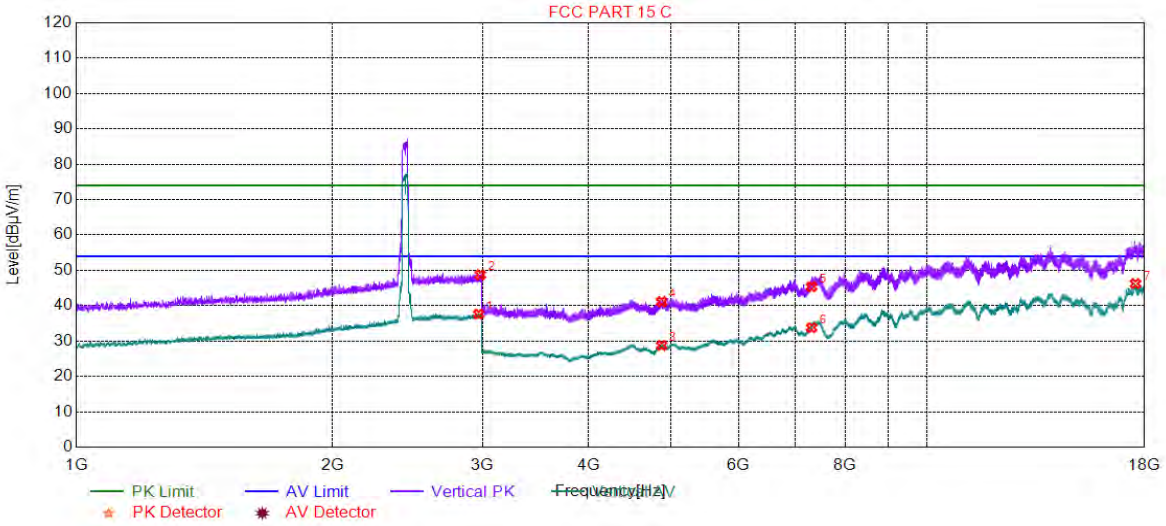
4.9.2.1.20 802.11N40_ Middle Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2969.99	37.63	2.31	54.00	16.37	150	276	Vertical
2	2983.49	48.74	2.32	74.00	25.26	150	189	Vertical
3	4874.00	28.78	-19.37	54.00	25.22	150	244	Vertical
4	4874.00	41.14	-19.37	74.00	32.86	150	260	Vertical
5	7311.00	45.40	-11.50	74.00	28.60	150	18	Vertical
6	7311.00	33.80	-11.50	54.00	20.20	150	341	Vertical
7	17557.9	46.26	1.09	54.00	7.74	150	257	Vertical

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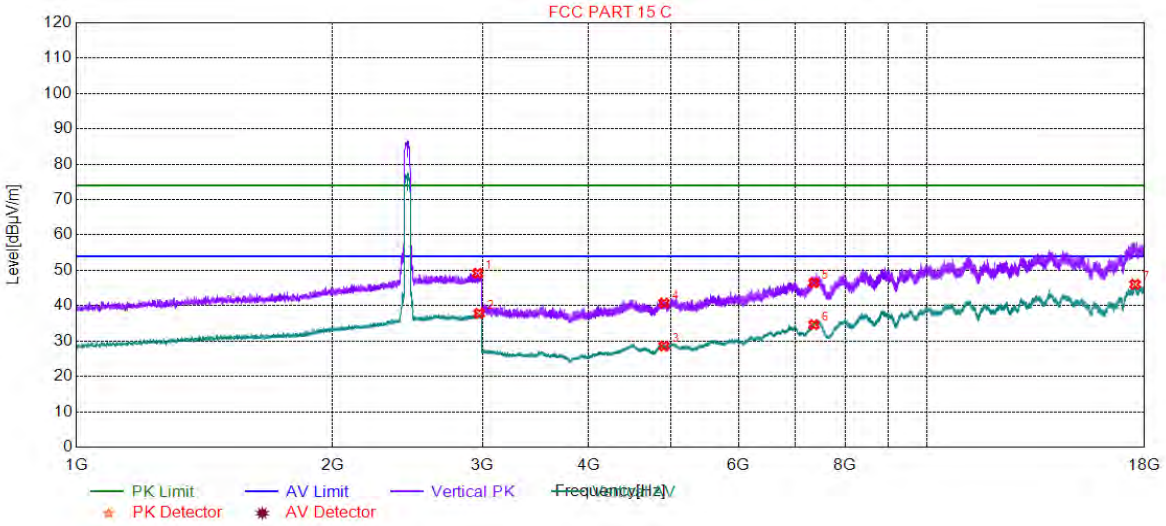
4.9.2.1.21 802.11N40_ Highest Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2962.49	49.18	2.30	74.00	24.82	150	343	Vertical
2	2973.49	37.84	2.31	54.00	16.16	150	273	Vertical
3	4904.00	28.59	-18.98	54.00	25.41	150	100	Vertical
4	4904.00	40.74	-18.98	74.00	33.26	150	360	Vertical
5	7356.00	46.47	-11.03	74.00	27.53	150	148	Vertical
6	7356.00	34.65	-11.03	54.00	19.35	150	67	Vertical
7	17538.4	46.05	0.84	54.00	7.95	150	171	Vertical

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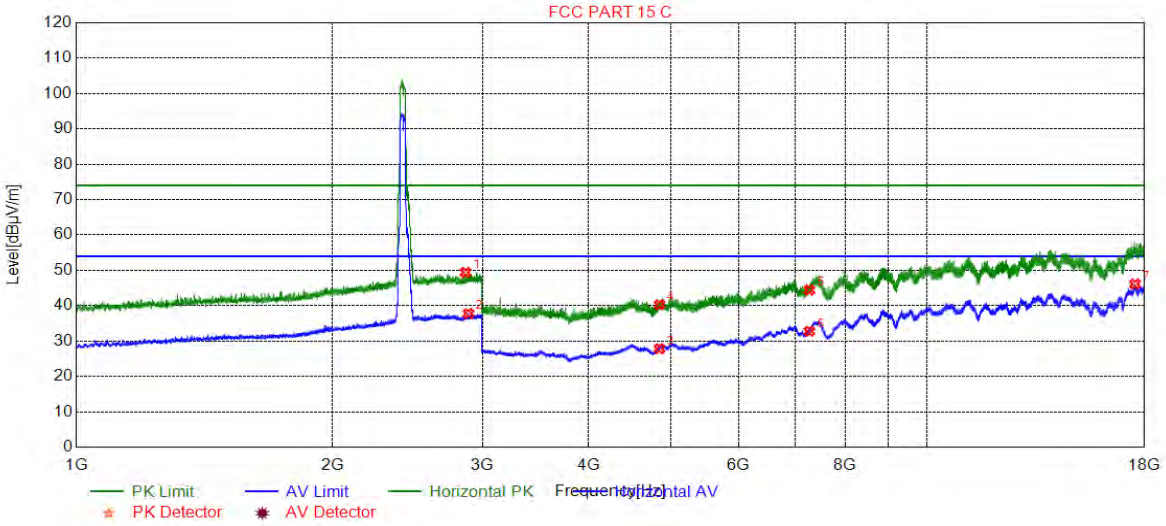
4.9.2.1.22 802.11N40_Lowest Channel_ Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2865.96	49.42	2.22	74.00	24.58	150	188	Horizontal
2	2888.97	37.80	2.25	54.00	16.20	150	352	Horizontal
3	4844.00	27.86	-19.80	54.00	26.14	150	277	Horizontal
4	4844.00	40.26	-19.80	74.00	33.74	150	115	Horizontal
5	7266.00	44.44	-12.03	74.00	29.56	150	115	Horizontal
6	7266.00	32.77	-12.03	54.00	21.23	150	18	Horizontal
7	17538.9	46.15	0.85	54.00	7.85	150	228	Horizontal

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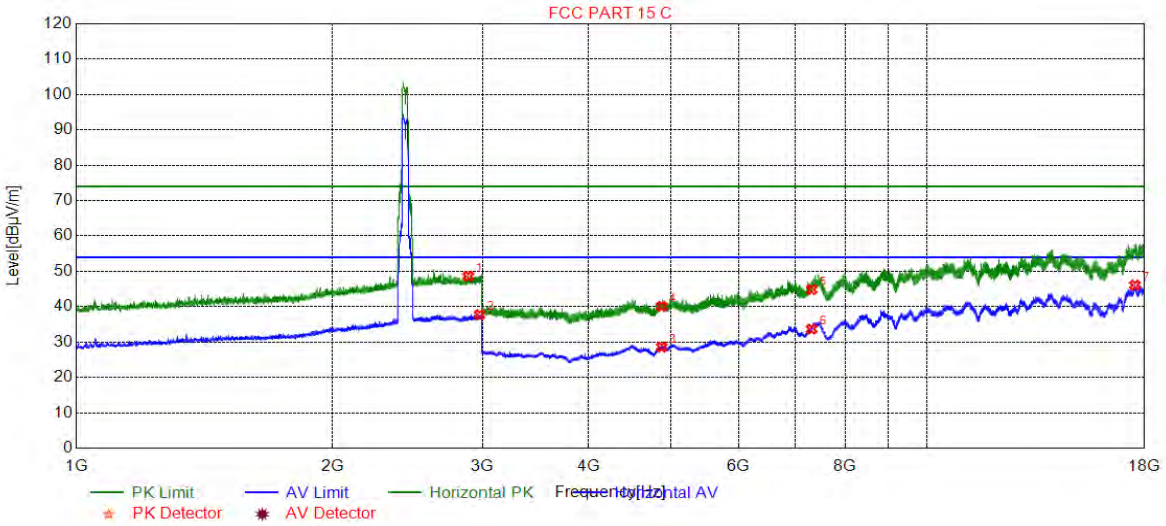
4.9.2.1.23 802.11N40_ Middle Channel_ Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2887.97	48.62	2.25	74.00	25.38	150	157	Horizontal
2	2976.99	37.77	2.31	54.00	16.23	150	141	Horizontal
3	4874.00	28.59	-19.37	54.00	25.41	150	83	Horizontal
4	4874.00	40.09	-19.37	74.00	33.91	150	277	Horizontal
5	7311.00	44.85	-11.50	74.00	29.15	150	277	Horizontal
6	7311.00	33.67	-11.50	54.00	20.33	150	34	Horizontal
7	17532.4	46.10	0.77	54.00	7.90	150	85	Horizontal

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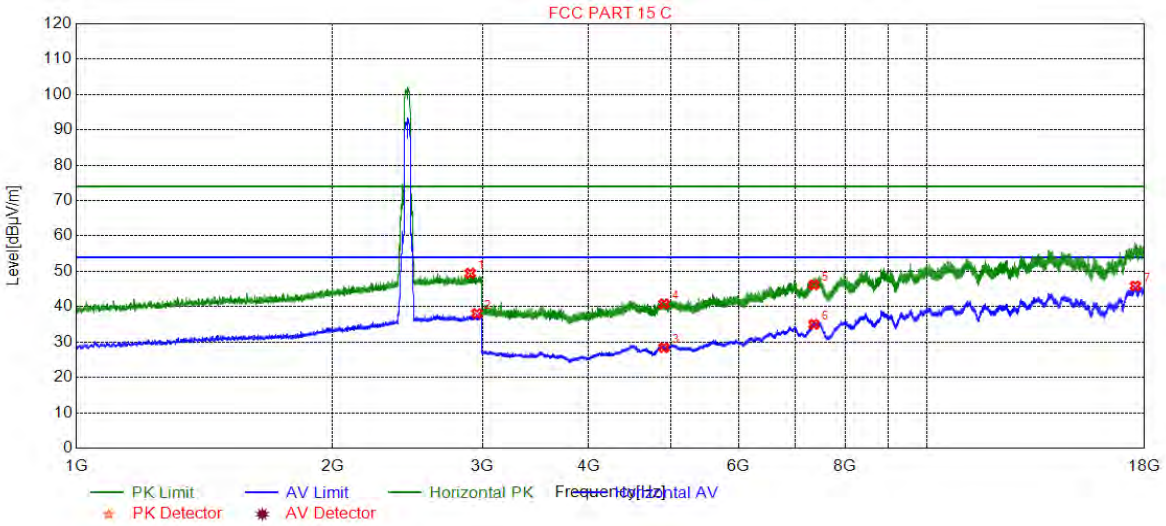
4.9.2.1.24 802.11N40_ Highest Channel_ Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2902.47	49.46	2.26	74.00	24.54	150	243	Horizontal
2	2955.48	38.08	2.30	54.00	15.92	150	337	Horizontal
3	4904.00	28.45	-18.98	54.00	25.55	150	281	Horizontal
4	4904.00	40.78	-18.98	74.00	33.22	150	329	Horizontal
5	7356.00	46.19	-11.03	74.00	27.81	150	232	Horizontal
6	7356.00	35.03	-11.03	54.00	18.97	150	18	Horizontal
7	17555.4	45.88	1.06	54.00	8.12	150	342	Horizontal

Remark:

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

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

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

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

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

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4.10 Restricted bands around fundamental frequency

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

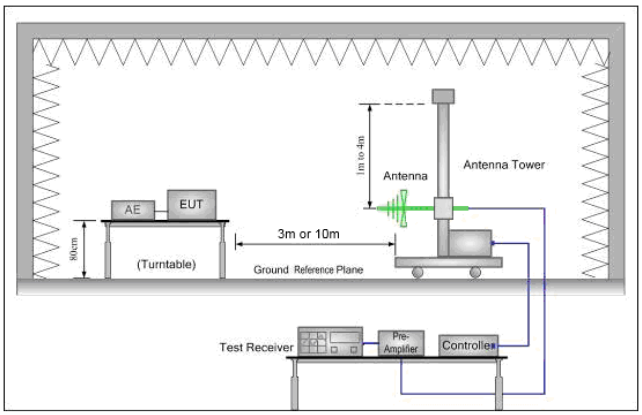

Figure 1. 30MHz to 1GHz

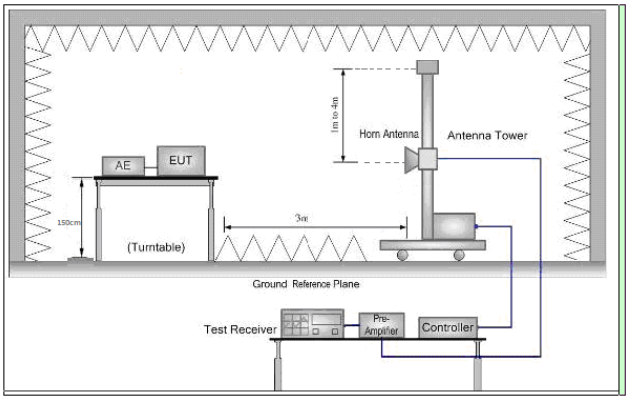

Figure 2. Above 1 GHz

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Test Procedure:	a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. g. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel h. Test the EUT in the lowest channel , the Highest channel i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode,And found the X axis positioning which it is worse case. j. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates. Charge + Transmitting mode.
Final Test Mode:	Pretest the EUT at Charge +Transmitting mode. Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G ; 6.5Mbps of rate is the worst case of 802.11N(HT20); 13.5Mbps of rate is the worst case of 802.11N(HT40). Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

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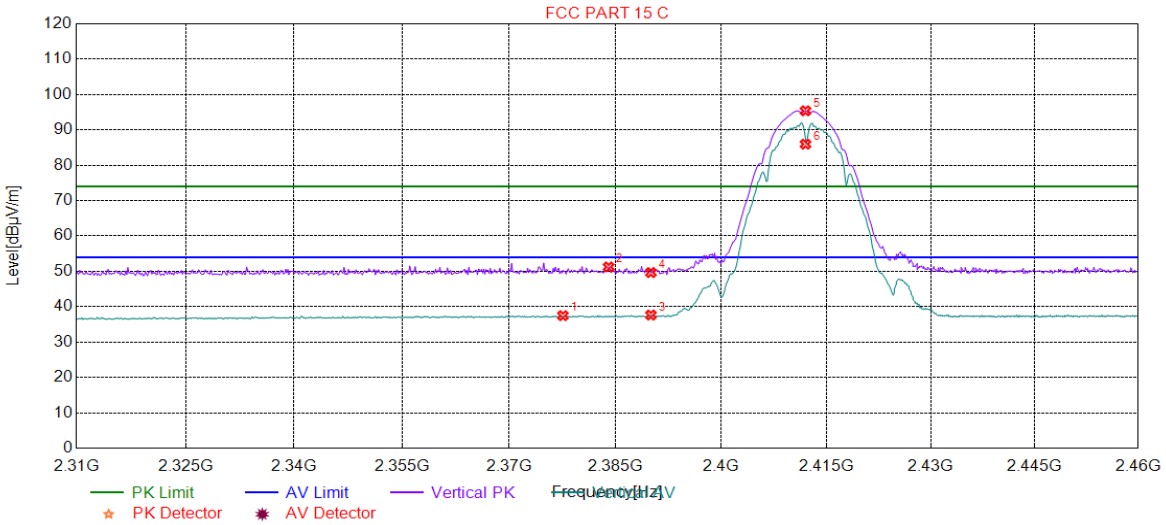
Test plot as follows:

4.10.1 ANT1

4.10.1.1 802.11B_Lowest Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2377.56	37.48	1.19	54.00	16.52	150	240	Vertical
2	2384.02	51.24	1.22	74.00	22.76	150	20	Vertical
3	2390.00	37.65	1.25	54.00	16.35	150	128	Vertical
4	2390.00	49.66	1.25	74.00	24.34	150	190	Vertical
5	2412.00	95.39	1.32	74.00	-21.39	150	134	Vertical
6	2412.00	85.96	1.32	54.00	-31.96	150	131	Vertical

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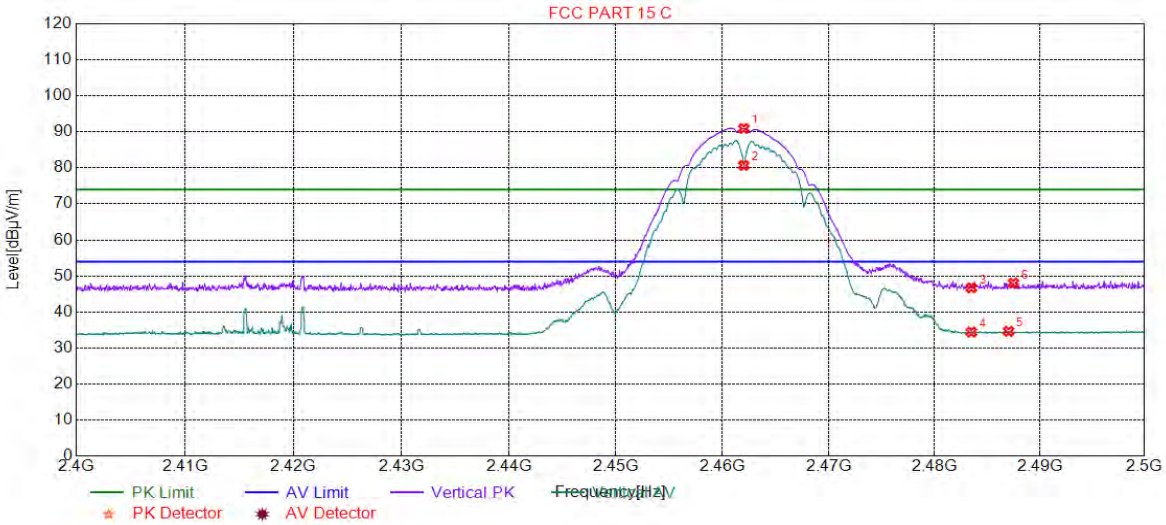
4.10.1.2 802.11B_ Highest Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	90.94	1.46	74.00	-16.94	150	133	Vertical
2	2462.00	80.71	1.46	54.00	-26.71	150	126	Vertical
3	2483.50	46.70	1.52	74.00	27.30	150	214	Vertical
4	2483.50	34.43	1.52	54.00	19.57	150	68	Vertical
5	2487.04	34.63	1.53	54.00	19.37	150	324	Vertical
6	2487.49	48.03	1.53	74.00	25.97	150	52	Vertical

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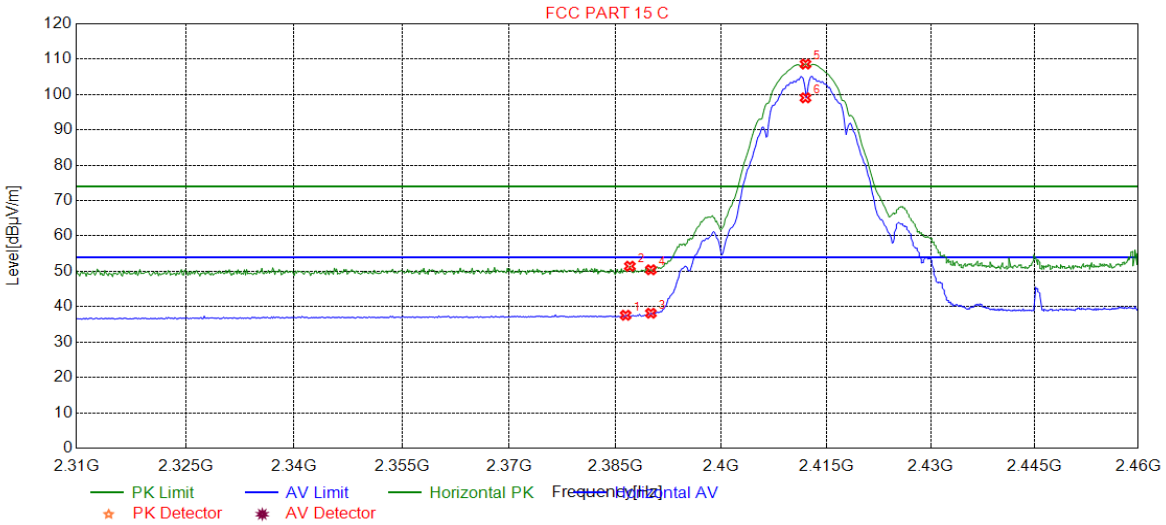
4.10.1.3 802.11B_Lowest Channel_ Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2386.42	37.59	1.23	54.00	16.41	150	94	Horizontal
2	2387.02	51.45	1.23	74.00	22.55	150	294	Horizontal
3	2390.00	38.16	1.25	54.00	15.84	150	113	Horizontal
4	2390.00	50.45	1.25	74.00	23.55	150	110	Horizontal
5	2412.00	108.60	1.32	74.00	-34.60	150	113	Horizontal
6	2412.00	99.06	1.32	54.00	-45.06	150	113	Horizontal

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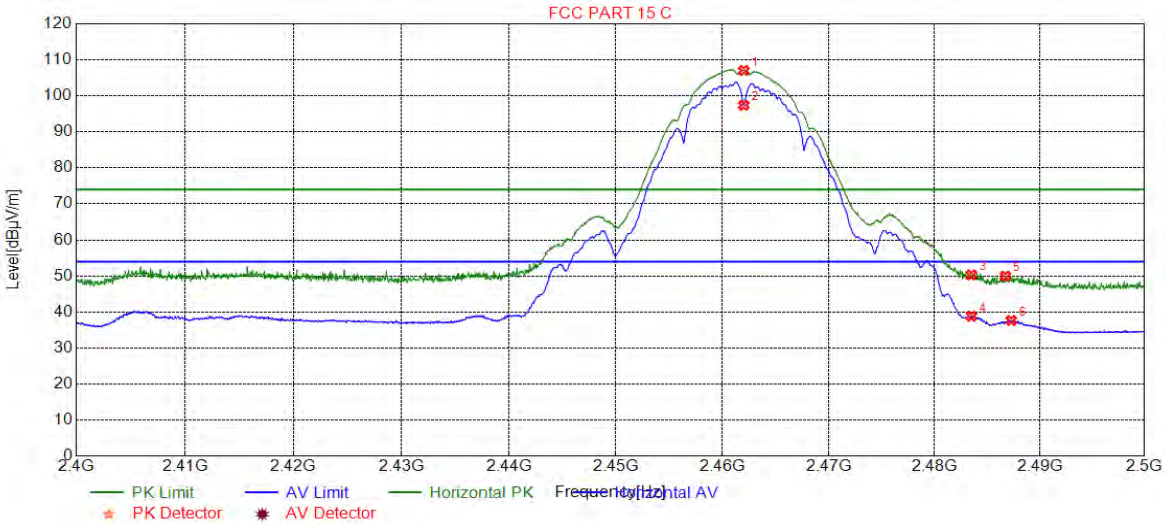
4.10.1.4 802.11B_ Highest Channel_ Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	107.03	1.46	74.00	-33.03	150	296	Horizontal
2	2462.00	97.38	1.46	54.00	-43.38	150	296	Horizontal
3	2483.50	50.31	1.52	74.00	23.69	150	299	Horizontal
4	2483.50	38.85	1.52	54.00	15.15	150	299	Horizontal
5	2486.74	49.97	1.53	74.00	24.03	150	108	Horizontal
6	2487.29	37.66	1.53	54.00	16.34	150	307	Horizontal

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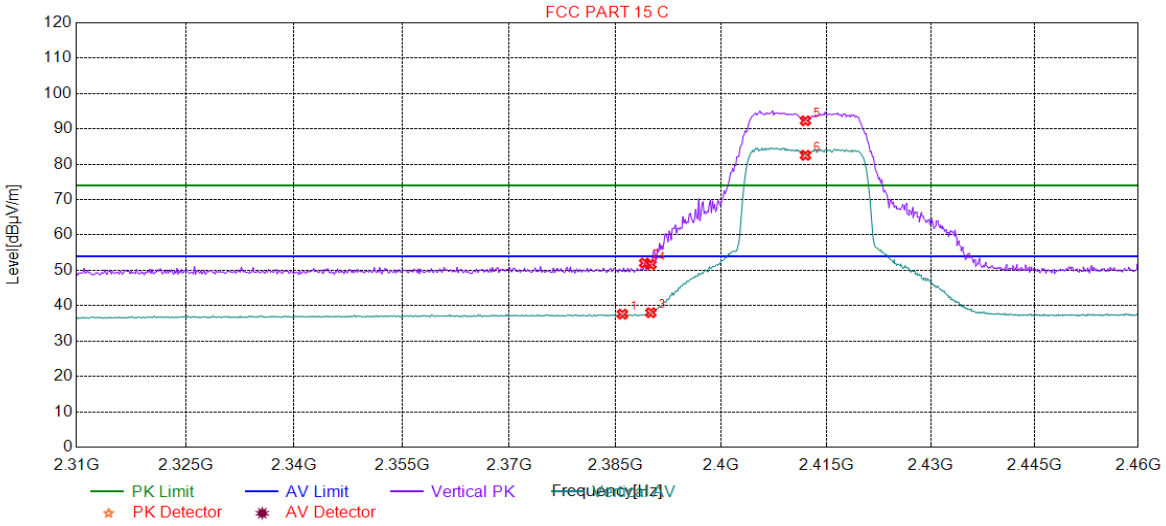
4.10.1.5 802.11G_Lowest Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2385.97	37.62	1.23	54.00	16.38	150	260	Vertical
2	2389.12	52.06	1.24	74.00	21.94	150	14	Vertical
3	2390.00	38.03	1.25	54.00	15.97	150	26	Vertical
4	2390.00	51.64	1.25	74.00	22.36	150	14	Vertical
5	2412.00	92.28	1.32	74.00	-18.28	150	132	Vertical
6	2412.00	82.53	1.32	54.00	-28.53	150	135	Vertical

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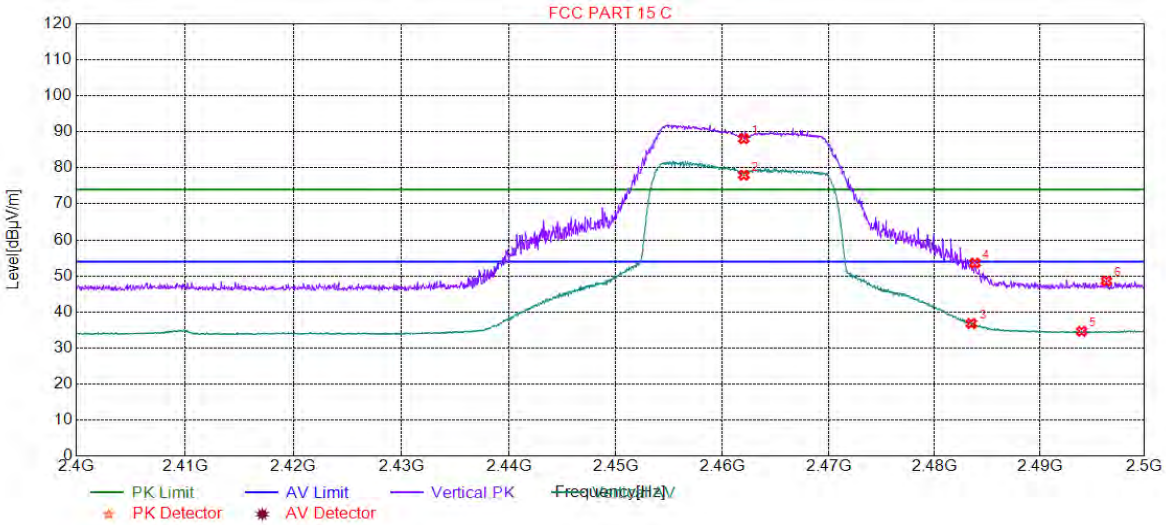
4.10.1.6 802.11G_ Highest Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	88.09	1.46	74.00	-14.09	150	36	Vertical
2	2462.00	77.97	1.46	54.00	-23.97	150	40	Vertical
3	2483.50	36.80	1.52	54.00	17.20	150	137	Vertical
4	2483.84	53.59	1.52	74.00	20.41	150	258	Vertical
5	2493.99	34.64	1.55	54.00	19.36	150	114	Vertical
6	2496.34	48.60	1.56	74.00	25.40	150	194	Vertical

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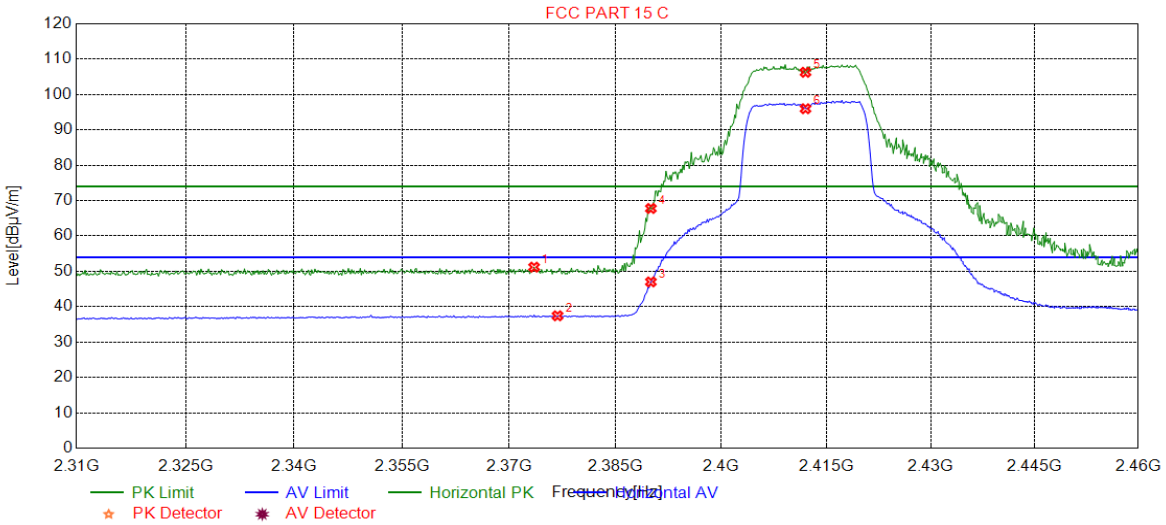
4.10.1.7 802.11G_Lowest Channel_ Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2373.51	51.19	1.17	74.00	22.81	150	63	Horizontal
2	2376.81	37.43	1.19	54.00	16.57	150	112	Horizontal
3	2390.00	47.02	1.25	54.00	6.98	150	296	Horizontal
4	2390.00	67.78	1.25	74.00	6.22	150	315	Horizontal
5	2412.00	106.29	1.32	74.00	-32.29	150	293	Horizontal
6	2412.00	95.98	1.32	54.00	-41.98	150	296	Horizontal

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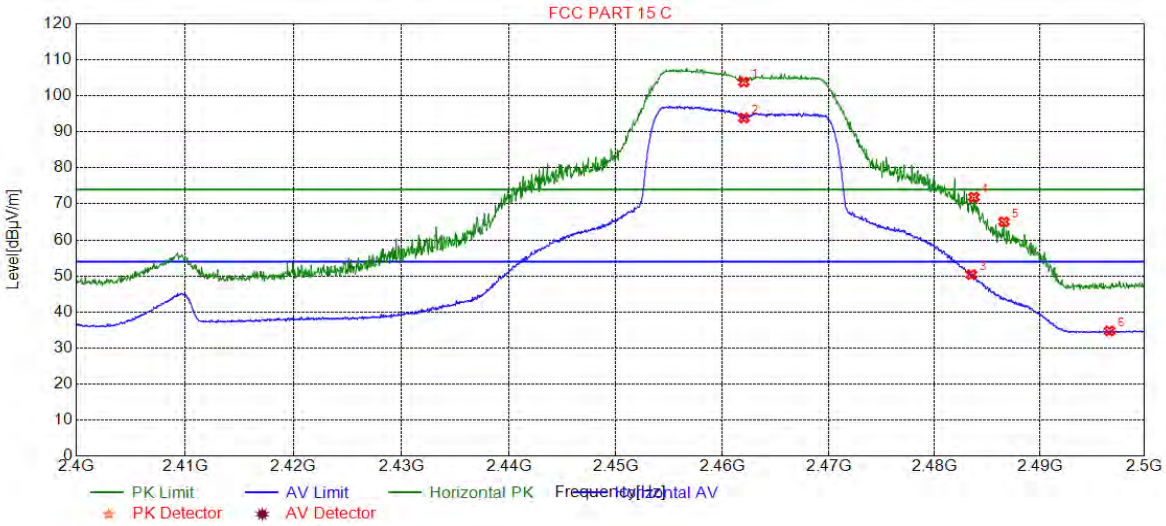
4.10.1.8 802.11G_ Highest Channel_ Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	103.83	1.46	74.00	-29.83	150	305	Horizontal
2	2462.00	93.83	1.46	54.00	-39.83	150	107	Horizontal
3	2483.50	50.37	1.52	54.00	3.63	150	313	Horizontal
4	2483.74	71.86	1.52	74.00	2.14	150	309	Horizontal
5	2486.59	65.03	1.53	74.00	8.97	150	309	Horizontal
6	2496.64	34.75	1.56	54.00	19.25	150	137	Horizontal

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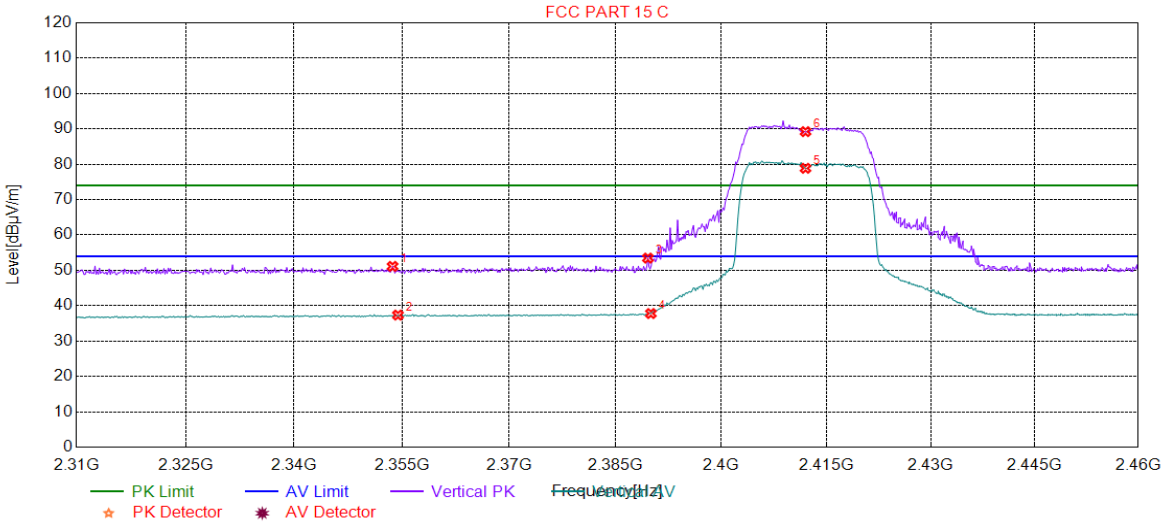
4.10.1.9 802.11N20_Lowest Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2353.69	51.12	1.09	74.00	22.88	150	358	Vertical
2	2354.44	37.35	1.09	54.00	16.65	150	120	Vertical
3	2389.57	53.46	1.24	74.00	20.54	150	260	Vertical
4	2390.00	37.79	1.25	54.00	16.21	150	126	Vertical
5	2412.00	78.86	1.32	54.00	-24.86	150	135	Vertical
6	2412.00	89.23	1.32	74.00	-15.23	150	138	Vertical

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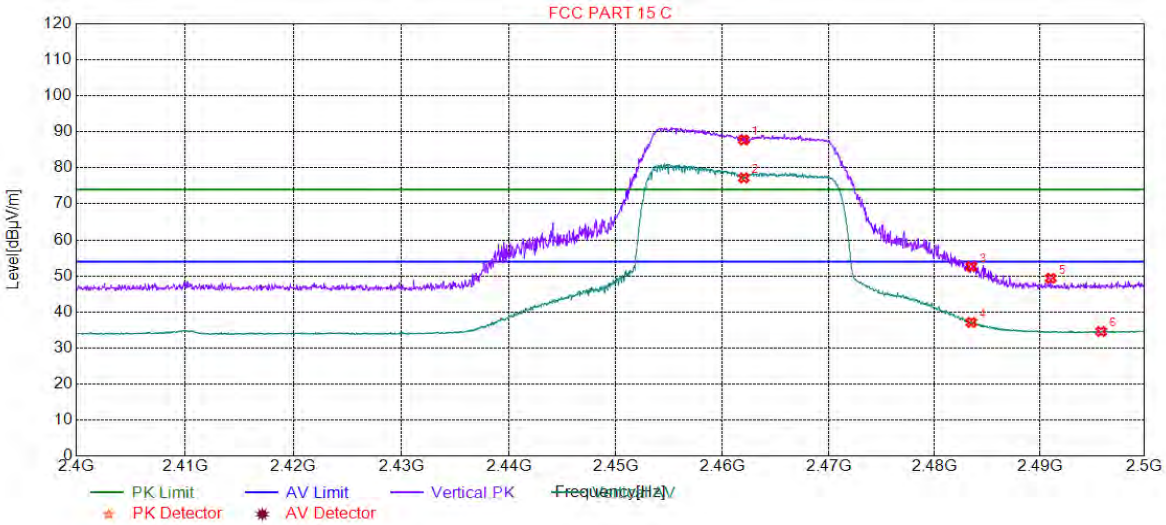
4.10.1.10 802.11N20_ Highest Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	87.76	1.46	74.00	-13.76	150	36	Vertical
2	2462.00	77.20	1.46	54.00	-23.20	150	40	Vertical
3	2483.50	52.61	1.52	74.00	21.39	150	48	Vertical
4	2483.50	37.10	1.52	54.00	16.90	150	138	Vertical
5	2491.04	49.36	1.54	74.00	24.64	150	207	Vertical
6	2495.84	34.59	1.56	54.00	19.41	150	97	Vertical

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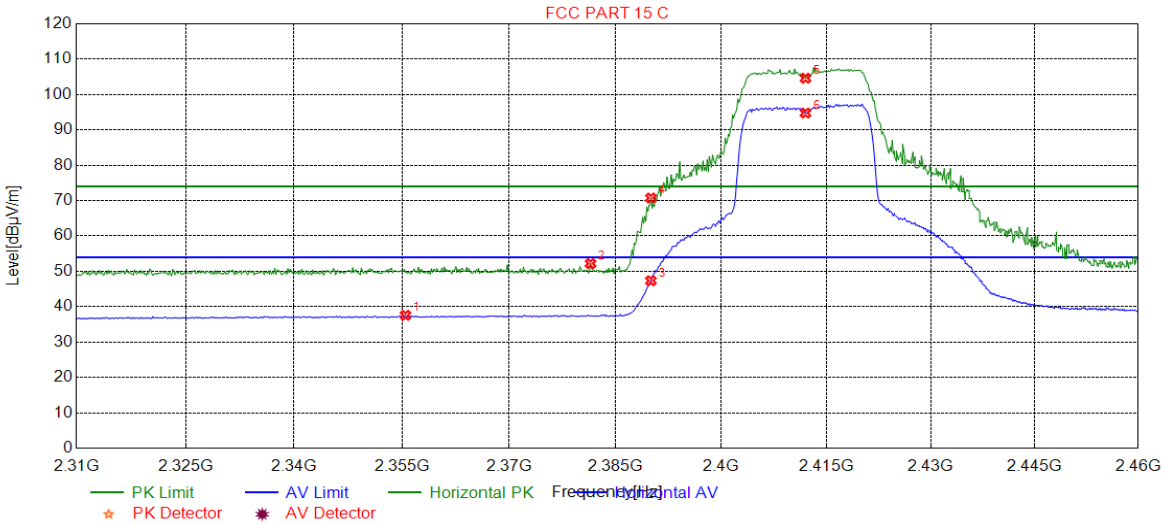
4.10.1.11 802.11N20_Lowest Channel_ Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2355.49	37.58	1.09	54.00	16.42	150	346	Horizontal
2	2381.47	52.21	1.21	74.00	21.79	150	180	Horizontal
3	2390.00	47.35	1.25	54.00	6.65	150	109	Horizontal
4	2390.00	70.74	1.25	74.00	3.26	150	118	Horizontal
5	2412.00	104.61	1.32	74.00	-30.61	150	97	Horizontal
6	2412.00	94.77	1.32	54.00	-40.77	150	115	Horizontal

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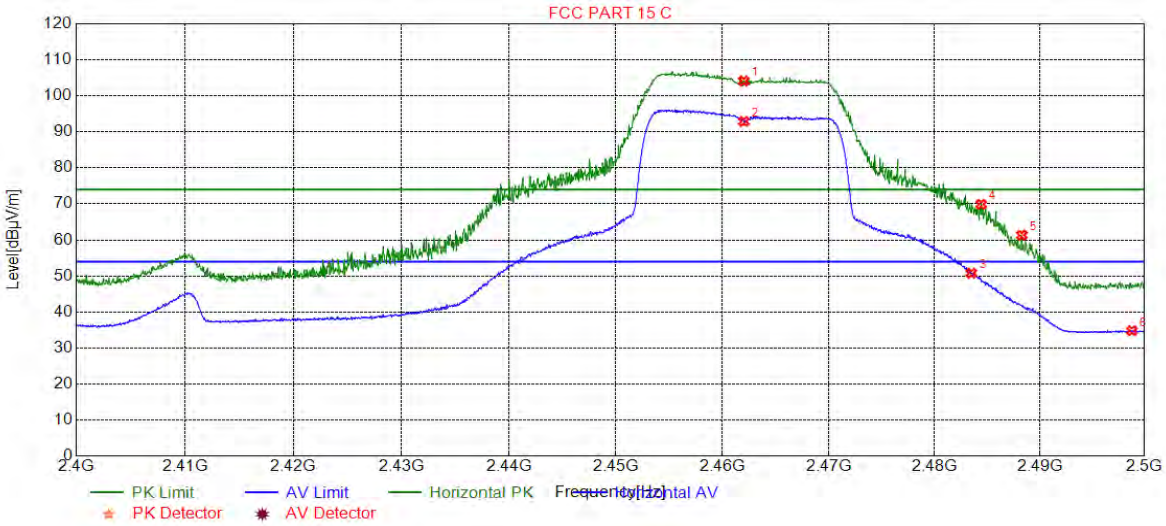
4.10.1.12 802.11N20_ Highest Channel_ Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	104.12	1.46	74.00	-30.12	150	110	Horizontal
2	2462.00	92.89	1.46	54.00	-38.89	150	306	Horizontal
3	2483.50	50.77	1.52	54.00	3.23	150	114	Horizontal
4	2484.44	69.89	1.53	74.00	4.11	150	302	Horizontal
5	2488.29	61.34	1.54	74.00	12.66	150	118	Horizontal
6	2498.79	34.81	1.57	54.00	19.19	150	114	Horizontal

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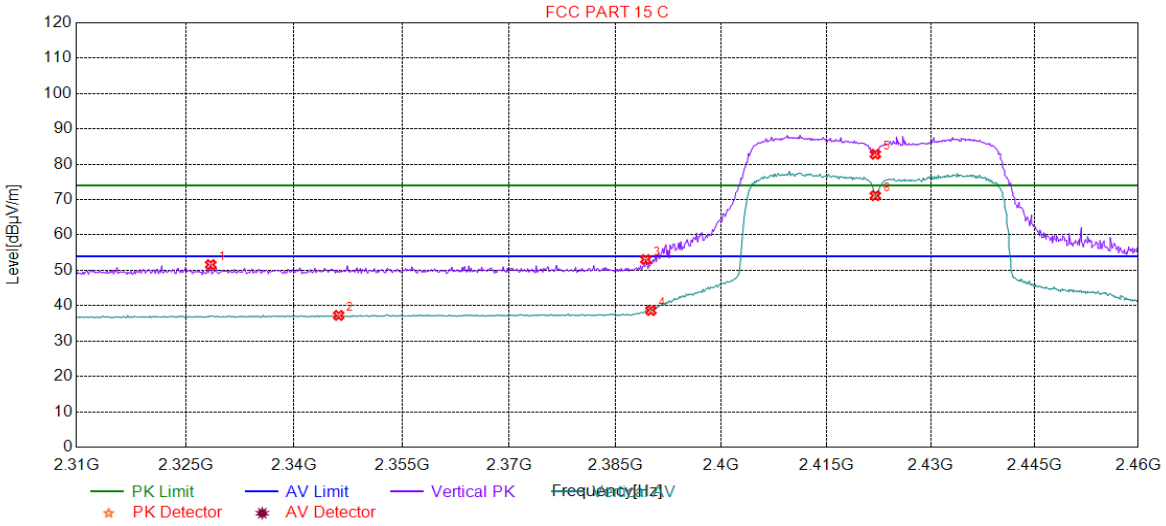
4.10.1.13 802.11N40_Lowest Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2328.46	51.61	0.98	74.00	22.39	150	310	Vertical
2	2346.18	37.26	1.05	54.00	16.74	150	122	Vertical
3	2389.27	53.06	1.24	74.00	20.94	150	132	Vertical
4	2390.00	38.63	1.25	54.00	15.37	150	135	Vertical
5	2422.00	82.83	1.35	74.00	-8.83	150	34	Vertical
6	2422.00	71.12	1.35	54.00	-17.12	150	71	Vertical

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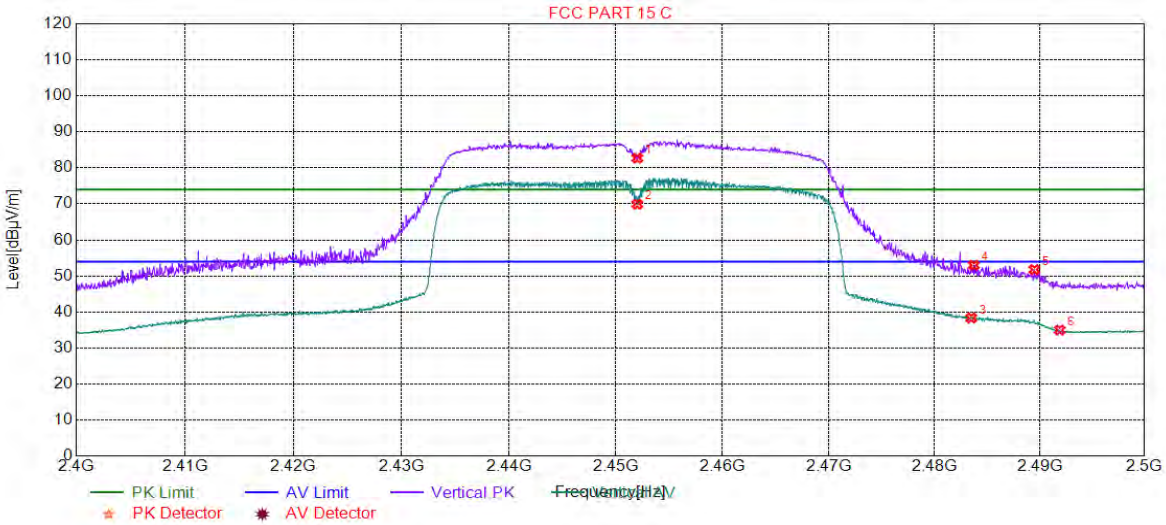
4.10.1.14 802.11N40_ Highest Channel_ Vertical



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2452.00	82.68	1.44	74.00	-8.68	150	134	Vertical
2	2452.00	69.91	1.44	54.00	-15.91	150	137	Vertical
3	2483.50	38.34	1.52	54.00	15.66	150	134	Vertical
4	2483.74	52.97	1.52	74.00	21.03	150	118	Vertical
5	2489.49	51.77	1.54	74.00	22.23	150	134	Vertical
6	2491.89	34.99	1.55	54.00	19.01	150	35	Vertical

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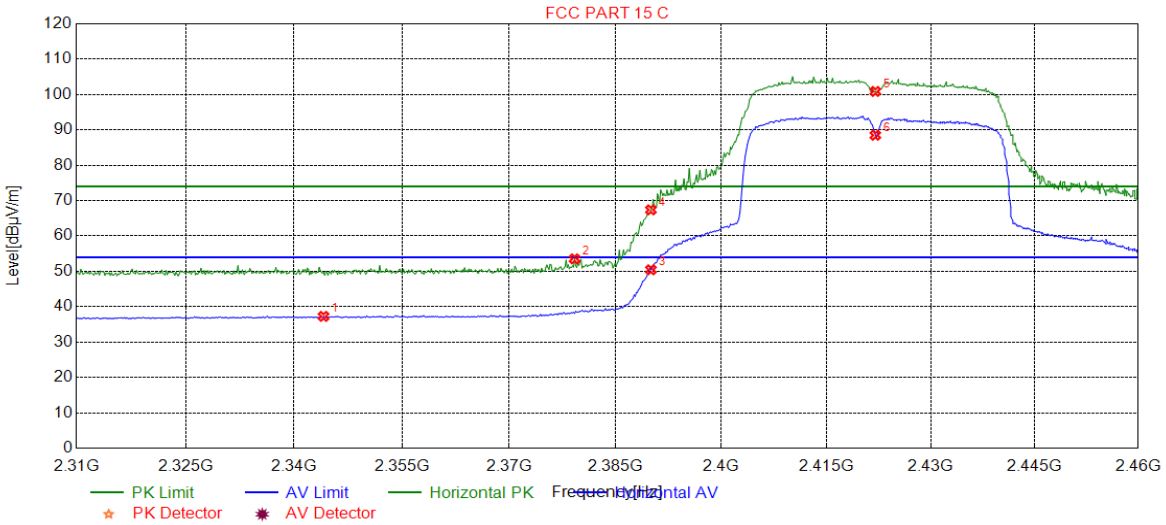
4.10.1.15 802.11N40_Lowest Channel_ Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2344.08	37.27	1.04	54.00	16.73	150	259	Horizontal
2	2379.21	53.53	1.20	74.00	20.47	150	115	Horizontal
3	2390.00	50.45	1.25	54.00	3.55	150	109	Horizontal
4	2390.00	67.39	1.25	74.00	6.61	150	106	Horizontal
5	2422.00	100.87	1.35	74.00	-26.87	150	115	Horizontal
6	2422.00	88.49	1.35	54.00	-34.49	150	109	Horizontal

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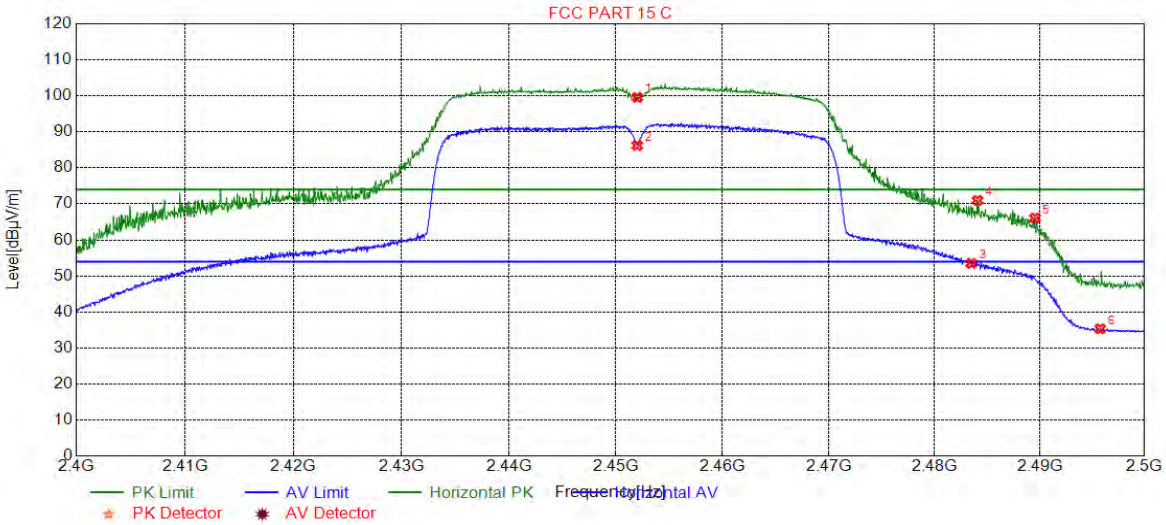
4.10.1.16 802.11N40_ Highest Channel_ Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2452.00	99.56	1.44	74.00	-25.56	150	105	Horizontal
2	2452.00	86.25	1.44	54.00	-32.25	150	314	Horizontal
3	2483.50	53.51	1.52	54.00	0.49	150	105	Horizontal
4	2484.09	70.99	1.53	74.00	3.01	150	113	Horizontal
5	2489.54	66.08	1.54	74.00	7.92	150	113	Horizontal
6	2495.74	35.33	1.56	54.00	18.67	150	109	Horizontal

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	2017/5/10	2020/5/9
LISN	Rohde & Schwarz	ENV216	SEM007-01	2018/9/2	2019/9/2
LISN	ETS-LINDGREN	Feb-16	SEM007-02	2018/4/2	2019/4/1
				2019/4/1	2020/3/31
Measurement Software	AUDIX	e3 V5.4.1221d	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM024-01	2018/7/12	2019/7/11
2 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T2-02	EMC0122	2019/2/11	2020/2/10
EMI Test Receiver	Rohde & Schwarz	ESCI	SEM004-02	2019/3/2	2020/3/1

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	2018/9/15	2019/9/15
Signal Analyzer	Rohde & Schwarz	FSV	W025-05	2019/1/13	2020/1/12
Coaxial Cable	SGS	N/A	SEM031-01	2018/7/13	2019/7/12
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018/9/2	2019/9/2
Temperature Chamber	GIANT FORCE	ICT-150-40-CP-AR	W027-03	2018/11/27	2019/11/27

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	2017/8/5	2020/8/4
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM025-01	2018/7/12	2019/7/11
MXE EMI Receiver (20Hz-8.4GHz)	Agilent Technologies	N9038A	SEM004-05	2018/9/2	2019/9/2
BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-01	2017/6/27	2020/6/26
Pre-amplifier (0.1-1.3GHz)	Agilent Technologies	8447D	SEM005-01	2019/3/2	2020/3/1

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	2018/7/12	2019/7/11
EXA Signal Analyzer (10Hz-26.5GHz)	Agilent Technologies Inc	N9010A	SEM004-09	2019/3/12	2020/3/11
BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-01	2017/6/27	2020/6/26
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	2018/9/2	2019/9/2
Low Noise Amplifier(100MHz-18GHz)	Black Diamond Series	BDLNA-0118-352810	SEM005-05	2018/9/27	2019/9/27
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	2019/3/2	2020/3/1

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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	2019/3/2	2020/3/1
Trilog-Broadband Antenna(25M-2GHz)	Schwarzbeck	VULB9168	SEM003-18	2016/6/29	2019/6/28
Pre-amplifier (9k-1GHz)	Sonoma	310N	SEM005-03	2019/3/12	2020/3/11
Loop Antenna (9kHz-30MHz)	ETS-Lindgren	6502	SEM003-08	2017/8/22	2020/8/21
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM029-01	2018/7/12	2019/7/11

7 Photographs - EUT Constructional Details

Refer to Appendix A - Photographs of EUT Constructional Details for HR/2019/50006.

The End

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