

EMC Test Report

**Industry Canada RSS-Gen Issue 3 / RSS 210 Issue 8
FCC Part 15, Subpart E**

**Intel® Centrino® Advanced-N 6205 with WNC
81XCAA15.G03 Dipole Antenna**

IC CERTIFICATION #: 1000M-62205ANHU
FCC ID: PD962205ANHU

APPLICANT: Intel Corporation
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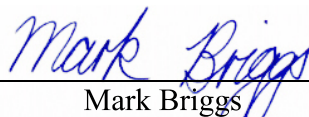
TEST SITE(S): Elliott Laboratories
41039 Boyce Road.
Fremont, CA. 94538-2435

IC SITE REGISTRATION #: 2845B-4, 2845B-5

REPORT DATE: June 24, 2011

FINAL TEST DATES: June 16, 17 and 20, 2011

AUTHORIZED SIGNATORY:



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Testing Cert #2016.01

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REVISION HISTORY

Rev#	Date	Comments	Modified By
1	06-24-2011	First release	

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SCOPE

An electromagnetic emissions test has been performed on the Intel Corporation Intel® Centrino® Advanced-N 6205 with WNC 81XCAA15.G03 Dipole Antenna, pursuant to the following rules:

Industry Canada RSS-Gen Issue 3

RSS 210 Issue 8 “Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment”

FCC Part 15, Subpart E requirements for UNII Devices (using FCC DA 02-2138, August 30, 2002)

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in Elliott Laboratories test procedures:

ANSI C63.4:2003

FCC UNII test procedure 2002-08 DA-02-2138, August 2002

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada performance and procedural standards.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, all unlicensed transmitters and transceivers require certification. Receive-only devices operating between 30 MHz and 960 MHz are subject to either certification or a manufacturer’s declaration of conformity, with all other receive-only devices exempt from the technical requirements.

Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification. Class II devices are required to meet the appropriate technical requirements but are exempt from certification requirements.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body’s review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

STATEMENT OF COMPLIANCE

The tested sample of Intel Corporation Intel® Centrino® Advanced-N 6205 with WNC 81XCAA15.G03 Dipole Antenna complied with the requirements of the following regulations:

RSS 210 Issue 8 “Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment”
FCC Part 15, Subpart E requirements for UNII Devices

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

The test results recorded herein are based on a single type test of Intel Corporation Intel® Centrino® Advanced-N 6205 with WNC 81XCAA15.G03 Dipole Antenna and therefore apply only to the tested sample. The sample was selected and prepared by Steve Hackett of Intel Corporation.

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

TEST RESULTS SUMMARY**UNII / LELAN DEVICES****Operation in the 5.15 – 5.25 GHz Band**

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.407(e)		Indoor operation only	Not evaluated. The proposed changes (addition of a new antenna type of lower gain than the originally certified antenna) do not affect the values previously reported.		
15.407(a) (2)		26dB Bandwidth			
15.407 (a) (1)	A9.2(1)	Output Power			
15.407 (a) (1)	-	Power Spectral Density			
-	A9.5 (2)				

Operation in the 5.25 – 5.35 GHz Band

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.407(a) (2)		26dB Bandwidth	Not evaluated. The proposed changes (addition of a new antenna type of lower gain than the originally certified antenna) do not affect the values previously reported.		
15.407(a) (2)	A9.2(2)	Output Power			
15.407(a) (2)	-	Power Spectral Density			
-	A9.2(2) / A9.5 (2)	Power Spectral Density			

Operation in the 5.47 – 5.725 GHz Band

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.407(a) (2)		26dB Bandwidth	Not evaluated. The proposed changes (addition of a new antenna type of lower gain than the originally certified antenna) do not affect the values previously reported.		
15.407(a) (2)	A9.2(2)	Output Power			
15.407(a) (2)		Power Spectral Density			
	A9.2(2) / A9.5 (2)	Power Spectral Density			
KDB 443999	A9	Non-operation in 5600 – 5650 MHz sub band			

Requirements for all U-NII/LELAN bands

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.407	A9.5a	Modulation	Not evaluated. The proposed changes (addition of a new antenna type of lower gain than the originally certified antenna) do not affect the values previously reported.		
15.407(b) (5) / 15.209	A9.3	Spurious Emissions below 1GHz			
15.407(b) (5) / 15.209	A9.3	Spurious Emissions above 1GHz	52.1dB μ V/m @ 5150.0MHz	Refer to page 19	Complies (-1.9dB)
15.407(a)(6)	-	Peak Excursion Ratio	Not evaluated. The proposed changes (addition of a new antenna type of lower gain than the originally certified antenna) do not affect the values previously reported.		
15.407 (c)	A9.5(4)	Operation in the absence of information to transmit			
15.407 (g)	A9.5 (5)	Frequency Stability			
15.407 (h1)	A9.4	Transmit Power Control	TPC is not required as the device operates at below 500mW eirp		Complies
15.407 (h2)	A9.4	Dynamic frequency Selection (client-only device without radar detection)	Not evaluated. The proposed changes (addition of a new antenna type of lower gain than the originally certified antenna) do not affect the values previously reported.		
<p>Note 1: The previously reported worst case value for radiated spurious emissions was 52.9dBμV/m @ 5150MHz (1.1dB below the limit). Spurious emissions below 1Ghz were found to be independent of the transmitter/receiver during original device testing and related to the digital device emissions from the fixture and EUT.</p>					

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	Not evaluated. The proposed changes (addition of a new antenna type of lower gain than the originally certified antenna) do not affect the values previously reported.		
15.207	RSS GEN Table 2	AC Conducted Emissions			
15.109	RSS GEN 7.2.3 Table 1	Receiver spurious emissions	50.4dB μ V/m @ 10600.0MHz	Refer to page 19	Complies (- 3.6dB)
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to MPE calculations, RSS 102 declaration and User Manual statements.	Refer to OET 65, FCC Part 1 and RSS 102	Complies
-	RSP 100 RSS GEN 4.4.1	99% Bandwidth	Not evaluated. The proposed changes (addition of a new antenna type of lower gain than the originally certified antenna) do not affect the values previously reported.		
<p>Note 1: The previously reported worst case value for radiated spurious emissions was 34.9dBμV/m @ 199.83MHz (8.6dB below the limit).</p>					

MEASUREMENT UNCERTAINTIES

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with UKAS document LAB 34.

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
RF power, conducted (power meter)	dBm	25 to 7000 MHz	± 0.52 dB
RF power, conducted (Spectrum analyzer)	dBm	25 to 7000 MHz	± 0.7 dB
Conducted emission of transmitter	dBm	25 to 26500 MHz	± 0.7 dB
Conducted emission of receiver	dBm	25 to 26500 MHz	± 0.7 dB
Radiated emission (substitution method)	dBm	25 to 26500 MHz	± 2.5 dB
Radiated emission (field strength)	dB μ V/m	25 to 1000 MHz	± 3.6 dB
		1000 to 40000 MHz	± 6.0 dB
Conducted Emissions (AC Power)	dB μ V	0.15 to 30 MHz	± 2.4 dB

EQUIPMENT UNDER TEST (EUT) DETAILS**GENERAL**

The Intel Corporation Intel® Centrino® Advanced-N 6205 with WNC 81XCAA15.G03 Dipole Antenna is a PCIe Half Mini Card form factor IEEE 802.11a/b/g/n wireless network adapter that operates in both the 2.4 GHz and 5.0 GHz spectra. The card supports 2x2 MIMO for 802.11n modes in both 20MHz and 40MHz channels. In legacy modes 1x2 operation is supported.

For radio testing purposes the card was installed in a test fixture that exposed all sides of the card.

The card has been certified with limited modular approval. The limited modular version is intended to allow the OEM to permit user installation when the host system is provided with a bios locking feature that prevents unauthorized installation (FCC ID: PD962205ANHU; IC:1000M-62205ANHU) The U.S./FCC approved version is approved under Intel model 62205ANHMW and for Canada/IC as model 62205ANHU.

The scope of testing is to evaluate a new antenna type for use with the module (dipole type). The gain of this new antenna compared to the originally approved PIFA-type antennas are detailed below.

The sample was received on June 13, 2011 and tested on June 16, 17 and 20, 2011. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID IC UPN
Intel Corporation	C/M 62205ANHU	PCIe Half Mini Card 802.11a/b/g/n wireless network adapter	MAC address 001500634F48	PD962205ANHU 1000M- 62205ANHU

ANTENNA SYSTEM

The antenna originally approved with the system was a two-antenna PIFA antenna system – Shanghai Universe Communication Electron Co., Ltd. Testing under the scope of this report is to evaluate a new dipole antenna, part number WNC P/N 81XCAA15.G03. In all bands the new antenna has lower gain than the PIFA antenna.

Band	Antenna Gain	
	Original PIFA	New Dipole
200-2483.5 MHz	3.2 dBi	Tx/Rx1: -0.45 dBi Tx/Rx2: 1.26 dBi
5150-5350 MHz	3.7 dBi	Tx/Rx1: -0.36 dBi Tx/Rx2: 1.58 dBi
5470-5725 MHz	4.8 dBi	Tx/Rx1: -0.07 dBi Tx/Rx2: 1.01 dBi
5725-5850 MHz	5 dBi	Tx/Rx1: 0.83 dBi Tx/Rx2: 1.09 dBi

ENCLOSURE

The EUT does not have an enclosure as it is designed to be installed within the enclosure of a host computer or system.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at Elliott.

SUPPORT EQUIPMENT

The following equipment was used as support equipment for testing:

Company	Model	Description	Serial Number	FCC ID
Intel	Shiloh	MINI PCI test fixture	2009-1543	-
Dell	Prototype	Laptop PC	-	-
Ailent	-	DC bench supply	-	-

EUT INTERFACE PORTS

The I/O cabling configuration during testing was as follows:

Port	Connected To	Description	Cable(s)	
			Shielded or Unshielded	Length(m)
test fixture DC In	DC Supply out	2-wire	Unshielded	2
test fixture PCIe	Laptop PCIe	Ribbon	Unshielded	1

EUT OPERATION

The EUT was installed into a test fixture that exposed all sides of the card. The test fixture interfaced to a laptop computer and dc power supply. The laptop computer was used to configure the EUT to continuously transmit or continuously receive on the channel specified in the test data.

For transmit mode measurements the system was configured to operate in one or more of the available operating modes – 802.11b, 802.11g, 802.11a, 802.11n (20 MHz channel bandwidth) and 802.11n (40MHz channel bandwidth). The output power for all measurements was set to be within 0.5dB of the output power measured during the original testing.

The data rates used for all tests were the lowest data rates for each mode – 1Mb/s for 802.11b, 6Mb/s for 802.11a and 802.11g, 6.5MB/s for 802.11n (20MHz), and 13 Mb/s for 802.11n (40MHz). The device operates at its maximum output power at the lowest data rate (this was confirmed through separate measurements during the original device certification tests).

As the scope of testing was to evaluate a new antenna, and because output power ratings for this new antenna were to be the same as those originally approved with the device, testing was limited to an evaluation of the radiated spurious emissions. The actual modes evaluated were based on the worst case mode or modes observed during the original tests.

Compliance with radiated spurious emissions requirements in the restricted bands adjacent to the allocated bands was evaluated in the worst case 20-MHz (which was 802.11n 20MHz for all bands) and also in the 802.11n 40-MHz mode.

Compliance with radiated spurious emissions requirements away from the allocated band edges was performed in the worst case OFDM mode. In the UNII bands the worst case OFDM modes were 802.11n (20MHz) MIMO mode in the 5150-5250 MHz and 5250-5350 MHz bands and 802.11a mode in the upper 5470-5725 MHz band. Legacy SISO modes were evaluated on each chain on the center channel and then on the worst-case chain on the top and bottom channels. MIMO modes were evaluated with both chains active and operating at the maximum power per chain.

The PC was using the Intel test utility DRTU Version 1.1.3 and the device driver was version 13.0.0.238.

TEST SITE**GENERAL INFORMATION**

Final test measurements were taken at the test sites listed below. Pursuant to section 2.948 of the FCC's Rules and section 3.3 of RSP-100, construction, calibration, and equipment data has been filed with the Commission and with industry Canada.

Site	Registration Numbers		Location
	FCC	Canada	
Chamber 4	211948	2845B-4	41039 Boyce Road Fremont, CA 94538-2435
Chamber 5	211948	2845B-5	

ANSI C63.4:2003 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement. The test site(s) contain separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4:2003.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment or in a semi-anechoic chamber. The test sites are maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4:2003 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4:2003.

MEASUREMENT INSTRUMENTATION**RECEIVER SYSTEM**

An EMI receiver as specified in CISPR 16-1-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde & Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A loop antenna is used below 30 MHz. For the measurement range 30 MHz to 1000 MHz either a combination of a biconical antenna and a log periodic or a bi-log antenna is used. Above 1000 MHz, horn antennas are used. The antenna calibration factors to convert the received voltage to an electric field strength are included with appropriate cable loss and amplifier gain factors to determine an overall site factor, which is then programmed into the test receivers or incorporated into the test software.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane.

ANSI C63.4:2003 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The regulations require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4:2003, and the worst-case orientation is used for final measurements.

RADIATED EMISSIONS

