



FCCTEST REPORT

Application No:	ZR/2019/90020
Applicant:	Qualcomm Atheros, Inc.
Address of Applicant	1700 Technology Drive, San Jose, CA 95110
Manufacturer:	Qualcomm Atheros, Inc.
Address of Manufacturer:	1700 Technology Drive, San Jose, CA 95110
EUT Description:	2x2 802.11A/B/G/N/AC WiFi + Bluetooth Module
Model No.:	QCNFA324
Trade Mark:	Qualcomm
FCC ID:	PPD-QCNFA324
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:	2019/11/30
Date of Test:	2019/12/1 to 2019/12/16
Date of Issue:	2020/1/8
Test Result:	PASS *

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

Authorized Signature:

Derek Yang

Wireless Laboratory Manager



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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
00		2019/12/16		Original
01		2020/1/6		Modified limit for Unwanted Emissions in the Restricted Bands (Radiated)
02		2020/1/8		Updated the peak power

Authorized for issue by:			
Tested By		 (Mike Hu) /Project Engineer	2020/1/8
Checked By		 (David Chen) /Reviewer	2020/1/8
			Date
			Date

Remark:

This is to request a Class II permissive change for 2x2 802.11a/b/g/n/ac + Bluetooth Module, Model Name: QCNFA324, FCC ID: PPD-QCNFA324.

The major change filed under this application is:

- The subject approved module is being used in a specific host (portable category configuration, brand name/model: Lenovo/Lenovo CT-X636F).
- Power reduction in order to comply with SAR and RSE requirements.

So only conducted output power and unwanted emissions that fall Out of the Restricted Bands (Radiated), unwanted emissions in the Restricted Bands (Radiated) spot checked, and the data displayed in this report, other data can refer to the original report (Report No.: RF140808E04).

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2 Test Summary

Test Item	Test Requirement	Test method	Test Result	Result
Conducted Output Power	15.247 (b)(3)	ANSI C63.10 2013	Clause 4.1	PASS
Radiated Spurious Emissions	15.247(d); 15.205/15.209	ANSI C63.10 2013	Clause 4.2	PASS
Restricted bands around fundamental frequency (Radiated Emission)	15.247(d); 15.205/15.209	ANSI C63.10 2013	Clause 4.3	PASS

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Contents

1	VERSION	2
2	TEST SUMMARY	3
3	GENERAL INFORMATION	5
3.1	CLIENT INFORMATION	5
3.2	TEST LOCATION	5
3.3	TEST FACILITY	5
3.4	GENERAL DESCRIPTION OF EUT	6
3.5	TEST ENVIRONMENT AND MODE	7
3.6	DESCRIPTION OF SUPPORT UNITS	7
4	TEST RESULTS AND MEASUREMENT DATA	8
4.1	CONDUCTED OUTPUT POWER	8
4.1.1	<i>Test Results</i>	9
4.2	RADIATED SPURIOUS EMISSIONS	10
4.2.1	<i>Transmitter emission above 1GHz</i>	13
4.3	RESTRICTED BANDS AROUND FUNDAMENTAL FREQUENCY	15
5	MEASUREMENT UNCERTAINTY (95% CONFIDENCE LEVELS, K=2)	27
6	EQUIPMENT LIST	28
7	PHOTOGRAPHS - EUT TEST SETUP DETAILS	29



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3 General Information

3.1 Client Information

Applicant:	Qualcomm Atheros, Inc.
Address of Applicant:	1700 Technology Drive, San Jose, CA 95110
Manufacturer:	Qualcomm Atheros, Inc.
Address of Manufacturer:	1700 Technology Drive, San Jose, CA 95110

3.2 Test Location

Company:	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
Address:	No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China
Post code:	518057
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 17025:2005 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:	2x2 802.11A/B/G/N/AC WiFi + Bluetooth Module
Model No.:	QCNFA324
Trade Mark:	Qualcomm
Product Description of Host	Portable Tablet Computer
Model No. of Host:	Lenovo CT-X636F
Trade Mark of Host:	Lenovo
Host	Hardware Version: Google Chrome 79.0.3940.0 (Platform 12601.0.0-19.10.16)
	Software Version: Lenovo Tablet CT-X636F
IEEE 802.11 WLAN Mode Supported	<input checked="" type="checkbox"/> 802.11B (20 MHz channel bandwidth), <input checked="" type="checkbox"/> 802.11G (20 MHz channel bandwidth) <input checked="" type="checkbox"/> 802.11N (20 MHz channel bandwidth), <input checked="" type="checkbox"/> 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:	<input type="checkbox"/> Portable Device, <input checked="" type="checkbox"/> Module
Antenna Type:	<input type="checkbox"/> External, <input checked="" type="checkbox"/> Integrated
Antenna Ports:	<input checked="" type="checkbox"/> Ant 1, <input checked="" type="checkbox"/> Ant 2, <input type="checkbox"/> Ant 3
Smart System:	<input checked="" type="checkbox"/> SISO (for 802.11B/G/N), <input checked="" type="checkbox"/> MIMO (for 802.11N): 2 Tx & 2 Rx, <input type="checkbox"/> Diversity (for 802.11B/G) : Tx & Rx
Antenna Gain:	Ant1:-0.8dBi; Ant2:-0.9dBi
Power Supply:	<input type="checkbox"/> AC/DC Adapter; <input checked="" type="checkbox"/> Battery <input type="checkbox"/> PoE; <input type="checkbox"/> Other:

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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 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:	101.30KPa
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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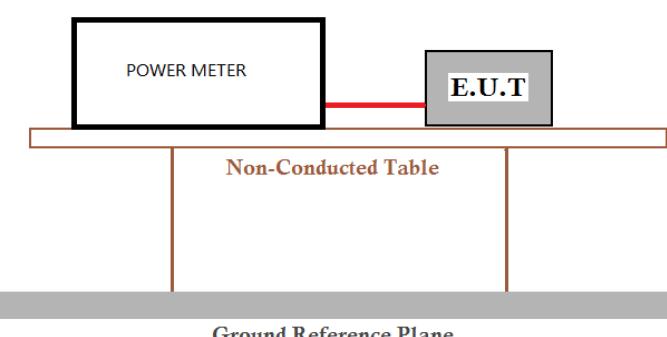
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4 Test results and Measurement Data

4.1 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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4.1.1 Test Results

Measurement Data of Average Power:

Mode	Test Channel	Average Output Power (dBm)		Total Power (dBm)	Result
		ANT1	ANT2		
802.11B	Lowest	17.28	17.52	20.41	Pass
	Middle	17.58	17.79	20.70	Pass
	Highest	17.72	17.68	20.71	Pass
802.11G	Lowest	12.21	12.44	15.34	Pass
	Middle	17.66	17.89	20.79	Pass
	Highest	12.56	12.55	15.57	Pass
802.11N20	Lowest	11.94	12.28	15.12	Pass
	Middle	17.36	17.72	20.55	Pass
	Highest	12.17	11.89	15.04	Pass
802.11N40	Lowest	10.93	10.57	13.76	Pass
	Middle	13.08	13.26	16.18	Pass
	Highest	7.91	7.98	10.96	Pass

Measurement Data of Peak Power:

Mode	Test Channel	Peak Output Power (dBm)		Total Power (dBm)	Result
		ANT1	ANT2		
802.11B	Lowest	20.15	20.48	23.33	Pass
	Middle	20.70	20.54	23.63	Pass
	Highest	20.77	21.15	23.97	Pass
802.11G	Lowest	19.93	19.18	22.58	Pass
	Middle	23.72	23.91	26.83	Pass
	Highest	19.49	19.67	22.59	Pass
802.11N20	Lowest	19.12	18.98	22.06	Pass
	Middle	23.67	23.45	26.57	Pass
	Highest	18.75	18.78	21.78	Pass
802.11N40	Lowest	17.23	17.08	20.17	Pass
	Middle	18.85	18.96	21.92	Pass
	Highest	14.90	15.07	18.00	Pass

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4.2 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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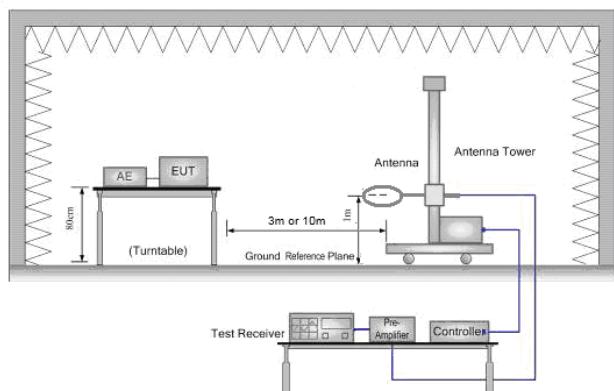


Figure 1. Below 30MHz

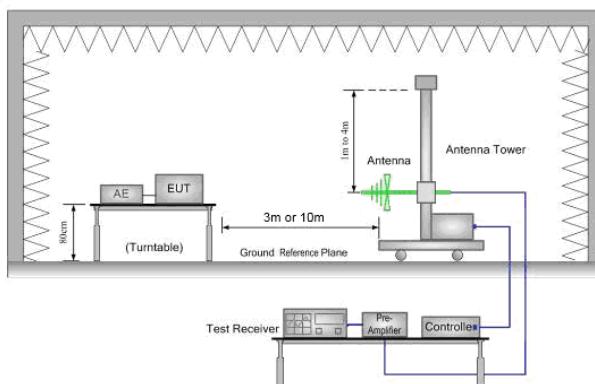


Figure 2. 30MHz to 1GHz

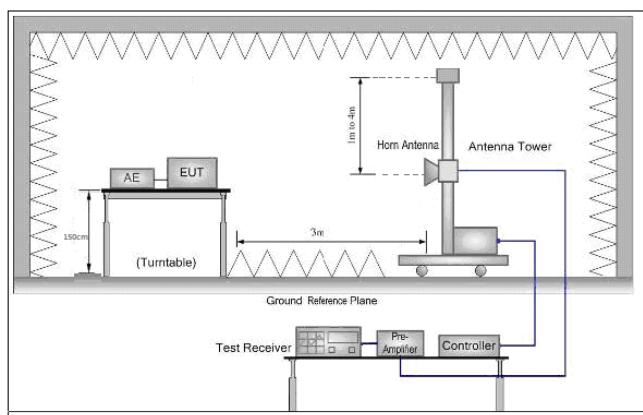


Figure 3. Above 1 GHz

Test Procedure:

- 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 chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- 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 chamber. The table was rotated 360 degrees to determine the position of the highest radiation
- 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.
- 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.
- 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.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- 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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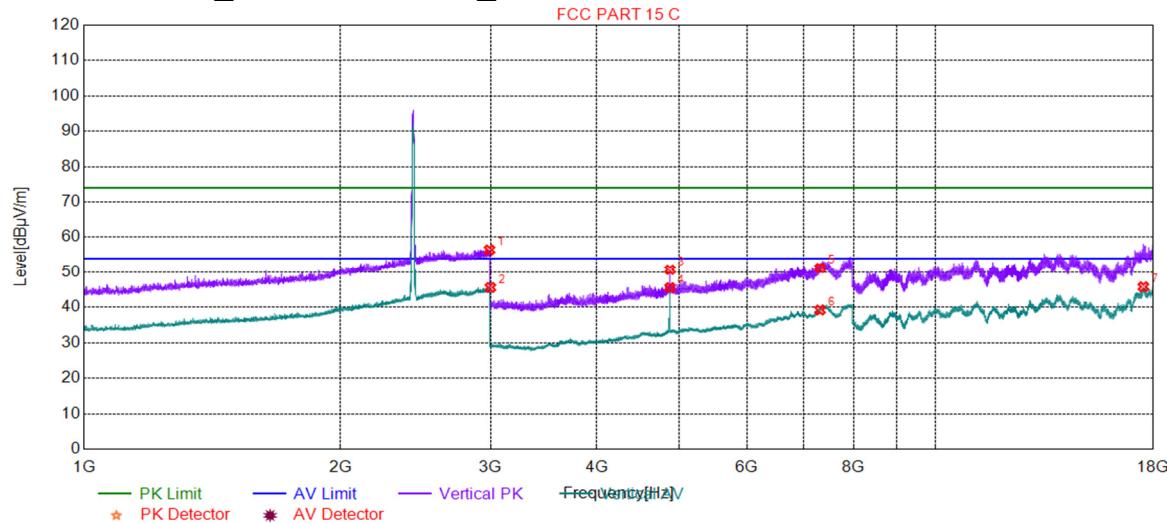


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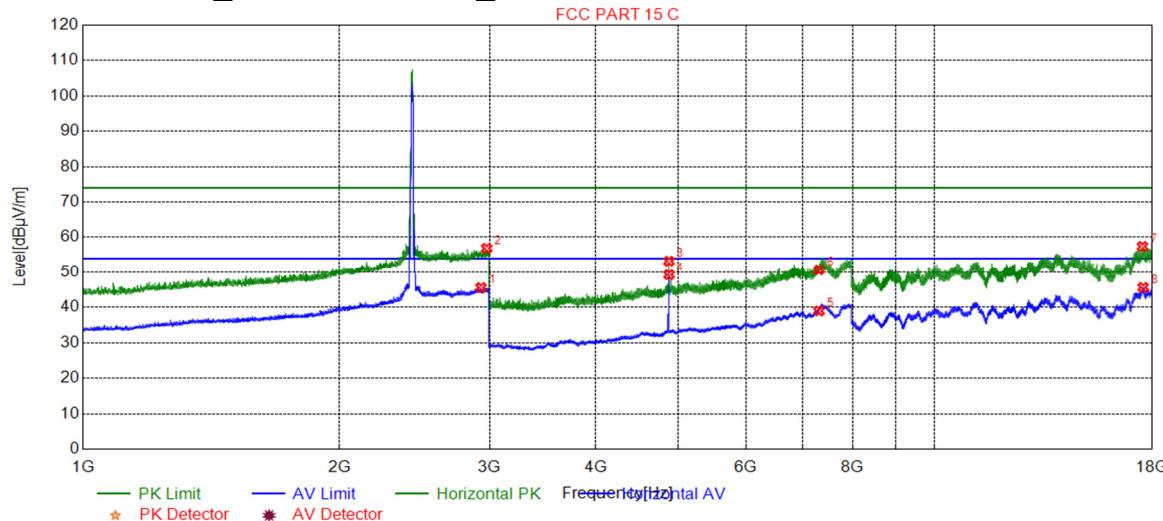
4.2.1 Transmitter emission above 1GHz**4.2.1.1 802.11B_Middle Channel_Vertical**

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity
1	2992.4981	56.47	11.36	74.00	17.53	150	114	PK	Vertical
2	2998.9998	45.62	11.36	54.00	8.38	150	86	AV	Vertical
3	4873.6874	50.73	-14.68	74.00	23.27	150	0	PK	Vertical
4	4874.6875	45.57	-14.67	54.00	8.43	150	0	AV	Vertical
5	7311.0000	51.23	-6.24	74.00	22.77	150	151	PK	Vertical
6	7311.0000	39.25	-6.24	54.00	14.75	150	0	AV	Vertical
7	17519.4760	45.81	0.60	54.00	8.19	150	18	AV	Vertical

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4.2.1.1.2 802.11B_Middle Channel_Horizontal

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity
1	2931.9830	45.57	11.39	54.00	8.43	150	232	AV	Horizontal
2	2977.4944	56.91	11.37	74.00	17.09	150	39	PK	Horizontal
3	4873.6874	53.24	-14.68	74.00	20.76	150	70	PK	Horizontal
4	4874.6875	49.25	-14.67	54.00	4.75	150	97	AV	Horizontal
5	7311.0000	38.99	-6.24	54.00	15.01	150	15	AV	Horizontal
6	7311.0000	50.67	-6.24	74.00	23.33	150	288	PK	Horizontal
7	17524.4762	57.44	0.66	74.00	16.56	150	277	PK	Horizontal
8	17555.4778	45.63	1.06	54.00	8.37	150	68	AV	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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4.3 Restricted bands around fundamental frequency

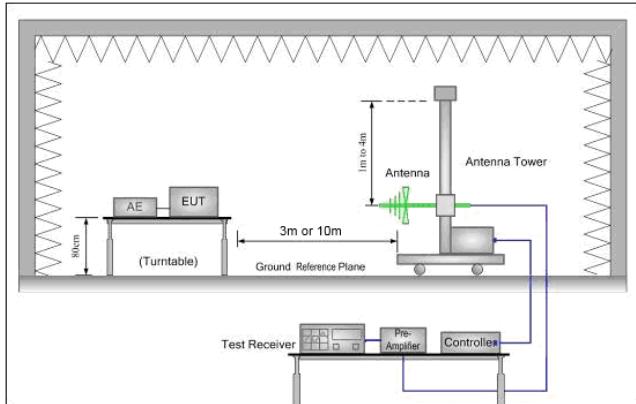
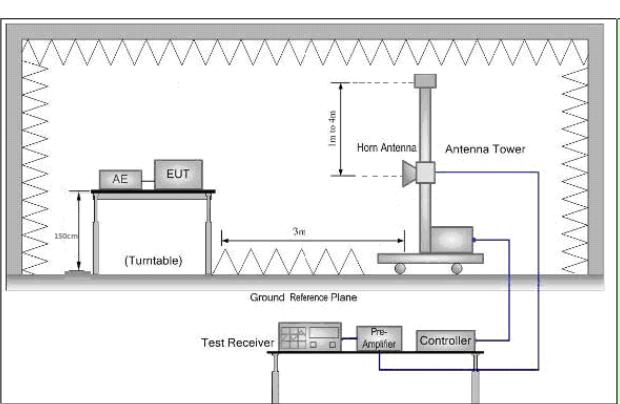
Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205		
Test Method:	ANSI C63.10: 2013 Section 11.12		
Test Site:	Measurement Distance: 3m or 10m (Semi-Anechoic Chamber)		
Limit:	Frequency	Limit (dBuV/m @3m)	Remark
	30MHz-88MHz	40.0	Quasi-peak Value
	88MHz-216MHz	43.5	Quasi-peak Value
	216MHz-960MHz	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:	<ul style="list-style-type: none">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 chamber. 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 chamber. 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 channelh. Test the EUT in the lowest channel, the Highest channeli. 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 were 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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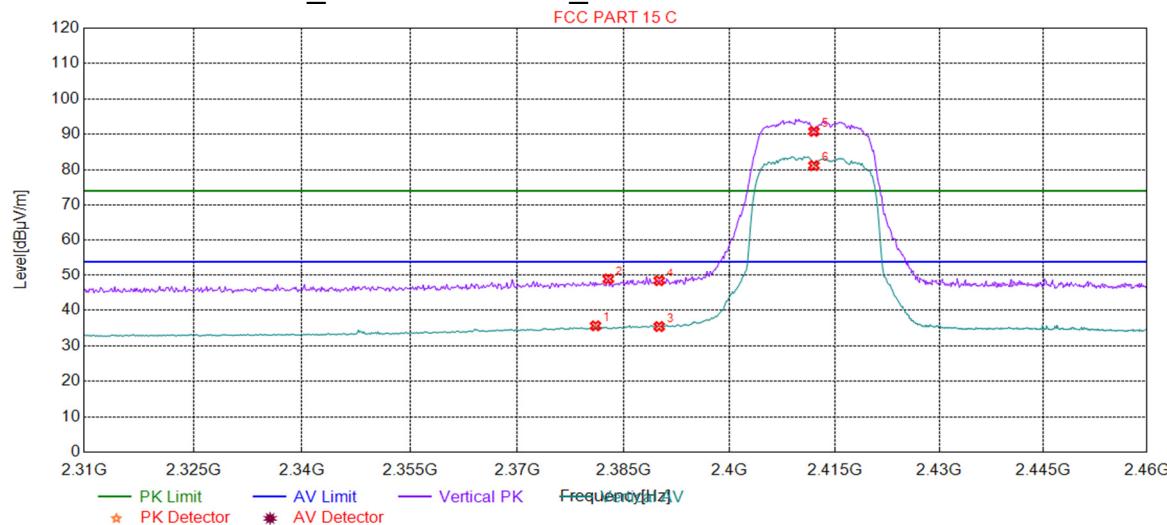
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Test plot as follows:

4.3.1.1 802.11B_Lowest Channel_Verical

NO.	Freq. [MHz]	Level [dB μ V/m]	Factor [dB]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity
1	2381.0210	35.63	9.17	54.00	18.37	150	292	AV	Vertical
2	2382.8228	48.84	9.17	74.00	25.16	150	246	PK	Vertical
3	2390.0000	35.42	9.20	54.00	18.58	150	333	AV	Vertical
4	2390.0000	48.36	9.20	74.00	25.64	150	342	PK	Vertical
5	2412.0000	90.80	9.27	---	---	150	225	PK	Vertical
6	2412.0000	81.15	9.27	---	---	150	304	AV	Vertical

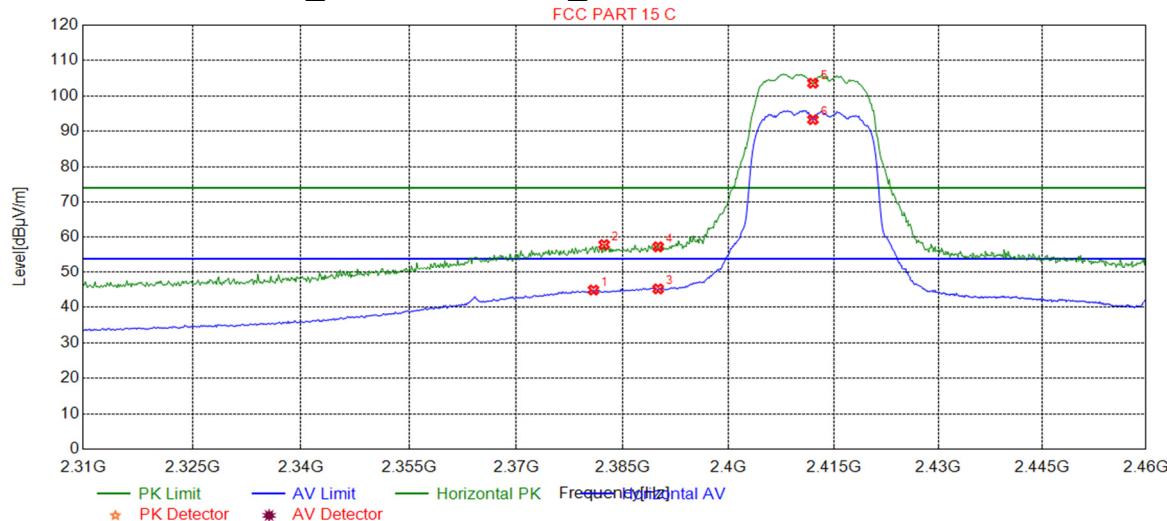
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4.3.1.2 802.11B_Lowest Channel_Horizontal

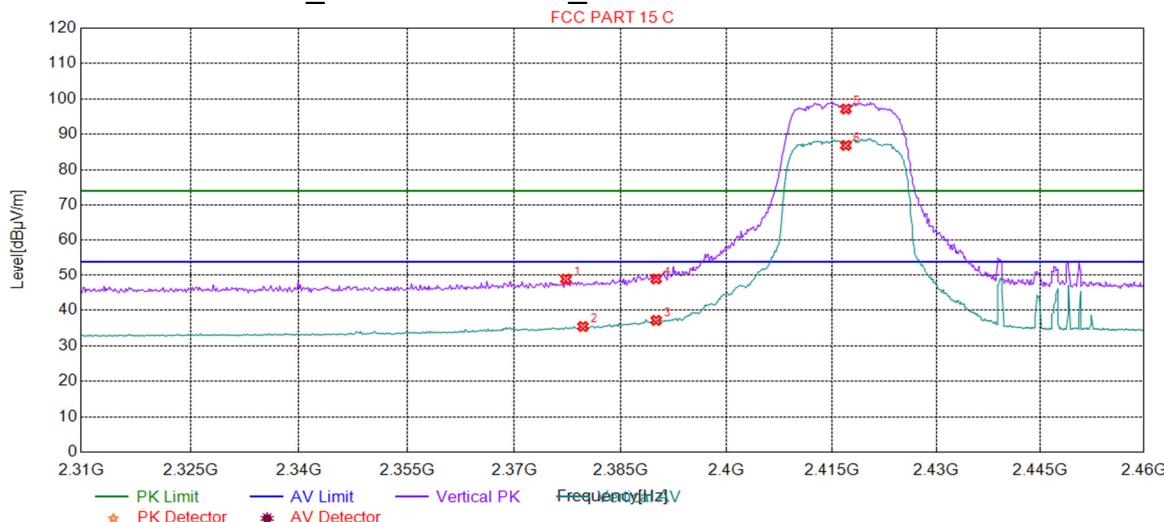
NO.	Freq. [MHz]	Level [dB μ V/m]	Factor [dB]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity
1	2380.8709	44.86	9.17	54.00	9.14	150	318	AV	Horizontal
2	2382.3724	57.97	9.17	74.00	16.03	150	314	PK	Horizontal
3	2390.0000	45.19	9.20	54.00	8.81	150	322	AV	Horizontal
4	2390.0000	57.35	9.20	74.00	16.65	150	309	PK	Horizontal
5	2412.0000	103.60	9.27	---	---	150	322	PK	Horizontal
6	2412.0000	93.29	9.27	---	---	150	322	AV	Horizontal

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4.3.1.3 802.11G_Lowest Channel_Verical

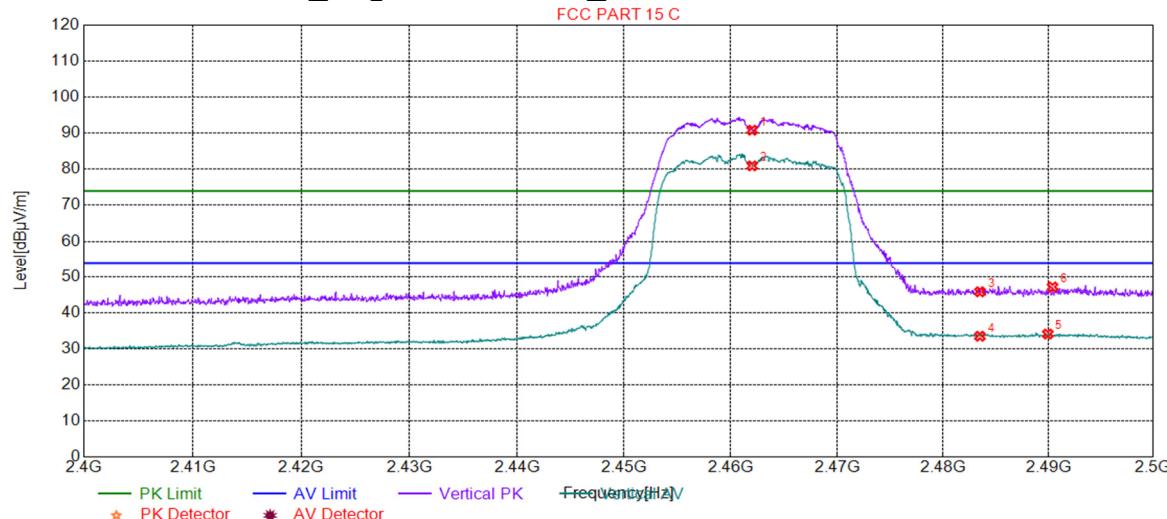
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity
1	2377.2673	48.81	9.15	74.00	25.19	150	41	PK	Vertical
2	2379.6697	35.43	9.16	54.00	18.57	150	90	AV	Vertical
3	2390.0000	37.17	9.20	54.00	16.83	150	86	AV	Vertical
4	2390.0000	48.85	9.20	74.00	25.15	150	118	PK	Vertical
5	2417.0000	97.15	9.28	---	---	150	70	PK	Vertical
6	2417.0000	86.86	9.28	---	---	150	70	AV	Vertical

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4.3.1.4 802.11G_Highest Channel_Verical

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity
1	2462.0000	90.86	9.43	---	---	150	292	PK	Vertical
2	2462.0000	80.96	9.43	---	---	150	243	AV	Vertical
3	2483.5000	45.76	9.50	74.00	28.24	150	330	PK	Vertical
4	2483.5000	33.47	9.50	54.00	20.53	150	325	AV	Vertical
5	2489.9450	34.06	9.52	54.00	19.94	150	330	AV	Vertical
6	2490.3952	47.11	9.52	74.00	26.89	150	330	PK	Vertical

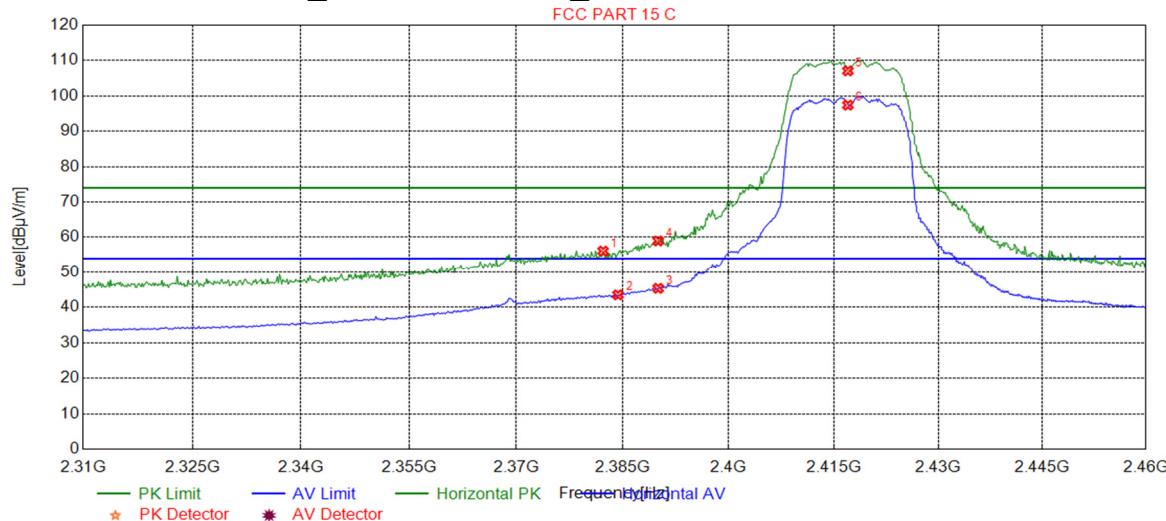
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4.3.1.5 802.11G_Lowest Channel_Horizontal

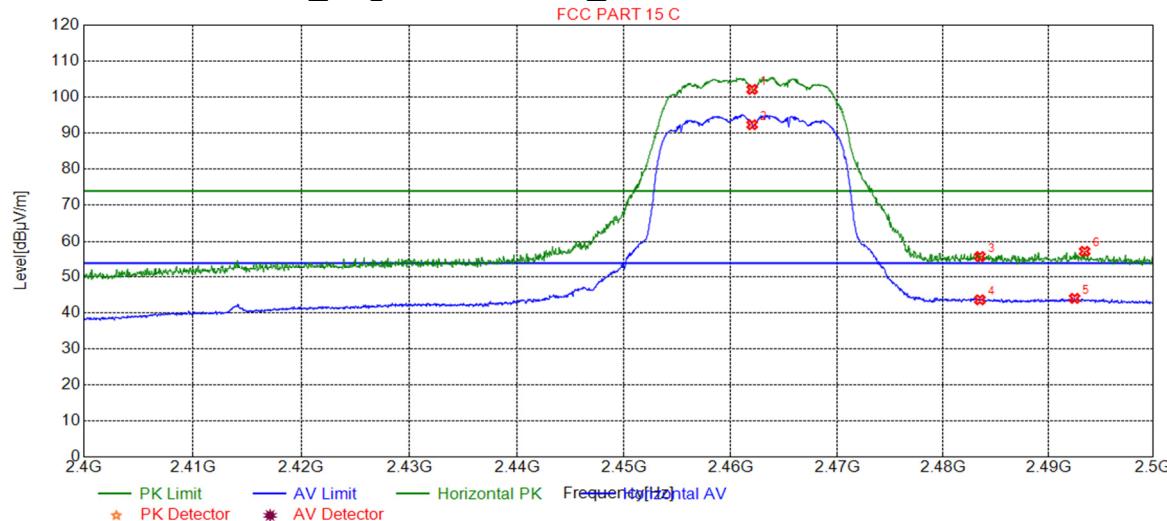
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity
1	2382.2222	56.14	9.17	74.00	17.86	150	104	PK	Horizontal
2	2384.3243	43.52	9.18	54.00	10.48	150	108	AV	Horizontal
3	2390.0000	45.36	9.20	54.00	8.64	150	104	AV	Horizontal
4	2390.0000	59.00	9.20	74.00	15.00	150	104	PK	Horizontal
5	2417.0000	107.09	9.28	---	---	150	104	PK	Horizontal
6	2417.0000	97.40	9.28	---	---	150	112	AV	Horizontal

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4.3.1.6 802.11G_Highest Channel_Horizontal

NO.	Freq. [MHz]	Level [dB μ V/m]	Factor [dB]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity
1	2462.0000	102.16	9.43	---	---	150	316	PK	Horizontal
2	2462.0000	92.37	9.43	---	---	150	316	AV	Horizontal
3	2483.5000	55.79	9.50	74.00	18.21	150	316	PK	Horizontal
4	2483.5000	43.54	9.50	54.00	10.46	150	316	AV	Horizontal
5	2492.4962	43.94	9.53	54.00	10.06	150	310	AV	Horizontal
6	2493.4467	57.24	9.53	74.00	16.76	150	288	PK	Horizontal

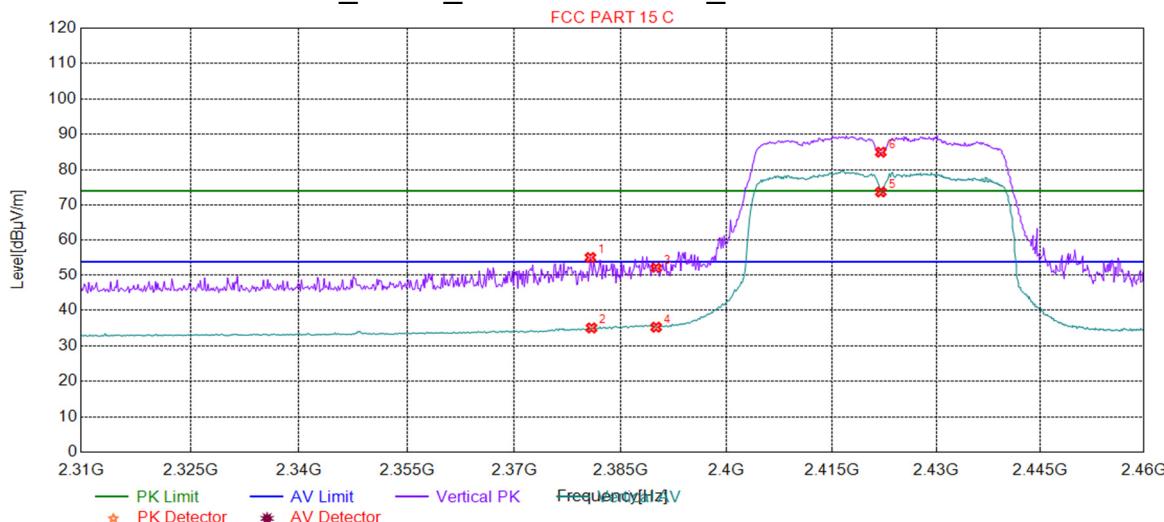
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4.3.1.7 802.11N40_MIMO_Lowest Channel_Verical

NO.	Freq. [MHz]	Level [dB μ V/m]	Factor [dB]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity
1	2380.7207	55.17	9.17	74.00	18.83	150	304	PK	Vertical
2	2380.8709	35.03	9.17	54.00	18.97	150	300	AV	Vertical
3	2390.0000	52.13	9.20	74.00	21.87	150	79	PK	Vertical
4	2390.0000	35.25	9.20	54.00	18.75	150	116	AV	Vertical
5	2422.0000	73.70	9.30	---	---	150	100	AV	Vertical
6	2422.0000	84.94	9.30	---	---	150	259	PK	Vertical

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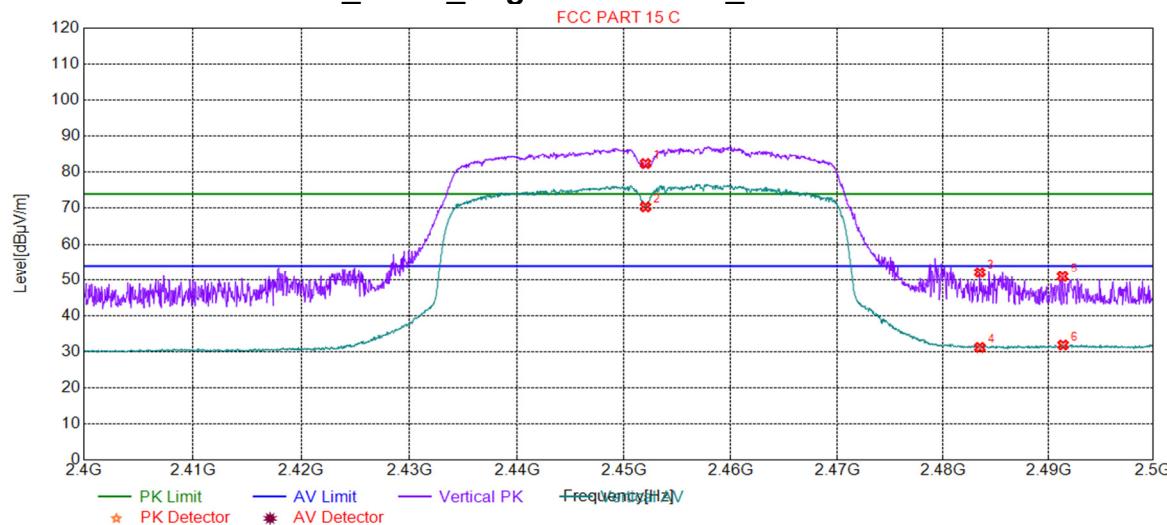


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4.3.1.8

802.11N40_MIMO_Highest Channel_Vertical



NO.	Freq. [MHz]	Level [dB μ V/m]	Factor [dB]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity
1	2452.0000	82.43	9.40	---	---	150	84	PK	Vertical
2	2452.0000	70.40	9.40	---	---	150	84	AV	Vertical
3	2483.4917	52.07	9.50	74.00	21.93	150	298	AV	Vertical
4	2483.5000	31.19	9.50	54.00	22.81	150	277	PK	Vertical
5	2491.3457	50.90	9.52	74.00	23.10	150	298	AV	Vertical
6	2491.3957	31.86	9.52	54.00	22.14	150	277	PK	Vertical

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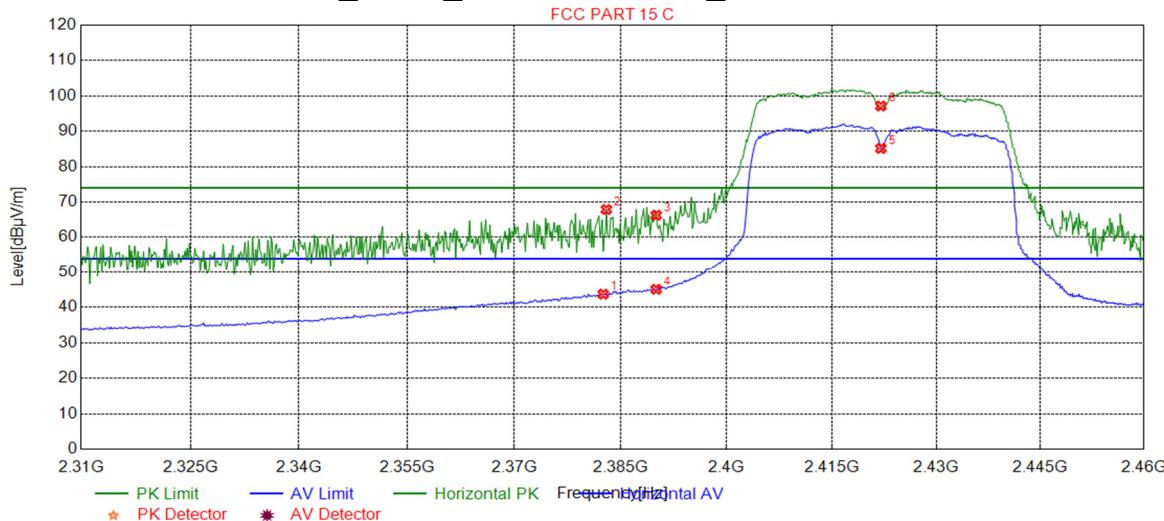


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4.3.1.9 802.11N40_MIMO_Lowest Channel_Horizontal

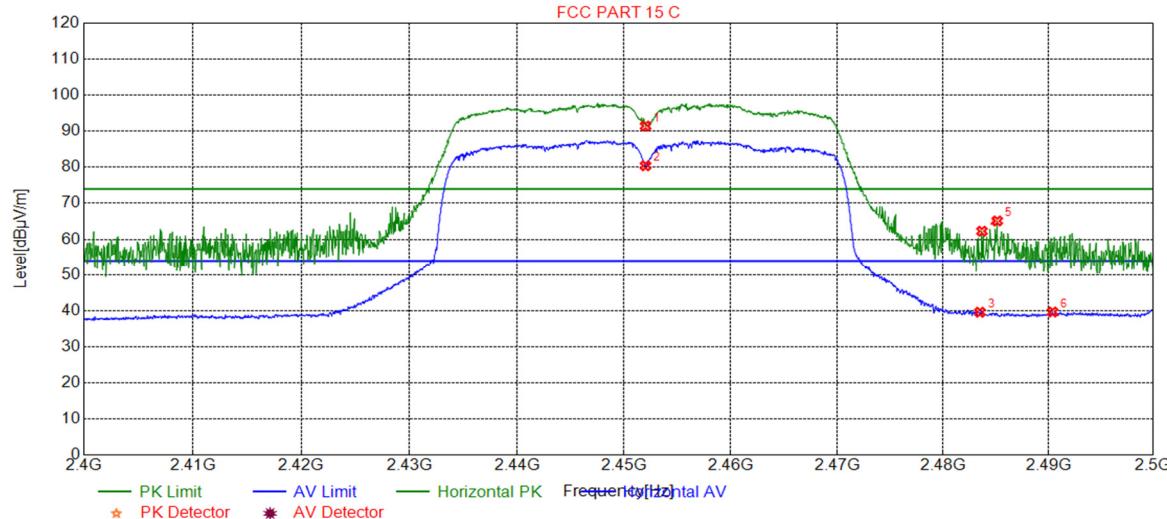
NO.	Freq. [MHz]	Level [dB μ V/m]	Factor [dB]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity
1	2382.5225	43.71	9.17	54.00	10.29	150	318	AV	Horizontal
2	2382.9730	67.91	9.17	74.00	6.09	150	318	PK	Horizontal
3	2390.0000	66.27	9.20	74.00	7.73	150	272	PK	Horizontal
4	2390.0000	45.09	9.20	54.00	8.91	150	318	AV	Horizontal
5	2422.0000	85.16	9.30	---	---	150	289	AV	Horizontal
6	2422.0000	97.14	9.30	---	---	150	305	PK	Horizontal

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4.3.1.10 802.11N40_MIMO_Highest Channel_Horizontal

NO.	Freq. [MHz]	Level [dB μ V/m]	Factor [dB]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity
1	2452.0000	91.44	9.40	---	---	150	292	PK	Horizontal
2	2452.0000	80.43	9.40	---	---	150	298	AV	Horizontal
3	2483.5000	39.55	9.50	54.00	14.45	150	315	AV	Horizontal
4	2483.6918	62.28	9.50	74.00	11.72	150	320	PK	Horizontal
5	2485.1426	65.13	9.50	74.00	8.87	150	320	AV	Horizontal
6	2490.3952	39.61	9.52	54.00	14.39	150	315	PK	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.Due date (yyyy-mm-dd)
Shielding Room	ZhongYu Electron	GB-88	SEM001-06	2017/5/10	2020/5/9
LISN	Rohde & Schwarz	ENV216	SEM007-01	2019/7/14	2020/7/14
LISN	ETS-LINDGREN	Feb-16	SEM007-02	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	2019/6/12	2020/6/11
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.Due date (yyyy-mm-dd)
DC Power Supply	Agilent Technologies Inc	66311B	W009-09	2019/7/15	2020/7/15
Signal Analyzer	Rohde & Schwarz	FSV	W025-05	2019/1/13	2020/1/12
Coaxial Cable	SGS	N/A	SEM031-01	2019/6/12	2020/6/11
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2019/7/14	2020/7/14
Temperature Chamber	GIANT FORCE	ICT-150-40-CP-AR	W027-03	2019/10/27	2020/10/27
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2019/7/14	2020/7/14

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	2019/6/12	2020/6/11
MXE EMI Receiver (20Hz-8.4GHz)	Agilent Technologies	N9038A	SEM004-05	2019/7/14	2020/7/14
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	2019/6/12	2020/6/11
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	2019/7/14	2020/7/14
Low Noise Amplifier(100MHz-18GHz)	Black Diamond Series	BDLNA-0118-352810	SEM005-05	2019/9/3	2020/9/2
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	2019/3/2	2020/3/1
Band filter	N/A	N/A	SEM023-01	N/A	N/A

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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	2018/3/15	2020/3/14	
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	2019/6/12	2020/6/11	

7 Photographs - EUT Test Setup Details

Refer to Appendix A - Photographs of Set-Up for ZR/2019/90020.

The End

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