CERTIFICATE #3478.01

TEST REPORT

EUT Description	**WLAN and BT, 2x2 PCIe M.2 1216 SD adapter card, Monopole Antenna**
Brand Name	**Intel® WI-FI 6 AX200**
Model Name	**AX200D2WL**
FCC ID	**PD9AX200D2L**
Date of Test Start/End	**2019-11-26 / 2019-12-04**
Features	**802.11 a/b/g/n/ac/ax Wireless LAN + Bluetooth® 5** (see section 5)

Applicant	**Intel Mobile Communications**
Address	**100 Center Point Circle, Suite 200** **Columbia, South Carolina 29210** **USA**
Contact Person	**Steven Hackett**
Telephone/Fax/ Email	**steven.c.hackett@intel.com**

Reference Standards	**FCC CFR Title 47 Part 15 E, C** (see section 1)

Test Report identification	**191113-02.TR01**
Revision Control	**Rev. 01** **This test report revision replaces any previous test report revision** (see section 8)

The test results relate only to the samples tested.
The test report shall not be reproduced in full, without written approval of the laboratory.
Reference to accreditation shall be used only by full reproduction of test report.

Issued by

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Table of Contents

1. Standards, reference documents and applicable test methods

1. FCC 47 CFR part 15 – Subpart E – Unlicensed National Information Infrastructure Devices.
2. FCC 47 CFR part 15 - Subpart C – §15.209 Radiated emission limits; general requirements.
3. FCC OET KDB 558074 D01 15.247 DTS Meas Guidance v05 – Guidance for Compliance Measurements on Digital Transmission Systems, frequency hopping spead spectrum system, and hybrid system devices operating under section §15.247 of the FCC rules.
4. FCC OET KDB 662911 D01 Multiple Transmitter Output v02r01.
5. FCC OET KDB 789033 D02 General U-NII Test Procedures New Rules v02r01 – Guidelines for compliance testing of Unlicensed National Information Infrastructure (U-NII) Devices (Part 15, Subpart E).
6. ANSI C63.10-2013 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

2. General conditions, competences and guarantees

- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is an ISO/IEC 17025:2017 laboratory accredited by the American Association for Laboratory Accreditation (A2LA) with the certificate number 3478.01.
- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is an Accredited Test Firm recognized by the FCC, with Designation Number FR0011.
- ✓ Intel WRF Lab declines any responsibility with respect to the identified information provided by the customer and that may affect the validity of results.
- ✓ Intel WRF Lab only provides testing services and is committed to providing reliable, unbiased test results and interpretations.
- ✓ Intel WRF Lab is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.
- ✓ Intel WRF Lab has developed calibration and proficiency programs for its measurement equipment to ensure correlated and reliable results to its customers.
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- ✓ This report does not imply an approval of the product by the Certification Bodies or competent Authorities.
- ✓ Complete or partial reproduction of the report cannot be made without written permission of Intel WRF Lab.

3. Environmental Conditions

- ✓ At the site where the measurements were performed the following limits were not exceeded during the tests:

Temperature	24ºC ± 2ºC
Humidity	44% ± 3%

4. Test samples

Sample	Control #	Description	Model	Serial #	Date of receipt
#01	191113-02.S06	Tablet	1927	-	2019-11-26
	191113-02.S08	Antenna	Advanced Wireless & antenna Inc.	DQ60AML0001	2019-11-26

5. EUT Features

Brand Name	Intel® WI-FI 6 AX200
Model Name	AX200D2WL
FCC ID	PD9AX200D2L
Software Version	11.185.0-08900
Driver Version	99.0.41.5
Prototype / Production	Prototype
Supported Radios	802.11b/g/n 2.4GHz (2400.0 – 2483.5 MHz) 802.11a/n/ac/ax 5.2GHz (5150.0 – 5250.0 MHz) 5.3GHz (5250.0 – 5350.0 MHz) 5.6GHz (5470.0 – 5725.0 MHz) 5.8GHz (5725.0 – 5850.0 MHz) Bluetooth 5 2.4GHz (2400.0 – 2483.5 MHz)
Antenna Information	CHAIN A: Main: Monopole, Advanced Wireless and Antenna Inc. - S/N: DQ60AML0001 CHAIN B: Aux: Monopole, Advanced Wireless and Antenna Inc - S/N: DQ60AML0001

6. Remarks and comments

1. The tested configurations were selected based on the worst case spurious emissions per band from modular type approval report.

7. Test Verdicts summary

The statement of conformity to applicable standards in the table below are based on the measured values, without taking into account the measurement uncertainties.

FCC part	Test name	Verdict
15.247 (d) 15.407 (b) 15.209	Undesirable emissions limits (radiated)	P

P: Pass
F: Fail
NM: Not Measured
NA: Not Applicable

8. Document Revision History

Revision #	Date	Modified by	Revision Details
Rev. 00	2019-12-04	A. AZIZE GILBERT	First Issue
Rev. 01	2019-12-12	B.Lavenant	Editorial update

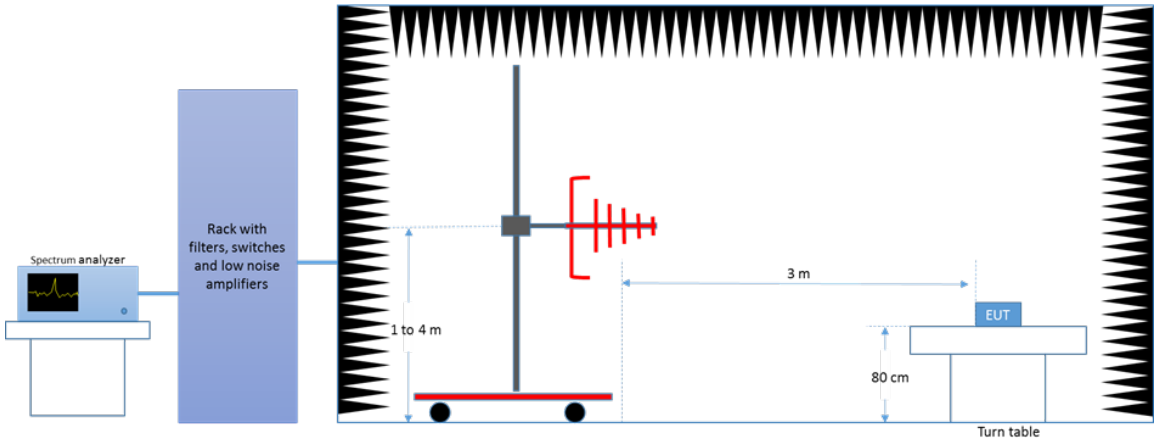
Annex A. Test & System Description

A.1 Measurement System

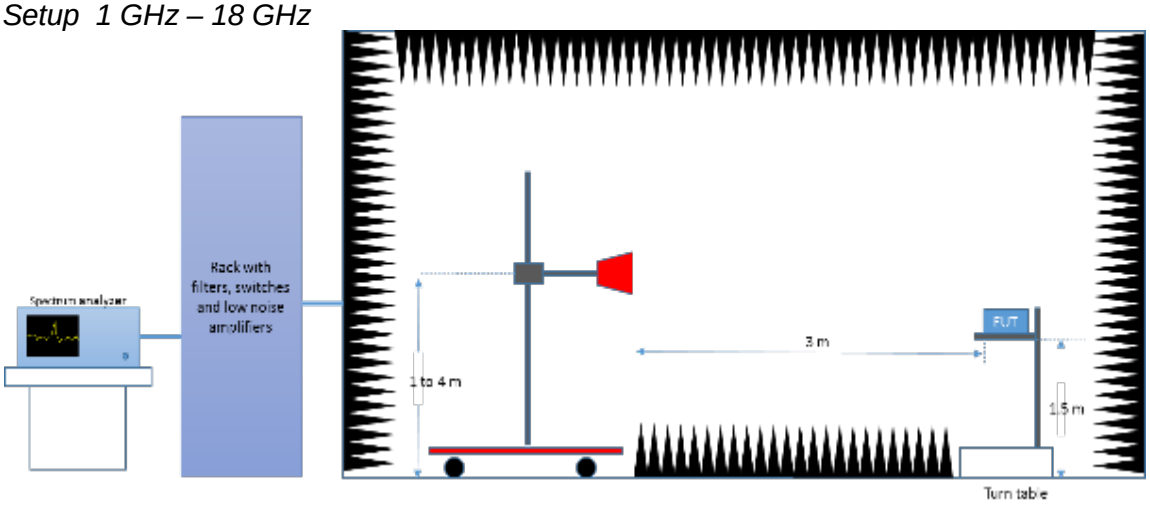
Measurements were performed using the following setups according to ANSI 63.10- 2013.

The DUT (the antennas) is installed in a host provided by the customer. The Intel proprietary tool DRTU is installed on the host, and is used to configure the DUT to continuously transmit at a specified output power using all different modes and modulation schemes.

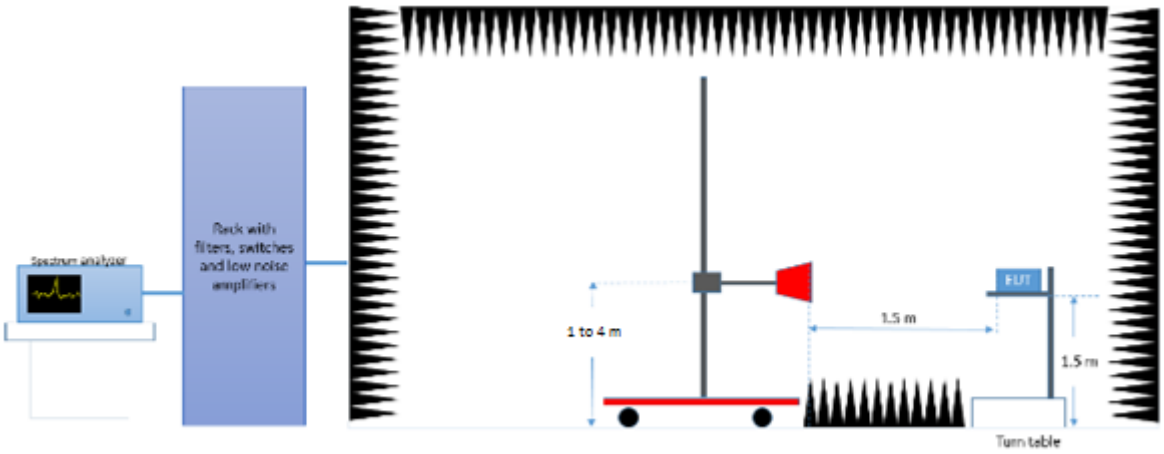
Radiated Setup 30 MHz - 1GHz



Radiated Setup 1 GHz – 18 GHz



Radiated Setup 18 GHz – 40 GHz



Sample Calculation

The spurious received voltage V(dBµV) in the spectrum Analyzer is converted to Electric field strength using the transducer factor F corresponding to the Rx path Loss:

F (dB/m)= Rx Antenna Factor (dB/m) + Cable losses (dB) – Amplifiers Gain (dBi)
E (dBuV/m) = V(dBµV) + F (dB/m)

For field strength measurements made at other than the distance at which the applicable limit is specified, the field strength of the emission at the distance specified by the limit is deduced as follows:

$$E_{SpecLimit} = E_{Meas} + 20*\log(D_{Meas}/D_{SpecLimit})$$

where

$E_{SpecLimit}$ is the field strength of the emission at the distance specified by the limit, in dBµV/m
E_{Meas} is the field strength of the emission at the measurement distance, in dBµV/m
D_{Meas} is the measurement distance, in m
$D_{SpecLimit}$ is the distance specified by the limit, in m

A.2 Test Equipment List

Radiated Setup-1

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
0419	Spectrum analyzer	FSW67	103266	Rohde & Schwarz	2019-02-04	2021-02-04
0138	Double Ridged Horn Antenna 1 GHz – 18 GHz	3117	00152266	ETS Lindgren	2018-03-29	2020-03-29
0141	Double Ridged Horn Antenna 1 GHz – 18 GHz	3117	00157736	ETS Lindgren	2018-05-11	2020-05-11
0334	Double Ridged Waveguide Horn with Pre-Amplifier 18 GHz – 40 GHz	3116C-PA	00169308bis + 00196308	ETS Lindgren	2019-07-24	2021-07-24
0337	Full Anechoic chamber	RFD_FA_100	5996	ETS Lindgren	2018-04-17	2020-04-17
0329	Measurement Software	EMC32 V10.40.10	100401	Rohde & Schwarz	N/A	N/A
0577	Temperature & Humidity Logger	RA12E-TH1-RAS	RA12-B89702	AVTECH	2018-03-01	2020-03-01

N/A: Not Applicable

Radiated Setup-2

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
0420	Spectrum analyzer	FSV40	101556	Rohde & Schwarz	2018-04-11	2020-04-11
0137	Log antenna 30 MHz – 1 GHz	3142E	00156946	ETS Lindgren	2019-08-22	2021-08-22
0135	Semi Anechoic chamber	FACT 3	5720	ETS Lindgren	2018-04-18	2020-04-18
0530	Measurement Software	EMC32 V10.40.10	100623	Rohde & Schwarz	N/A	N/A
0797	Temperature & Humidity Logger	RA12E-TH1-RAS	RA12-D0EB1A	AVTECH	2019-07-04	2021-07-04

N/A: Not Applicable

Radiated Setup - shared equipment

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
0617	Power Sensor 50MHz-18GHz	NRP-Z81	104386	Rohde & Schwarz	2018-04-16	2020-04-16

A.3 Measurement Uncertainty Evaluation

The system uncertainty evaluation is shown in the below table:

Measurement type	Uncertainty [±dB]
Radiated tests <1GHz	±3.0
Radiated tests 1GHz - 40 GHz	±5.0

Annex B. Test Results

B.1.1 Radiated spurious emission

Standard references

<table>
<tr><th>FCC part</th><th>Limits</th></tr>
<tr><td>15.247 (d)</td><td>In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).</td></tr>
<tr><td>15.407 (b)</td><td>For transmitters operating in the 5.15-5.25 GHz and 5.25-5.35 GHz bands: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.</td></tr>
<tr><td>15.209</td><td>Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a):

<table>
<tr><th>Freq Range (MHz)</th><th>Field Strength (µV/m)</th><th>Field Strength (dBµV/m)</th><th>Meas. Distance (m)</th></tr>
<tr><td>30-88</td><td>100</td><td>40</td><td>3</td></tr>
<tr><td>88-216</td><td>150</td><td>43.5</td><td>3</td></tr>
<tr><td>216-960</td><td>200</td><td>46</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>54</td><td>3</td></tr>
</table>

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
For average radiated emission measurements above 1000 MHz, there is also a limit specified when measuring with peak detector function, corresponding to 20 dB above the indicated values in the table.</td></tr>
</table>

Test Conditons

For 802.11b and 802.11a modes the EUT can transmit at both CHAIN A and CHAIN B RF outputs individually, but not simultaneously.

For 802.11n20 (20 MHz channel bandwidth), 802.11n40 (40MHz channel bandwidth), 802.11ac80 (80MHz channel bandwidth) and 802.11ac160 (160 MHz channel bandwidth) modes the EUT can transmit at both CHAIN A and CHAIN B RF outputs individually, and also simultaneously.

The conducted RF output power at each chain was adjusted according to the client's supplied Target values (see following table) using the Intel DRTU tool and measuring the power by using a calibrated average power meter. Measured values for adjustment were within -0.2 dB/+0.3 dB from the declared Target values

		Declared max power values			Antenna		
Mode	BW (MHz)	Channel	Data Rate	Frequency (MHz)	Chain A (dBm)	Chain B (dBm)	Chain A+B (dBm)
802.11b	20	7	1 Mbps	2442	21.0	21.0	--
802.11ax	160	50	MCS0	5250	17.0	17.0	14.0
	80	106	MCS0	5530	17.0	17.5	14.5
	80	155	MCS0	5775	17.5	17.5	14.5

Test procedure

The radiated setups shown in section *Test & System Description* were used to measure the radiated spurious emissions. Depending of the frequency range and bands being tested, different antennas and filters were used.
The final measurement is done by varying the antenna height, the EUT azimuth over 360º and for both Vertical and Horizontal polarizations.

Test Results

30 MHz – 1GHz – All modes

The spurious signals detected do not depend on either the operating channel or the modulation mode.

Frequency	Quasi-Peak	Limit	Margin	Polarization
MHz	**dBµV/m**	**dBµV/m**	**dB**	**V/H**
125.0	24.0	43.6	19.6	V
250.0	29.7	46.0	16.3	V

1 GHz – 26 GHz, 802.11b, 1Mbps, Chain A

Radiated Spurious – CH7

Frequency	MaxPeak	Avg	Limit	Margin	Polarization
MHz	**dBµV/m**	**dBµV/m**	**dBµV/m**	**dB**	**V/H**
4991.5	---	44.4	54.0	9.6	H
4991.5	55.7	---	74.0	18.3	V
7324.1	46.7	---	74.0	27.3	V
7325.2	---	36.6	54.0	17.4	H
24403.3	---	37.2	54.0	16.8	V
24403.3	47.4	---	74.0	26.6	H

1 GHz – 40 GHz, 802.11ax, MCS0, Chain B

Radiated Spurious – CH50

Frequency	MaxPeak	Avg	Limit	Margin	Polarization
MHz	**dBµV/m**	**dBµV/m**	**dBµV/m**	**dB**	**V/H**
6365.0	57.2	---	68.2	11.1	V
6562.4	47.4	---	68.2	20.8	H
10353.2	49.7	---	68.2	18.6	V
21000.0	---	37.6	54.0	16.4	V
21000.0	46.7	---	74.0	27.3	H

1 GHz – 40 GHz, 802.11ax, MCS0, Chain A

Radiated Spurious – CH106

Frequency	MaxPeak	Avg	Limit	Margin	Polarization
MHz	**dBµV/m**	**dBµV/m**	**dBµV/m**	**dB**	**V/H**
6248.0	57.3	---	68.2	10.9	V
6876.6	48.7	---	68.2	19.5	H
6912.3	46.8	---	68.2	21.4	V
16481.4	55.2	---	68.2	13.0	H
39826.4	55.2	---	68.2	13.0	H

1 GHz – 40 GHz, 802.11ax, MCS0, Chain A+B

Radiated Spurious – CH155

Frequency	MaxPeak	Avg	Limit	Margin	Polarization
MHz	**dBµV/m**	**dBµV/m**	**dBµV/m**	**dB**	**V/H**
6148.5	---	44.6	54.0	9.4	H
6148.5	54.7	---	74.0	19.3	H
7182.3	---	36.2	54.0	17.8	H
39802.3	---	43.8	54.0	10.2	H
39802.3	53.7	---	74.0	20.4	H