

# Intel® Wireless Adapter Information Guide

This version of Intel® PROSet/Wireless WiFi Software is compatible with the adapters listed next. However, note that newer features provided in this software release are generally not supported for older, legacy adapters.

- Intel® Centrino® Wireless-N 100
- Intel® Centrino® Wireless-N 105
- Intel® Centrino® Wireless-N 130
- Intel® Centrino® Wireless-N 135
- Intel® WiFi Link 1000
- Intel® Centrino® Wireless-N 1030
- Intel® Centrino® Wireless-N 2200
- Intel® Centrino® Wireless-N 2230
- Intel® Centrino® Wireless-N + WiMAX 6150
- Intel® Centrino® Advanced-N 6200
- Intel® Centrino® Advanced-N 6205
- Intel® Centrino® Advanced-N 6230
- Intel® Centrino® Advanced-N 6235
- Intel® Centrino® Advanced-N + WiMAX 6250
- Intel® Centrino® Ultimate-N 6300

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With your WiFi network card, you can access WiFi networks, share files or printers, or even share your Internet connection. All of these features can be explored using a WiFi network in your home or office. This WiFi network solution is designed for both home and business use. Additional users and features can be added as your networking needs grow and change.

This guide contains basic information about Intel adapters. It includes information about several adapter properties that you can set to control and enhance the performance of your adapter with your particular wireless network and environment. Intel® wireless adapters enable fast connectivity without wires for desktop and notebook PCs.

- [Adapter Settings](#)
- [Regulatory Information](#)
- [Specifications](#)
- [Important Information](#)
- [Support](#)
- [Warranty](#)
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Depending on the model of your Intel WiFi adapter, your adapter is compatible with 802.11a, 802.11b, 802.11g, and 802.11n (draft 2.0) wireless standards. Operating at 5 GHz or 2.4 GHz frequency at data rates of up to 450 Mbps, you can now connect your computer to existing high-

speed networks that use multiple access points within large or small environments. Your WiFi adapter maintains automatic data rate control according to the access point location and signal strength to achieve the fastest possible connection. All of your wireless network connections are easily managed by the WiFi connection utility. Profiles that are set up through the WiFi connection utility provide enhanced security measures with 802.1X network authentication.

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"IMPORTANT NOTICE FOR ALL USERS OR DISTRIBUTORS:

Intel wireless LAN adapters are engineered, manufactured, tested, and quality checked to ensure that they meet all necessary local and governmental regulatory agency requirements for the regions that they are designated and/or marked to ship into. Because wireless LANs are generally unlicensed devices that share spectrum with radars, satellites, and other licensed and unlicensed devices, it is sometimes necessary to dynamically detect, avoid, and limit usage to avoid interference with these devices. In many instances Intel is required to provide test data to prove regional and local compliance to regional and governmental regulations before certification or approval to use the product is granted. Intel's wireless LAN's EEPROM, firmware, and software driver are designed to carefully control parameters that affect radio operation and to ensure electromagnetic compliance (EMC). These parameters include, without limitation, RF power, spectrum usage, channel scanning, and human exposure.

For these reasons Intel cannot permit any manipulation by third parties of the software provided in binary format with the wireless LAN adapters (e.g., the EEPROM and firmware). Furthermore, if you use any patches, utilities, or code with the Intel wireless LAN adapters that have been manipulated by an unauthorized party (i.e., patches, utilities, or code (including open

source code modifications) which have not been validated by Intel), (i) you will be solely responsible for ensuring the regulatory compliance of the products, (ii) Intel will bear no liability, under any theory of liability for any issues associated with the modified products, including without limitation, claims under the warranty and/or issues arising from regulatory non-compliance, and (iii) Intel will not provide or be required to assist in providing support to any third parties for such modified products.

**Note:** Many regulatory agencies consider Wireless LAN adapters to be "modules", and accordingly, condition system-level regulatory approval upon receipt and review of test data documenting that the antennas and system configuration do not cause the EMC and radio operation to be non-compliant."

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June 20, 2012

# Adapter Settings

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The **Advanced** tab displays the device properties for the WiFi adapter installed on your computer.

## How to Access

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### WiFi Adapter Settings Description

Name	Description
<b>802.11n Channel Width (2.4 GHz)</b>	<p>Set high throughput channel width to maximize performance. Set the channel width to <b>Auto</b> or <b>20MHz</b>. Use 20MHz if 802.11n channels are restricted. This setting applies to 802.11n capable adapters only.</p> <p><b>NOTE:</b> This setting <i>does not apply</i> to the Intel® Wireless WiFi Link 4965AGN (uses 20 MHz channel width only).</p>
<b>802.11n Channel Width (5.2 GHz)</b>	<p>Set high throughput channel width to maximize performance. Set the channel width to <b>Auto</b> or <b>20MHz</b>. Use 20MHz if 802.11n channels are restricted. This setting applies to 802.11n capable adapters only.</p> <p><b>NOTE:</b> This setting <i>does not apply</i> to the following adapters:</p> <ul style="list-style-type: none"><li>• Intel® WiFi Link 1000</li><li>• Intel® Wireless WiFi Link 4965AGN</li></ul>
<b>802.11n Mode</b>	<p>The 802.11n standard builds on previous 802.11 standards by adding multiple-input multiple-output (MIMO). MIMO increases data throughput to improve transfer rate. Select <b>Enabled</b> or <b>Disabled</b> to set the 802.11n mode of the WiFi adapter. Enabled is the default setting. This setting applies to 802.11n capable adapters only.</p> <p><b>NOTE:</b> To achieve transfer rates greater than 54 Mbps on 802.11n connections, WPA2*-AES security must be selected. No security (<b>None</b>) can be selected to enable network setup and troubleshooting.</p> <p>An administrator can enable or disable support for high throughput mode to reduce power-consumption or conflicts with other bands or compatibility issues.</p>
<b>Ad Hoc Channel</b>	<p>Unless the other computers in the ad hoc network use a different channel</p>

from the default channel, there is no need to change the channel.

**Value:** Select the permitted operating channel from the list.

- **802.11b/g:** Select this option when 802.11b and 802.11g (2.4 GHz) ad hoc band frequency is used.
- **802.11a:** Select this option when 802.11a (5 GHz) ad hoc band frequency is used. This setting *does not apply* to the Intel® WiFi Link 1000 adapter.

**NOTE:** When an 802.11a channel is not displayed, initiating ad hoc networks is not supported for 802.11a channels.

### **Ad Hoc Power Management**

Set power saving features for device to device (ad hoc) networks.

- **Disable:** Select when connecting to ad hoc networks that contain stations that do not support ad hoc power management
- **Maximum Power Savings:** Select to optimize battery life.
- **Noisy Environment:** Select to optimize performance or connecting with multiple clients.

### **Ad Hoc QoS Mode**

Quality of Service (QoS) control in ad hoc networks. QoS provides prioritization of traffic from the access point over a wireless LAN based on traffic classification. WMM (Wi-Fi Multimedia) is the QoS certification of the Wi-Fi Alliance (WFA). When WMM is enabled, the WiFi adapter uses WMM to support priority tagging and queuing capabilities for Wi-Fi networks.

- **WMM Enabled** (Default)
- **WMM Disabled**

### **Fat Channel Intolerant**

This setting communicates to surrounding networks that this WiFi adapter is not tolerant of 40MHz channels in the 2.4GHz band. The default setting is for this to be turned off (disabled), so that the adapter does not send this notification.

**NOTE:** This setting *does not apply* to the following adapters:

- Intel® Wireless WiFi Link 4965AG\_
- Intel® PRO/Wireless 3945ABG Network Connection

### **Mixed mode protection**

Use to avoid data collisions in a mixed 802.11b and 802.11g environment. Request to Send/Clear to Send (RTS/CTS) should be used in an environment where clients may not hear each other. CTS-to-self can be used to gain more throughput in an environment where clients are in close proximity and can hear each other.

## Power Management

Lets you select a balance between power consumption and WiFi adapter performance. The WiFi adapter power settings slider sets a balance between the computer's power source and the battery.

- **Use default value:** (Default) Power settings are based on the computer's power source.
- **Manual:** Adjust the slider for the desired setting. Use the lowest setting for maximum battery life. Use the highest setting for maximum performance.

**NOTE:** Power consumption savings vary based on Network (Infrastructure) settings.

## Roaming Aggressiveness

This setting lets you define how aggressively your wireless client roams to improve connection to an access point.

- **Default:** Balanced setting between not roaming and performance.
- **Lowest:** Your wireless client will not roam. Only significant link quality degradation causes it to roam to another access point.
- **Highest:** Your wireless client continuously tracks the link quality. If any degradation occurs, it tries to find and roam to a better access point.

## Throughput Enhancement

Changes the value of the Packet Burst Control.

- **Enable:** Select to enable throughput enhancement.
- **Disable:** (Default) Select to disable throughput enhancement.

**Transmit Power** **Default Setting:** Highest power setting.

**Lowest: Minimum Coverage:** Set the adapter to the lowest transmit power. Enables you to expand the number of coverage areas or confine a coverage area. Reduces the coverage area in high traffic areas to improve overall transmission quality and avoids congestion and interference with other devices.

**Highest: Maximum Coverage:** Set the adapter to a maximum transmit power level. Select for maximum performance and range in environments with limited additional WiFi radio devices.

**NOTE:** The optimal setting is for a user to always set the transmit power at the lowest possible level that is still compatible with the quality of their communication. This allows the maximum number of wireless devices to operate in dense areas and reduce interference with other devices that it shares the same radio spectrum with.

**NOTE:** This setting takes effect when either Network (Infrastructure) or Device to Device (ad hoc) mode is used.

**Wireless Mode**

Select which mode to use for connection to a wireless network:

- **802.11a only:** Connect the wireless WiFi adapter to 802.11a networks only. Not applicable for all adapters.
- **802.11b only:** Connect the wireless WiFi adapter to 802.11b networks only. Not applicable for all adapters.
- **802.11g only:** Connect the wireless WiFi adapter to 802.11g networks only.
- **802.11a and 802.11g:** Connect the WiFi adapter to 802.11a and 802.11g networks only. Not applicable for all adapters.
- **802.11b and 802.11g:** Connect the WiFi adapter to 802.11b and 802.11g networks only. Not applicable for all adapters.
- **802.11a, 802.11b, and 802.11g:** (Default) - Connect to either 802.11a, 802.11b or 802.11g wireless networks. Not applicable for all adapters.

**OK**

Saves settings and returns to the previous page.

**Cancel**

Closes and cancels any changes.

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# Regulatory Information

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  - [Intel® Centrino® Ultimate-N 6300](#)
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## Intel WiFi/WiMAX Wireless Adapters

Information in this section supports the following wireless adapters:

- Intel® Centrino® Wireless-N + WiMAX 6150
- Intel® Centrino® Advanced-N + WiMAX 6250

See [Specifications](#) for complete wireless adapter specifications.

The following information is provided:

- [Information for the User](#)
  - [Regulatory Information](#)
  - [Information for OEMs and Host Integrators](#)
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## Information for the User

### Safety Notices



## USA/FCC – Radio Frequency Exposure

The FCC with its action in ET Docket 96-8 has adopted a safety standard for human exposure to radio frequency (RF) electromagnetic energy emitted by FCC certified equipment. The wireless adapter meets the Human Exposure limits found in OET Bulletin 65, supplement C, 2001, and ANSI/IEEE C95.1, 1992. Proper operation of this radio according to the instructions found in this manual will result in exposure substantially below the FCC's recommended limits.

The following safety precautions should be observed:

- Do not touch or move antenna while the unit is transmitting or receiving.
- Do not hold any component containing the radio such that the antenna is very close or touching any exposed parts of the body, especially the face or eyes, while transmitting.
- Do not operate the radio or attempt to transmit data unless the antenna is connected; this behavior may cause damage to the radio.
- Use in specific environments:
  - The use of wireless adapters in hazardous locations is limited by the constraints posed by the safety directors of such environments.
  - The use of electronic devices with wireless adapters on airplanes is governed by the rules of each commercial airlines operator.
  - The use of wireless adapters in hospitals is restricted to the limits set forth by each hospital.

## Explosive Device Proximity Warning



**Warning:** Do not operate a portable transmitter (including this wireless adapter) near unshielded blasting caps or in an explosive environment unless the transmitter has been modified to be qualified for such use.

## Antenna Warnings



**Warning:** The wireless adapter is not designed for use with high-gain directional antennas

## Use On Aircraft Caution



**Caution:** Regulations of commercial airlines operators may prohibit airborne operation of certain electronic devices with radio-frequency wireless devices (wireless adapters) because their signals could interfere with critical aircraft instruments.

**Safety Notices for Other Devices in the Wireless Network:** See the documentation supplied with wireless adapters or other devices in the wireless network.

## Local Restrictions on 802.11a, 802.11b, 802.11g, 802.11n, and 802.16e Radio Usage

**⚠ Caution:** Due to the fact that the frequencies used by 802.11a, 802.11b, 802.11g, 802.11n, and 802.16e wireless LAN devices may not yet be harmonized in all countries, 802.11a, 802.11b, 802.11g, 802.11n, and 802.16e products are designed for use only in specific countries, and are not allowed to be operated in countries other than those of designated use. As a user of these products, you are responsible for ensuring that the products are used only in the countries for which they were intended and for verifying that they are configured with the correct selection of frequency and channel for the country of use. The device transmit power control (TPC) interface is part of the Intel® PROSet/Wireless WiFi Connection Utility Software. Operational restrictions for Equivalent Isotropic Radiated Power (EIRP) are provided by the system manufacturer. Any deviation from the permissible power and frequency settings for the country of use is an infringement of national law and may be punished as such.

### **Wireless Interoperability**

The wireless adapter is designed to be interoperable with other wireless LAN products that are based on direct sequence spread spectrum (DSSS) radio technology and to comply with the following standards:

- IEEE Std. 802.11b compliant Standard on Wireless LAN
- IEEE Std. 802.11g compliant Standard on Wireless LAN
- IEEE Std. 802.11a compliant Standard on Wireless LAN
- IEEE Std. 802.11n draft 2.0 compliant on Wireless LAN
- IEEE 802.16e-2005 Wave 2 compliant
- Wireless Fidelity certification, as defined by the Wi-Fi Alliance
- WiMAX certification as defined by the WiMAX Forum

### **The Wireless Adapter and Your Health**

The wireless adapter, like other radio devices, emits radio frequency electromagnetic energy. The level of energy emitted by the wireless adapter, however, is less than the electromagnetic energy emitted by other wireless devices such as mobile phones. The wireless adapter operates within the guidelines found in radio frequency safety standards and recommendations. These standards and recommendations reflect the consensus of the scientific community and result from deliberations of panels and committees of scientists who continually review and interpret the extensive research literature. In some situations or environments, the use of the wireless adapter may be restricted by the proprietor of the building or responsible representatives of the applicable organization. Examples of such situations may include:

- Using the wireless adapter on board airplanes, or
- Using the wireless adapter in any other environment where the risk of interference with other devices or services is perceived or identified as being harmful.

If you are uncertain of the policy that applies to the use of wireless adapters in a specific organization or environment (an airport, for example), you are encouraged to ask for authorization to use the adapter before you turn it on.

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## Regulatory Information

### Local Restriction of 802.11a, 802.11b, 802.11g, and 802.11n Radio Usage

The following statement on local restrictions must be published as part of the compliance documentation for all 802.11a, 802.11b, 802.11g and 802.11n products.

- ⚠ Caution:** Due to the fact that the frequencies used by 802.11a, 802.11b, 802.11g, 802.11n, and 802.16e wireless LAN devices may not yet be harmonized in all countries, 802.11a, 802.11b, 802.11g, 802.11n, and 802.16e products are designed for use only in specific countries, and are not allowed to be operated in countries other than those of designated use. As a user of these products, you are responsible for ensuring that the products are used only in the countries for which they were intended and for verifying that they are configured with the correct selection of frequency and channel for the country of use. Any deviation from the permissible power and frequency settings for the country of use is an infringement of national law and may be punished as such.

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### USA—Federal Communications Commission (FCC)

This wireless adapter is restricted to indoor use due to its operation in the 5.15 to 5.25 GHz and 5.470 to 5.725 GHz frequency ranges. FCC requires this wireless adapter to be used indoors for the frequency ranges 5.15 to 5.25 GHz and 5.470 to 5.725 GHz to reduce the potential for harmful interference to co-channel mobile satellite systems. No configuration controls are provided for Intel® wireless adapters allowing any change in the frequency of operations outside the FCC grant of authorization for U.S. operation according to Part 15.407 of the FCC rules.

- Intel® wireless adapters are intended for OEM integrators only.
- Intel® wireless adapters cannot be co-located with any other transmitter unless approved by the FCC.

This wireless adapter complies with Part 15 of the FCC Rules. Operation of the device is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference that may cause undesired operation.

### Class B Device Interference Statement

This wireless adapter has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This wireless adapter generates, uses, and can radiate radio frequency energy. If the wireless adapter is not installed

and used in accordance with the instructions, the wireless adapter may cause harmful interference to radio communications. There is no guarantee, however, that such interference will not occur in a particular installation. If this wireless adapter does cause harmful interference to radio or television reception (which can be determined by turning the equipment off and on), the user is encouraged to try to correct the interference by taking one or more of the following measures:

- Reorient or relocate the receiving antenna of the equipment experiencing the interference.
  - Increase the distance between the wireless adapter and the equipment experiencing the interference.
  - Connect the computer with the wireless adapter to an outlet on a circuit different from that to which the equipment experiencing the interference is connected.
  - Consult the dealer or an experienced radio/TV technician for help.
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### **Safety Approval Considerations**

This device has been safety approved as a component and is for use only in complete equipment where the acceptability of the combination is determined by the appropriate safety agencies. When installed, consideration must be given to the following:

- It must be installed into a compliant host device meeting the requirement of UL/EN/IEC 60950-1 2nd edition including the general provisions of enclosure design 1.6.2 and specifically paragraph 1.2.6.2 (Fire Enclosure).
  - The device shall be supplied by a SELV source when installed in the end-use equipment.
  - A heating test shall be considered in the end-use product for meeting the requirement of UL/EN/IEC 60950-1 2nd edition.
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### **Low Halogen**

Applies only to brominated and chlorinated flame retardants (BFRs/CFRs) and PVC in the final product. Intel components as well as purchased components on the finished assembly meet JS-709 requirements, and the PCB / substrate meet IEC 61249-2-21 requirements. The replacement of halogenated flame retardants and/or PVC may not be better for the environment.

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### **Japan**

Indoor use only in the 5GHz band.

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## Korea

### 당해 무선설비는 운용 중 전파혼신 가능성이 있음

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## Mexico

La operación de este equipo está sujeta a las siguientes dos condiciones: (1) es posible que este equipo o dispositivo no cause interferencia perjudicial y (2) este equipo o dispositivo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.

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## Taiwan

### 第十二條

經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

### 第十四條

低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前項合法通信，指依電信法規定作業之無線電通信。

低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

在5.25-5.35 兆赫頻帶內操作之無線資訊傳輸設備，限於室內使用。

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## Modular Regulatory Certification Country Markings

A list of countries requiring regulatory markings is available. Note that the lists include only countries requiring marking but not all certified countries. To find the regulatory country marking information for your adapter, perform these steps

1. Open this web site: <http://www.intel.com/support/wireless/wlan/>
2. Click on the *link for your adapter*.
3. Click **Document and Guides**
4. Under **Regulatory Information**, click Regulatory documents *for your adapter*.

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## Information for OEMs and Host Integrators

The guidelines described within this document are provided to OEM integrators installing Intel® wireless adapters in notebook and tablet PC host platforms. Adherence to these requirements is necessary to meet the conditions of compliance with FCC rules, including RF exposure. When all antenna type and placement guidelines described herein are fulfilled the Intel® wireless adapters may be incorporated into notebook and tablet PC host platforms with no further restrictions. If any of the guidelines described herein are not satisfied it may be necessary for the OEM or integrator to perform additional testing and/or obtain additional approval. The OEM or integrator is responsible to determine the required host regulatory testing and/or obtaining the required host approvals for compliance.

- Intel® wireless adapters are intended for OEMs and host integrators only
- The Intel® wireless adapter FCC Grant of Authorization describes any limited conditions of modular approval.
- The Intel® wireless adapters must be operated with an access point that has been approved for the country of operation.
- Changes or modification to Intel® wireless adapters by OEMs, integrators or other third parties is not permitted. Any changes or modification to Intel® wireless adapters by OEMs, integrators or other third parties will void authorization to operate the adapter.

### Antenna Types and Gains

Only antennas of the same type and with equal or less gains as shown below may be used with the Intel® wireless adapters. Other types of antennas and/or higher gain antennas may require additional authorization for operation.

Antenna Type	Antenna Location (Main/Aux)	2.4GHz Peak Gain in dBi*	2.6GHz Peak Gain in dBi*	5.2GHz Peak Gain in dBi*	5.5GHz Peak Gain in dBi*	5.7GHz Peak Gain in dBi*
PIFA	Main	3.24	3.47	3.73	4.77	4.97
	Aux					
	MIMO					
*All Antenna gains include cable loss						

### Antenna Placement Within the Host Platform

To ensure RF exposure compliance the antenna(s) used with the Intel® wireless adapters must be installed in notebook or tablet PC host platforms to provide a minimum separation distance from all persons, in all operating modes and orientations of the host platform, with strict adherence to the table below. The antenna separation distance applies to both horizontal and vertical orientation of the antenna when installed in the host system.

Intel® Wireless Adapter	Minimum required antenna-to-user separation distance (mm)
Intel® Centrino® Wireless-N + WiMAX 6150	18
Intel® Centrino® Advanced-N + WiMAX 6250	17

### **Simultaneous transmission of Intel® Wireless Adapters with Other Integrated or Plug-In Transmitters**

Based upon FCC Knowledge Database publication number 616217 D03 Supplement <https://fjallfoss.fcc.gov/kdb/GetAttachment.html?id=30257> , when there are multiple transmitting devices installed in a host device, an RF exposure transmitting assessment shall be performed to determine the necessary application and test requirements. OEM integrators must identify all possible combinations of simultaneous transmission configurations for all transmitters and antennas installed in the host system. This includes transmitters installed in the host as mobile devices (>20cm separation from user) and portable devices (<20cm separation from user). OEM integrators should consult the actual FCC KDB 616217 D03 Supplement document for all details in making this assessment to determine if any additional requirements for testing or FCC approval is necessary.

## **Intel WiFi Adapters, 802.11n Compliant**

The information in this section applies to the following products:

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## Wireless Interoperability

The wireless adapter is designed to be interoperable with other wireless LAN products that are based on direct sequence spread spectrum (DSSS) radio technology and to comply with the following standards:

- IEEE Std. 802.11b compliant Standard on Wireless LAN
- IEEE Std. 802.11g compliant Standard on Wireless LAN
- IEEE Std. 802.11a compliant Standard on Wireless LAN
- IEEE Std. 802.11n draft 2.0 compliant on Wireless LAN
- Wireless Fidelity certification, as defined by the Wi-Fi Alliance

## The Wireless Adapter and Your Health

The wireless adapter, like other radio devices, emits radio frequency electromagnetic energy. The level of energy emitted by the wireless adapter, however, is less than the electromagnetic energy emitted by other wireless devices such as mobile phones. The wireless adapter operates within the guidelines found in radio frequency safety standards and recommendations. These standards and recommendations reflect the consensus of the scientific community and result from deliberations of panels and committees of scientists who continually review and interpret the extensive research literature. In some situations or environments, the use of the wireless

adapter may be restricted by the proprietor of the building or responsible representatives of the applicable organization. Examples of such situations may include:

- Using the wireless adapter on board airplanes, or
- Using the wireless adapter in any other environment where the risk of interference with other devices or services is perceived or identified as being harmful.


If you are uncertain of the policy that applies to the use of wireless adapters in a specific organization or environment (an airport, for example), you are encouraged to ask for authorization to use the adapter before you turn it on.

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## Regulatory Information

### Local Restriction of 802.11a, 802.11b, 802.11g, and 802.11n Radio Usage

The following statement on local restrictions must be published as part of the compliance documentation for all 802.11a, 802.11b, 802.11g and 802.11n products.

-  **Caution:** Due to the fact that the frequencies used by 802.11a, 802.11b, 802.11g and 802.11n wireless LAN devices may not yet be harmonized in all countries, 802.11a, 802.11b, 802.11g and 802.11n products are designed for use only in specific countries, and are not allowed to be operated in countries other than those of designated use. As a user of these products, you are responsible for ensuring that the products are used only in the countries for which they were intended and for verifying that they are configured with the correct selection of frequency and channel for the country of use. Any deviation from permissible settings and restrictions in the country of use could be an infringement of national law and may be punished as such.

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### USA—Federal Communications Commission (FCC)

This device is restricted to indoor use due to its operation in the 5.15 to 5.25 GHz and 5.470 to 5.725 GHz frequency ranges. FCC requires this product to be used indoors for the frequency ranges 5.15 to 5.25 GHz and 5.470 to 5.725 GHz to reduce the potential for harmful interference to co-channel mobile satellite systems. No configuration controls are provided for this wireless adapter allowing any change in the frequency of operations outside the FCC grant of authorization for U.S operation according to Part 15.407 of the FCC rules.

1. This device is intended for OEM integrators only.
2. This device cannot be co-located with any other transmitter unless approved by the FCC.

This device complies with Part 15 of the FCC Rules. Operation of the device is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference that may cause undesired operation.

### **Interference Statement**

This wireless adapter has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This wireless adapter generates, uses, and can radiate radio frequency energy. If the wireless adapter is not installed and used in accordance with the instructions, the wireless adapter may cause harmful interference to radio communications. There is no guarantee, however, that such interference will not occur in a particular installation. If this wireless adapter does cause harmful interference to radio or television reception (which can be determined by turning the equipment off and on), the user is encouraged to try to correct the interference by taking one or more of the following measures:

- Reorient or relocate the receiving antenna of the equipment experiencing the interference.
  - Increase the distance between the wireless adapter and the equipment experiencing the interference.
  - Connect the computer with the wireless adapter to an outlet on a circuit different from that to which the equipment experiencing the interference is connected.
  - Consult the dealer or an experienced radio/TV technician for help.
- 

### **Safety Approval Considerations**

This device has been safety approved as a component and is for use only in complete equipment where the acceptability of the combination is determined by the appropriate safety agencies. When installed, consideration must be given to the following:

- It must be installed into a compliant host device meeting the requirement of UL/EN/IEC 60950-1 2nd edition including the general provisions of enclosure design 1.6.2 and specifically paragraph 1.2.6.2 (Fire Enclosure).
  - The device shall be supplied by a SELV source when installed in the end-use equipment.
  - A heating test shall be considered in the end-use product for meeting the requirement of UL/EN/IEC 60950-1 2nd edition.
- 

### **Low Halogen**

Applies only to brominated and chlorinated flame retardants (BFRs/CFRs) and PVC in the final product. Intel components as well as purchased components on the finished assembly meet JS-709 requirements, and the PCB / substrate meet IEC 61249-2-21 requirements. The replacement of halogenated flame retardants and/or PVC may not be better for the environment.

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## Canada – Industry Canada (IC)

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil se conforme aux normes Canada d'Industrie de RSS permis-exempt. L'utilisation est assujetti aux deux conditions suivantes: (1) cet appareil ne peut pas causer d'interférences, et (2) cet appareil doit accepter des interférences, y compris des interférences qui peuvent causer desopérations non désirées de l'appareil.

**Caution:** When using IEEE 802.11a wireless LAN, this product is restricted to indoor use due to its operation in the 5.15- to 5.25-GHz frequency range. Industry Canada requires this product to be used indoors for the frequency range of 5.15 GHz to 5.25 GHz to reduce the potential for harmful interference to co-channel mobile satellite systems. High power radar is allocated as the primary user of the 5.25- to 5.35-GHz and 5.65 to 5.85-GHz bands. These radar stations can cause interference with and/or damage to this device. The maximum allowed antenna gain for use with this device is 6dBi in order to comply with the E.I.R.P limit for the 5.25- to 5.35 and 5.725 to 5.85 GHz frequency range in point-to-point operation. To comply with RF exposure requirements all antennas should be located at a minimum distance of 20cm, or the minimum separation distance allowed by the module approval, from the body of all persons.

**Attention:** l'utilisation d'un réseau sans fil IEEE802.11a est restreinte à une utilisation en intérieur à cause du fonctionnement dans la bande de fréquence 5.15-5.25 GHz. Industry Canada requiert que ce produit soit utilisé à l'intérieur des bâtiments pour la bande de fréquence 5.15-5.25 GHz afin de réduire les possibilités d'interférences nuisibles aux canaux co-existants des systèmes de transmission satellites. Les radars de puissances ont fait l'objet d'une allocation primaire de fréquences dans les bandes 5.25-5.35 GHz et 5.65-5.85 GHz. Ces stations radar peuvent créer des interférences avec ce produit et/ou lui être nuisible. Le gain d'antenne maximum permissible pour une utilisation avec ce produit est de 6 dBi afin d'être conforme aux limites de puissance isotropique rayonnée équivalente (P.I.R.E.) applicable dans les bandes 5.25-5.35 GHz et 5.725-5.85 GHz en fonctionnement point-à-point. Pour se conformer aux conditions d'exposition de RF toutes les antennes devraient être localisées à une distance minimum de 20 cm, ou la distance de séparation minimum permise par l'approbation du module, du corps de toutes les personnes.”

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Selon les règlements de Canada d'Industrie, cet émetteur de radio peut seulement fonctionner en utilisant une antenne du type et de gain maximum (ou moindre) que le gain approuvé pour l'émetteur par Canada d'Industrie. Pour réduire les interférences radio potentielles avec les autres utilisateurs, le type d'antenne et son gain devraient être choisis de façon à ce que la puissance isotrope rayonnée équivalente (P.I.R.E.) ne soit pas supérieure à celle qui est nécessaire pour une communication réussie.

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## European Union

The low band 5.15 -5.35 GHz is for indoor use only.

This equipment complies with the essential requirements of the European Union directive 1999/5/EC. See [Statements of European Union Compliance](#).

## European Union Declarations of Conformity

To view the European Union Declaration of Conformity for your adapter, perform these steps

1. Open this web site: [http://developer.intel.com/design/litcentr/ce\\_docs/index.htm](http://developer.intel.com/design/litcentr/ce_docs/index.htm)
2. Under the **Wireless Products** menu select your adapter.
3. Click **Go**

To view additional regulatory information for your adapter, perform these steps

1. Open this web site: <http://www.intel.com/support/wireless/wlan/>
  2. Click on the *link for your adapter*.
  3. Click **Document and Guides**
  4. Under **Regulatory Information**, click *Regulatory documents for your adapter*.
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## Japan

Indoor use only in the 5GHz band.

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## Korea

**당해 무선설비는 운용 중 전파혼신 가능성이 있음**

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## **Mexico**

La operación de este equipo está sujeta a las siguientes dos condiciones: (1) es posible que este equipo o dispositivo no cause interferencia perjudicial y (2) este equipo o dispositivo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.

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## **Morocco**

The operation of this product in the radio channel 2 (2417 MHz) is not authorized in the following cities: Agadir, Assa-Zag, Cabo Negro, Chaouen, Goulmima, Oujda, Tan Tan, Taourirt, Taroudant and Taza.

The operation of this product in the radio channels 4, 5, 6 et 7 (2425 - 2442 MHz) is not authorized in the following cities: Aéroport Mohamed V, Agadir, Aguelmous, Anza, Benslimane, Béni Hafida, Cabo Negro, Casablanca, Fès, Lakkab, Marrakech, Merchich, Mohammédia, Rabat, Salé, Tanger, Tan Tan, Taounate, Tit Mellil, Zag.

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## **Pakistan**

"PTA APPROVED MODEL"

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## **Taiwan**

### **第十二條**

經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

### **第十四條**

低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前項合法通信，指依電信法規定作業之無線電通信。

低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

在5.25-5.35 兆赫頻帶內操作之無線資訊傳輸設備，限於室內使用。

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## Singapore

Complies with IDA Standards DB02941
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### Modular Regulatory Certification Country Markings

A list of countries requiring regulatory markings is available. Note that the lists include only countries requiring marking but not all certified countries. To find the regulatory country marking information for your adapter, perform these steps

1. Open this web site: <http://www.intel.com/support/wireless/wlan/>
  2. Click on the *link for your adapter*.
  3. Click **Document and Guides**
  4. Under **Regulatory Information**, click *Regulatory documents for your adapter*.
- 

### Information for OEMs and Host Integrators

The guidelines described within this document are provided to OEM integrators installing Intel® wireless adapters in notebook and tablet PC host platforms. Adherence to these requirements is necessary to meet the conditions of compliance with FCC rules, including RF exposure. When all antenna type and placement guidelines described herein are fulfilled the Intel® wireless adapters may be incorporated into notebook and tablet PC host platforms with no further restrictions. If any of the guidelines described herein are not satisfied it may be necessary for the OEM or integrator to perform additional testing and/or obtain additional approval. The OEM or integrator is responsible to determine the required host regulatory testing and/or obtaining the required host approvals for compliance.

- Intel® wireless adapters are intended for OEMs and host integrators only
- The Intel® wireless adapter FCC Grant of Authorization describes any limited conditions of modular approval.
- The Intel® wireless adapters must be operated with an access point that has been approved for the country of operation.
- Changes or modification to Intel® wireless adapters by OEMs, integrators or other third parties is not permitted. Any changes or modification to Intel® wireless adapters by OEMs, integrators or other third parties will void authorization to operate the adapter.

### Antenna Types and Gains

Only antennas of the same type and with equal or less gains as shown below may be used with the Intel® wireless adapters. Other types of antennas and/or higher gain antennas may require additional authorization for operation.

Antenna Type	Antenna Location (Main/Aux)	2.4GHz Peak Gain in dBi*	2.6GHz Peak Gain in dBi*	5.2GHz Peak Gain in dBi*	5.5GHz Peak Gain in dBi*	5.7GHz Peak Gain in dBi*
PIFA	Main	3.24	3.47	3.73	4.77	4.97
	Aux					
	MIMO					
*All Antenna gains include cable loss						

### Antenna Placement Within the Host Platform

To ensure RF exposure compliance the antenna(s) used with the Intel® wireless adapters must be installed in notebook or tablet PC host platforms to provide a minimum separation distance from all persons, in all operating modes and orientations of the host platform, with strict adherence to the table below. The antenna separation distance applies to both horizontal and vertical orientation of the antenna when installed in the host system. In cases where host platforms cannot meet the minimum separation distances the OEM integrator must consult with the Intel regulatory group to assist with the required authorization requirements.

Intel® Wireless Adapter	Minimum required antenna-to-user separation distance (mm)
Intel® Centrino® Wireless-N 100	9
Intel® Centrino® Wireless-N 105	9
Intel® Centrino® Wireless-N 130	8
Intel® Centrino® Wireless-N 135	9
Intel® WiFi Link 1000 <sup>1</sup>	20
Intel® Centrino® Wireless-N 1030	8
Intel® Centrino® Wireless-N 2200	9
Intel® Centrino® Wireless-N 2230	6
Intel® Centrino® Advanced-N 6200 <sup>1</sup>	20
Intel® Centrino® Advanced-N 6205	12
Intel® Centrino® Advanced-N 6230	8
Intel® Centrino® Advanced-N 6235	8
Intel® Centrino® Ultimate-N 6300	13

<sup>1</sup> This wireless adapter may be installed in mobile devices only (> 20 cm antenna separation to the body of user)



Main and auxiliary antennas should be located within the host platform with a minimum separation of 50mm to comply with RF exposure conditions when transmitting simultaneously.

### **Simultaneous transmission of Intel® Wireless Adapters with Other Integrated or Plug-In Transmitters**

OEM integrators should consult with FCC KDB 447498 to apply the simultaneous transmission SAR test evaluation and exclusion provisions to determine final compliance requirements for the host computer configuration. OEM integrators must identify all possible combinations of simultaneous transmission configurations for all transmitters and antennas installed in the host system. This includes transmitters installed in the host as mobile devices (>20cm separation from user) and portable devices (<20cm separation from user). OEM integrators should consult the actual FCC KDB 616217 document for all details in making this assessment to determine if any additional requirements for testing or FCC approval is necessary.

## **Statement of European Compliance**

Each of the adapters listed below comply with the essential requirements of the European Union directive 1999/5/EC.

- Intel® Centrino® Wireless-N 100
- Intel® Centrino® Wireless-N 105
- Intel® Centrino® Wireless-N 130
- Intel® Centrino® Wireless-N 135
- Intel® WiFi Link 1000
- Intel® Centrino® Wireless-N 1030
- Intel® Centrino® Wireless-N 2200
- Intel® Centrino® Wireless-N 2230
- Intel® Centrino® Advanced-N 6200
- Intel® Centrino® Advanced-N 6205
- Intel® Centrino® Advanced-N 6230
- Intel® Centrino® Advanced-N 6235
- Intel® Centrino® Ultimate-N 6300

Česky [Czech]	Tímto Intel ® Corporation prohlašuje, že toto zařízení je ve shodě se základními požadavky a dalšími příslušnými ustanoveními směrnice EU 1999/5/ES.
Dansk [Danish]	Herved, Intel ® Corporation, erklærer, at dette udstyr er i overensstemmelse med de væsentlige krav og øvrige relevante bestemmelser i EU-direktiv 1999/5/EF.
Deutsch [German]	Hiermit erklärt Intel ® Corporation, dass dieses Gerät in Übereinstimmung mit den grundlegenden Anforderungen und anderen relevanten Bestimmungen der EU Richtlinie 1999/5/EG befindet.
Esti	Käesolevaga Intel ® Corporation teatab, et see seade on vastavuses põhinõuete ja

[Estonian]	teistele asjakohastele sätetele Euroopa Liidu direktiivis 1999/5/EÜ.
English	Hereby, Intel® Corporation, declares that this equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
Español [Spanish]	Por este medio, Intel ® Corporation, declara que este equipo cumple con los requisitos esenciales y otras disposiciones pertinentes de la Directiva Europea 1999/5/CE.
Ελληνική [Greek]	Δια του παρόντος, η Intel ® Corporation, δηλώνει ότι ο εξοπλισμός αυτός είναι σε συμμόρφωση με τις βασικές απαιτήσεις και άλλες σχετικές διατάξεις της κοινοτικής οδηγίας 1999/5/EK.
Français [French]	Par la présente, Intel ® Corporation, déclare que cet équipement est en conformité avec les exigences essentielles et autres dispositions pertinentes de la directive européenne 1999/5/CE.
Italiano [Italian]	Con la presente, Intel ® Corporation, dichiara che questa apparecchiatura è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti della direttiva UE 1999/5/CE.
Latviski [Latvian]	Ar šo, Intel ® Corporation paziņo, ka šī tehnika ir atbilstība būtiskajām prasībām un citiem svarīgajiem nosacījumiem ES Direktīvas 1999/5/EK.
Lietuvių [Lithuanian]	Šiuo dokumentu, Intel ® Corporation ", pareiškia, kad šis įrenginys atitinka esminius reikalavimus ir kitus reikiamus ES Direktyvos 1999/5/EB.
Nederlands [Dutch]	Hierbij Intel ® Corporation, verklaart dat deze apparatuur in overeenstemming is met de essentiële eisen en andere relevante bepalingen van EU-richtlijn 1999/5/EG.
Malti [Maltese]	Hawnhekk, Intel ® Korporazzjoni, jiddikjara li dan it-tagħmir huwa konformi mar-rekwiziti essenzjali u dispożizzjonijiet oħra rilevanti tal-UE-Direttiva 1999/5/KE.
Magyar [Hungarian]	Ezáltal, az Intel ® Corporation kijelenti, hogy ez a berendezés megfelel az alapvető követelményeknek és más vonatkozó uniós 1999/5/EK irányelv.
Norsk [Norwegian]	Erklærer herved Intel ® Corporation, at dette utstyret er i samsvar med de grunnleggende kravene og andre relevante bestemmelser i EU direktiv 1999/5/EC.
Polski [Polish]	Niniejszym Intel ® Corporation, deklaruje, że ten sprzęt jest zgodny z zasadniczymi wymaganiami oraz pozostałymi stosownymi postanowieniami dyrektywy UE 1999/5/WE.
Português [Portuguese]	Nisto, a Intel ® Corporation, declara que este equipamento está em conformidade com os requisitos essenciais e outras disposições relevantes da Directiva da UE 1999/5/CE.
Slovensko [Slovenian]	S tem, Intel ® Corporation, izjavlja, da je ta oprema v skladu z bistvenimi zahtevami in drugimi relevantnimi določili direktive 1999/5/ES EU.
Slovensky [Slovak]	Týmto Intel ® Corporation prehlasuje, že toto zariadenie je v zhode so základnými požiadavkami a ďalšími príslušnými ustanoveniami smernice EÚ 1999/5/ES.
Suomi [Finnish]	Täten Intel ® Corporation vakuuttaa, että tämä laite on direktiivin olennaisten vaatimusten ja muiden määräysten EU-direktiivin 1999/5/EY.
Svenska	Härmed förklarar Intel ® Corporation, att denna utrustning är i överensstämmelse

[Swedish]	med de väsentliga egenskapskrav och övriga relevanta bestämmelser i EU-direktivet 1999/5/EC.
Íslenska [Icelandic]	Hér með lýsir, Intel ® Corporation, segir að þessi búnaður er í samræmi við grunnkröfur og önnur viðeigandi ákvæði ESB tilskipun 1999/5/EB.

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## Specifications

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- [Intel® Centrino® Wireless-N 135](#)
- [Intel® WiFi Link 1000](#)
- [Intel® Centrino® Wireless-N 1030](#)
- [Intel® Centrino® Wireless-N 2200](#)
- [Intel® Centrino® Wireless-N 2230](#)
- [Intel® Centrino® Wireless-N + WiMAX 6150](#)
- [Intel® Centrino® Advanced-N 6200](#)
- [Intel® Centrino® Advanced-N 6205](#)
- [Intel® Centrino® Advanced-N 6230](#)
- [Intel® Centrino® Advanced-N 6235](#)
- [Intel® Centrino® Advanced-N + WiMAX 6250](#)
- [Intel® Centrino® Ultimate-N 6300](#)

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## Intel® Centrino® Wireless-N 100, Intel® Centrino® Wireless-N 105, Intel® Centrino® Wireless-N 130 and Intel® Centrino® Wireless-N 135

Antenna Interface  
Connector

Hirose U.FL-R-SMT mates with cable connector U.FL-LP-066

Antenna Diversity	On-board diversity
Connector Interface	52-pin Mini Card edge connector
Voltage	3.3 V
Operating Temperature	0 to +80 degrees Celsius
Humidity	50% to 95% non-condensing (at temperatures of 25 °C to 35 °C)
<b>WiFi</b>	
Frequency Modulation	2.4 GHz (802.11b/g/n)
Frequency band	2.400 - 2.4835 GHz (dependent on country)
Modulation	BPSK, QPSK, 16 QAM, 64 QAM CCK, DQPSK, DBPSK
Wireless Medium Channels	2.4 GHz ISM: Orthogonal Frequency Division Multiplexing (OFDM) All channels as defined by the relevant specification and country rules. MIMO Configuration: 1X1
IEEE 802.11n Data Rates	<b>Tx/Rx:</b> 150, 144, 135, 130, 120, 117, 115.5, 90, 86.667, 72.2, 65, 60, 57.8, 45, 43.3, 30, 28.9, 21.7, 15, 14.4, 7.2 Mbps
IEEE 802.11g Data Rates	54, 48, 36, 24, 18, 12, 9, 6 Mbps
IEEE 802.11b Data Rates	11, 5.5, 2, 1 Mbps
Bluetooth Support	<ul style="list-style-type: none"> <li>• Intel® Centrino® Wireless-N 100: None</li> <li>• Intel® Centrino® Wireless-N 105: None</li> <li>• Intel® Centrino® Wireless-N 130: Bluetooth 2.1, 2.1 + EDR, 3.0, 3.0+HS</li> <li>• Intel® Centrino® Wireless-N 135: Bluetooth 4.0 (Bluetooth Low-Energy and Bluetooth 3.0 +HS)</li> </ul>
<b>General</b>	
Operating Systems	Windows* 7 (32-bit and 64-bit)
Wi-Fi Alliance* certification	Wi-Fi* certification for 802.11b, 802.11g, 802.11n, WPA-Personal, WPA-Enterprise, WPA2-Personal, WPA2-Enterprise, WMM, WPS
Cisco Compatible Extensions certification	Cisco Compatible Extensions, v4.0
IEEE Feature Sets Architecture	IEEE 802.11b, 802.11g, 802.11n, 802.11e, 802.11i, 802.11d, 802.11h Infrastructure or ad hoc (peer-to-peer) operating modes
Security	WPA-Personal, WPA2-Personal, WPA-Enterprise, WPA2-Enterprise, AES-CCMP 128-bit, WEP 128-bit and 64-bit; 802.1X: EAP-SIM, LEAP, PEAP, TKIP, EAP-FAST, EAP-TLS, EAP-TTLS, EAP-AKA
Product Safety	UL, C-UL, CB (IEC/EN 60950-1)

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## Intel® WiFi Link 1000

### WiFi / WiMAX

Form Factor	PCI Express* Mini Card and Half-Mini Card
SKUs	Intel® WiFi Link 1000 - 1X2 MC/HMC Mini Card: Width 2.0 in x Length 1.18 in x Height 0.18 in (50.80 mm x 30 mm x 4.5 mm)
Dimensions	Half-Mini Card: Width 1.049 in x Length 1.18 in x Height 0.18 in (26.64 mm x 30 mm x 4.5 mm)
Antenna Interface Connector	Hirose U.FL-R-SMT mates with cable connector U.FL-LP-066
Antenna Diversity Connector Interface	On-board diversity 52-pin Mini Card edge connector
Voltage	3.3 V
Operating Temperature	0 to +80 degrees Celsius
Humidity	50% to 90% non-condensing (at temperatures of 25 °C to 35 °C)

### WiFi

Frequency Modulation	2.4 GHz (802.11b/g/n)
Frequency band	2.41-2.474 GHz (dependent on country)
Modulation	BPSK, QPSK, 16 QAM, 64 QAM, CCK, DQPSK, DBPSK
Wireless Medium Channels	2.4 GHz ISM: Orthogonal Frequency Division Multiplexing (OFDM) All channels as defined by the relevant specification and country rules.
IEEE 802.11n Data Rates	300, 270, 243, 240, 180, 150, 144, 135, 130, 120, 117, 115.5, 90, 86.667, 72.2, 65, 60, 57.8, 45, 43.3, 30, 28.9, 21.7, 15, 14.4, 7.2 Mbps
IEEE 802.11g Data Rates	54, 48, 36, 24, 18, 12, 9, 6 Mbps
IEEE 802.11b Data Rates	11, 5.5, 2, 1 Mbps

### WiFi General

Operating Systems	Microsoft Windows* XP (32 and 64 bit) and Windows Vista* (32 and 64 bit), Ubuntu Linux*
Wi-Fi Alliance* certification	Wi-Fi* certification for 802.11b, 802.11g, 802.11n, WPA-Personal, WPA-Enterprise, WPA2-Personal, WPA2-Enterprise, WMM, WPS
Cisco Compatible Extensions certification	Cisco Compatible Extensions, v4.0
WLAN Standard Architecture	IEEE 802.11g, 802.11b, 802.11n, 802.11d, 802.11e, 802.11i, Infrastructure or ad hoc (peer-to-peer) operating modes

Security	WPA-Personal, WPA2-Personal, WPA-Enterprise, WPA2-Enterprise, 802.1X: EAP-SIM, LEAP, PEAP, EAP-FAST, EAP-TLS, EAP-TTLS, EAP-AKA
Encryption	AES-CCMP 128-bit, WEP 128-bit and 64-bit, CKIP, TKIP
Product Safety	UL, C-UL, CB (IEC/EN 60950-1)

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## Intel® Centrino® Wireless-N 2200 and Intel® Centrino® Wireless-N 2230

Antenna Interface Connector	Hirose U.FL-R-SMT mates with cable connector U.FL-LP-066
Antenna Diversity	On-board diversity
Connector Interface	52-pin Mini Card edge connector
Voltage	3.3 V
Operating Temperature	0 to +80 degrees Celsius
Humidity	50% to 95% non-condensing (at temperatures of 25 °C to 35 °C)
<b>WiFi</b>	
Frequency Modulation	2.4 GHz (802.11b/g/n)
Frequency band	2.400 - 2.4835 GHz (dependent on country)
Modulation	BPSK, QPSK, 16 QAM, 64 QAM CCK, DQPSK, DBPSK
Wireless Medium Channels	2.4 GHz ISM: Orthogonal Frequency Division Multiplexing (OFDM) All channels as defined by the relevant specification and country rules. MIMO Configuration: 2X2
IEEE 802.11n Data Rates	<b>Tx/Rx:</b> 300, 150, 144, 135, 130, 120, 117, 115.5, 90, 86.667, 72.2, 65, 60, 57.8, 45, 43.3, 30, 28.9, 21.7, 15, 14.4, 7.2 Mbps
IEEE 802.11g Data Rates	54, 48, 36, 24, 18, 12, 9, 6 Mbps
IEEE 802.11b Data Rates	11, 5.5, 2, 1 Mbps
Bluetooth Support	<ul style="list-style-type: none"> <li>Intel® Centrino® Wireless-N 2200: None</li> <li>Intel® Centrino® Wireless-N 2230: Bluetooth 4.0 (Bluetooth Low-Energy and Bluetooth 3.0 +HS)</li> </ul>
<b>General</b>	
Operating Systems	Windows* 7 (32-bit and 64-bit)
Wi-Fi Alliance* certification	Wi-Fi* certification for 802.11b, 802.11g, 802.11n, WPA-Personal, WPA-Enterprise, WPA2-Personal, WPA2-Enterprise, WMM, WPS

Cisco Compatible Extensions certification	Cisco Compatible Extensions, v4.0
IEEE Feature Sets Architecture	IEEE 802.11b, 802.11g, 802.11n, 802.11e, 802.11i, 802.11d, 802.11h Infrastructure or ad hoc (peer-to-peer) operating modes
Security	WPA-Personal, WPA2-Personal, WPA-Enterprise, WPA2-Enterprise, AES-CCMP 128-bit, WEP 128-bit and 64-bit; 802.1X: EAP-SIM, LEAP, PEAP, TKIP, EAP-FAST, EAP-TLS, EAP-TTLS, EAP-AKA
Product Safety	UL, C-UL, CB (IEC/EN 60950-1)

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## Intel® Centrino® Wireless-N 1030 and Intel® Centrino® Advanced-N 6230

Form Factor	PCI Express* Half-Mini Card	
Dimensions	Half-Mini Card: Width 1.049 in x Length 1.18 in x Height 0.18 in (26.64 mm x 30 mm x 4.5 mm)	
Antenna Interface Connector	Hirose U.FL-R-SMT mates with cable connector U.FL-LP-066	
Antenna Diversity	On-board diversity	
Network Standards	802.11a/b/g/n (varies by adapter) and Bluetooth 3.0 + HS	
Connector Interface	52-pin Mini Card edge connector	
Voltage	3.3 V	
Operating Temperature	0 to +80 degrees Celsius	
Humidity	50% to 95% non-condensing (at temperatures of 25 °C to 35 °C)	
WiFi Network Standards	Intel® Centrino® Wireless-N 1030: 802.11b/g/n Intel® Centrino® Advanced-N 6230: 802.11a/g/n	
<b>Frequency Modulation</b>	<b>5 GHz (802.11a/n)</b>	<b>2.4 GHz (802.11b/g/n)</b>
Frequency band	5.15 GHz - 5.85 GHz (dependent on country)	2.400 - 2.4835 GHz (dependent on country)
Modulation	BPSK, QPSK, 16 QAM, 64 QAM	CCK, DQPSK, DBPSK
Wireless Medium	5 GHz UNII: Orthogonal Frequency Division Multiplexing (OFDM)	2.4 GHz ISM: Orthogonal Frequency Division Multiplexing (OFDM)
Channels	All channels as defined by the relevant specification and country rules.	
IEEE 802.11n Data Rates	Intel® Centrino® Advanced-N 6230:	

Tx/Rx (Mbps): 300, 270, 243, 240, 216.7, 195, 180, 173.3, 150, 144, 135, 130, 120, 117, 115.5, 90, 86.667, 72.2, 65, 60, 57.8, 45, 43.3, 30, 28.9, 21.7, 15, 14.4, 7.2

Intel® Centrino® Wireless-N 1030:

Rx (Mbps): 300, 270, 243, 240, 180

Rx/Tx (Mbps): 150, 144, 135, 130, 120, 117, 115.5, 90, 86.667, 72.2, 65, 60, 57.8, 45, 43.3, 30, 28.9, 21.7, 15, 14.4, 7.2

IEEE 802.11a  
Data Rates 54, 48, 36, 24, 18, 12, 9, 6 Mbps

IEEE 802.11g  
Data Rates 54, 48, 36, 24, 18, 12, 9, 6 Mbps

IEEE 802.11b  
Data Rates 11, 5.5, 2, 1 Mbps

Bluetooth Bluetooth Version 3.0 + HS

### General

Operating Systems

- Microsoft Windows\* XP (32-bit and 64-bit)
- Windows Vista\* (32-bit and 64-bit)
- Windows\* 7 (32-bit and 64-bit)

Wi-Fi Alliance\* certification Wi-Fi\* certification for 802.11b, 802.11g, 802.11a, 802.11h, 802.11d, WPA-Personal, WPA-Enterprise, WPA2-Personal, WPA2-Enterprise, WPS, WMM, WMM Power Save, EAP-SIM, LEAP, PEAP, TKIP, EAP-FAST, EAP-TLS, EAP-TTLS, EAP-AKA, P2P

Cisco Compatible Extensions certification Cisco Compatible Extensions, v4.0

WLAN Standard IEEE 802.11g, 802.11b, 802.11a, 802.11n

Architecture Infrastructure or ad hoc (peer-to-peer) operating modes

Security WPA-Personal, WPA2-Personal, WPA-Enterprise, WPA2-Enterprise, AES-CCMP 128-bit, WEP 128-bit and 64-bit; 802.1X: EAP-SIM, LEAP, PEAP, TKIP, EAP-FAST, EAP-TLS, EAP-TTLS, EAP-AKA

Product Safety UL, C-UL, CB (IEC/EN 60950-1)

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## Intel® Centrino® Advanced-N 6235

Form Factor PCI Express\* Half-Mini Card

Dimensions Half-Mini Card: Width 1.049 in x Length 1.18 in x Height 0.18 in (26.64 mm x 30 mm x 4.5 mm)

Antenna Interface Connector Hirose U.FL-R-SMT mates with cable connector U.FL-LP-066



Antenna Diversity	On-board diversity	
Network Standards	802.11a/b/g/n and Bluetooth 4.0	
Connector Interface	52-pin Mini Card edge connector	
Voltage	3.3 V	
Operating Temperature	0 to +80 degrees Celsius	
Humidity	50% to 95% non-condensing (at temperatures of 25 °C to 35 °C)	
<b>Frequency Modulation</b>	<b>5 GHz (802.11a/n)</b>	<b>2.4 GHz (802.11b/g/n)</b>
Frequency band	5.15 GHz - 5.85 GHz (dependent on country)	2.400 - 2.4835 GHz (dependent on country)
Modulation	BPSK, QPSK, 16 QAM, 64 QAM	CCK, DQPSK, DBPSK
Wireless Medium	5 GHz UNII: Orthogonal Frequency Division Multiplexing (OFDM)	2.4 GHz ISM: Orthogonal Frequency Division Multiplexing (OFDM)
Channels	All channels as defined by the relevant specification and country rules.	
IEEE 802.11n Data Rates	Tx/Rx (Mbps): 300, 270, 243, 240, 216.7, 195, 180, 173.3, 150, 144, 135, 130, 120, 117, 115.5, 90, 86.667, 72.2, 65, 60, 57.8, 45, 43.3, 30, 28.9, 21.7, 15, 14.4, 7.2	
IEEE 802.11a Data Rates	54, 48, 36, 24, 18, 12, 9, 6 Mbps	
IEEE 802.11g Data Rates	54, 48, 36, 24, 18, 12, 9, 6 Mbps	
IEEE 802.11b Data Rates	11, 5.5, 2, 1 Mbps	
Bluetooth	Bluetooth Version 4.0 (3.0 +HS )	
<b>General</b>		
Operating Systems	Windows* 7 (32-bit and 64-bit)	
Wi-Fi Alliance* certification	Wi-Fi* certification for 802.11b, 802.11g, 802.11a, 802.11h, 802.11d, WPA-Personal, WPA-Enterprise, WPA2-Personal, WPA2-Enterprise, WPS, WMM, WMM Power Save, EAP-SIM, LEAP, PEAP, TKIP, EAP-FAST, EAP-TLS, EAP-TTLS, EAP-AKA, P2P	
Cisco Compatible Extensions certification	Cisco Compatible Extensions, v4.0	
WLAN Standard Architecture	IEEE 802.11g, 802.11b, 802.11a, 802.11n Infrastructure or ad hoc (peer-to-peer) operating modes	
Security	WPA-Personal, WPA2-Personal, WPA-Enterprise, WPA2-Enterprise, AES-CCMP 128-bit, WEP 128-bit and 64-bit; 802.1X: EAP-SIM, LEAP, PEAP, TKIP, EAP-FAST, EAP-TLS, EAP-TTLS, EAP-AKA	

## Intel® Centrino® Advanced-N + WiMAX 6250 and Intel® Centrino® Wireless-N + WiMAX 6150

Antenna Interface Connector	Hirose U.FL-R-SMT mates with cable connector U.FL-LP-066
Antenna Diversity Connector Interface	On-board diversity 52-pin Mini Card edge connector
Voltage	3.3 V
Operating Temperature	0 to +80 degrees Celsius
Humidity	50% to 95% non-condensing (at temperatures of 25 °C to 35 °C)

### WiFi

	Intel® Centrino® Advanced-N + WiMAX 6250	Intel® Centrino® Wireless-N + WiMAX 6150
Frequency Modulation	2.4 GHz (802.11b/g/n), 5 GHz (802.11a/n)	2.4 GHz (802.11b/g/n)
Frequency band	5.15 GHz - 5.85 GHz (dependent on country)	2.400 - 2.4835 GHz (dependent on country)
Modulation	BPSK, QPSK, 16 QAM, 64 QAM	CCK, DQPSK, DBPSK
Wireless Medium	5 GHz UNII: Orthogonal Frequency Division Multiplexing (OFDM)	2.4 GHz ISM: Orthogonal Frequency Division Multiplexing (OFDM)
Channels	All channels as defined by the relevant specification and country rules.	

### Intel® Centrino® Wireless-N + WiMAX 6150

MIMO Configuration: 1X2

**Rx:** 300, 270, 243, 240, 180 Mbps  
**Rx/Tx:** 150, 144, 135, 130, 120, 117, 115.5, 90, 86.667, 72.2, 65, 60, 57.8, 45, 43.3, 30, 28.9, 21.7, 15, 14.4, 7.2 Mbps

IEEE 802.11n  
Data Rates

### Intel® Centrino® Advanced-N + WiMAX 6250

MIMO Configuration: 2X2

**Tx/Rx:** 300, 270, 243, 240, 180, 150, 144, 135, 130, 120, 117, 115.5, 90, 86.667, 72.2, 65, 60, 57.8, 45, 43.3, 30, 28.9, 21.7, 15, 14.4, 7.2 Mbps

IEEE 802.11a  
Data Rates

54, 48, 36, 24, 18, 12, 9, 6 Mbps

IEEE 802.11g  
Data Rates 54, 48, 36, 24, 18, 12, 9, 6 Mbps

IEEE 802.11b  
Data Rates 11, 5.5, 2, 1 Mbps

### General

Operating Systems

- Microsoft Windows\* XP (32-bit and 64-bit)
- Windows Vista\* (32-bit and 64-bit)
- Windows\* 7 (32-bit and 64-bit)

Wi-Fi Alliance\*  
certification Wi-Fi\* certification for 802.11b, 802.11g, 802.11a, 802.11h, 802.11d, WPA-Personal, WPA-Enterprise, WPA2-Personal, WPA2-Enterprise, WMM, WMM Power Save, EAP-SIM, LEAP, PEAP, TKIP, EAP-FAST, EAP-TLS, EAP-TTLS, EAP-AKA

Cisco Compatible  
Extensions  
certification Cisco Compatible Extensions, v4.0

### **Intel® Centrino® Wireless-N + WiMAX 6150:**

IEEE 802.11b, 802.11g, 802.11n, 802.11e, 802.11i, 802.11h, 802.11d

IEEE Feature Sets

### **Intel® Centrino® Advanced-N + WiMAX 6250:**

802.11a, IEEE 802.11b, 802.11g, 802.11n, 802.11e, 802.11i, 802.11h, 802.11d

Architecture Infrastructure or ad hoc (peer-to-peer) operating modes

Security WPA-Personal, WPA2-Personal, WPA-Enterprise, WPA2-Enterprise, AES-CCMP 128-bit, WEP 128-bit and 64-bit; 802.1X: EAP-SIM, LEAP, PEAP, TKIP, EAP-FAST, EAP-TLS, EAP-TTLS, EAP-AKA

Product Safety UL, C-UL, CB (IEC/EN 60950-1)

### **WiMAX General**

Operating Systems

- Microsoft Windows\* XP (32-bit and 64-bit)
- Windows Vista\* (32-bit and 64-bit)
- Windows\* 7 (32-bit and 64-bit)

Standard  
Compliance 802.16e-2005 Corrigenda 2 (D4)

### **Intel® Centrino® Wireless-N + WiMAX 6150:**

Mobile WiMAX release 1, Wave II. Supports 3A and 1A/B profiles

WiMAX System

Profile Feature set **Intel® Centrino® Advanced-N + WiMAX 6250:**

Mobile WiMAX release 1, Wave II. Supports 3A, 5A/C, 1A/B, and 5BL profiles

Security Key Management Protocol (PKMv2)

Encryption 128-bit CCMP (Counter-Mode/CBC-MAC) based on AES encryption

### **WiMAX**

Frequency band	Intel® Centrino® Wireless-N + WiMAX 6150: 2.3-2.4 GHz / 2.496-2.690 GHz	
Modulation	Intel® Centrino® Advanced-N + WiMAX 6250: 2.3-2.4 GHz / 2.496-2.690 GHz / 3.4-3.8 GHz UL - QPSK, 16 QAM DL - QPSK, 16 QAM, 64 QAM	
Wireless Medium	Duplex mode: TDD operations	Scalable OFDMA (SOFDMA): 512 and 1024 FFT Intel® Centrino® Wireless-N + WiMAX 6150: Channel bandwidths: 5 and 10 MHz sub-carrier permutation: PUSC Intel® Centrino® Advanced-N + WiMAX 6250: Channel bandwidths: 5, 7, 8.75 and 10 MHz
WiMAX Network Release Feature set	SPWG/NWG Release 1.5	
Rate Performance	Intel® Centrino® Wireless-N + WiMAX 6150: Up to 10 Mbps DL and 4 Mbps UL @ peak rate (OTA performance, 10MHz channel)  Intel® Centrino® Advanced-N + WiMAX 6250: Up to 20 Mbps DL and 6 Mbps UL @ peak rate (OTA performance, 10MHz channel)	
RF Transmitter Output Power	Compliance with Power class 2	

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## **Intel® Centrino® Advanced-N 6200, Intel® Centrino® Advanced-N 6205 and Intel® Centrino® Ultimate-N 6300**

Antenna Interface Connector	Hirose U.FL-R-SMT mates with cable connector U.FL-LP-066
Antenna Diversity	On-board diversity
Connector Interface	52-pin Mini Card edge connector
Voltage	3.3 V
Operating Temperature	0 to +80 degrees Celsius

Humidity	50% to 95% non-condensing (at temperatures of 25 °C to 35 °C)	
<b>Frequency Modulation</b>	<b>5 GHz (802.11a/n)</b>	<b>2.4 GHz (802.11b/g/n)</b>
Frequency band	5.15 GHz - 5.85 GHz (dependent on country)	2.400 - 2.4835 GHz (dependent on country)
Modulation	BPSK, QPSK, 16 QAM, 64 QAM	CCK, DQPSK, DBPSK
Wireless Medium	5 GHz UNII: Orthogonal Frequency Division Multiplexing (OFDM)	2.4 GHz ISM: Orthogonal Frequency Division Multiplexing (OFDM)
Channels	All channels as defined by the relevant specification and country rules. Intel® Centrino® Ultimate-N 6300:  Tx/Rx: 450, 405, 360, 300, 270, 243, 240, 216.7, 195, 180, 173.3, 150, 144, 135, 130, 120, 117, 115.5, 90, 86.667, 72.2, 65, 60, 57.8, 45, 43.3, 30, 28.9, 21.7, 15, 14.4, 7.2 Mbps Intel® Centrino® Advanced-N 6200, Intel® Centrino® Advanced-N 6205:  Tx/Rx: 300, 270, 243, 240, 180, 150, 144, 135, 130, 120, 117, 115.5, 90, 86.667, 72.2, 65, 60, 57.8, 45, 43.3, 30, 28.9, 21.7, 15, 14.4, 7.2 Mbps	
IEEE 802.11n Data Rates	54, 48, 36, 24, 18, 12, 9, 6 Mbps	
IEEE 802.11a Data Rates	54, 48, 36, 24, 18, 12, 9, 6 Mbps	
IEEE 802.11g Data Rates	11, 5.5, 2, 1 Mbps	
IEEE 802.11b Data Rates		
<b>General</b>		
Operating Systems	<ul style="list-style-type: none"> <li>• Microsoft Windows* XP (32-bit and 64-bit)</li> <li>• Windows Vista* (32-bit and 64-bit)</li> <li>• Windows* 7 (32-bit and 64-bit)</li> </ul>	
Wi-Fi Alliance* certification	Wi-Fi* certification for 802.11b, 802.11g, 802.11a, 802.11h, 802.11d, WPA-Personal, WPA-Enterprise, WPA2-Personal, WPA2-Enterprise, WMM, WMM Power Save, EAP-SIM, LEAP, PEAP, TKIP, EAP-FAST, EAP-TLS, EAP-TTLS, EAP-AKA	
Cisco Compatible Extensions certification	Cisco Compatible Extensions, v4.0	
WLAN Standard Architecture	IEEE 802.11g, 802.11b, 802.11a, 802.11n Infrastructure or ad hoc (peer-to-peer) operating modes	
Security	WPA-Personal, WPA2-Personal, WPA-Enterprise, WPA2-Enterprise, AES-CCMP 128-bit, WEP 128-bit and 64-bit; 802.1X: EAP-SIM, LEAP, PEAP, TKIP, EAP-FAST, EAP-TLS, EAP-TTLS, EAP-AKA	
Product Safety	UL, C-UL, CB (IEC/EN 60950-1)	

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[Trademarks and Disclaimers](#)

# Customer Support

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Intel support is available online or by telephone. Available services include the most up-to-date product information, installation instructions about specific products, and troubleshooting tips.

## Online Support

**Technical Support:** <http://www.intel.com/support>

**Wireless Product Support:** <http://www.intel.com/content/www/us/en/wireless-network/wireless-products.html>

**Corporate Web Site:** <http://www.intel.com>

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# Warranty

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## Product Warranty Information

### One-Year Limited Hardware Warranty

#### Limited Warranty

In this warranty statement, the term "Product" applies to the wireless adapters listed in [Specifications](#).

Intel warrants to the purchaser of the Product that the Product, if properly used and installed, will be free from defects in material and workmanship and will substantially conform to Intel's publicly available specifications for the Product for a period of one (1) year beginning on the date the Product was purchased in its original sealed packaging.

SOFTWARE OF ANY KIND DELIVERED WITH OR AS PART OF THE PRODUCT IS EXPRESSLY PROVIDED "AS IS", SPECIFICALLY EXCLUDING ALL OTHER WARRANTIES, EXPRESS, IMPLIED (INCLUDING WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT OR FITNESS FOR A PARTICULAR PURPOSE), provided however, that Intel warrants that the media on which the software is furnished will be free from defects for a period of ninety (90) days from the date of delivery. If such a defect appears within the warranty period, you may return the defective media to Intel for replacement or alternative delivery of the software at Intel's discretion and without charge. Intel does not warrant or assume responsibility for the accuracy or completeness of any information, text, graphics, links or other items contained within the software.

If the Product which is the subject of this Limited Warranty fails during the warranty period for reasons covered by this Limited Warranty, Intel, at its option, will:

- **REPAIR** the Product by means of hardware and/or software; OR
- **REPLACE** the Product with another product, OR, if Intel is unable to repair or replace the Product,
- **REFUND** the then-current Intel price for the Product at the time a claim for warranty service is made to Intel under this Limited Warranty.

THIS LIMITED WARRANTY, AND ANY IMPLIED WARRANTIES THAT MAY EXIST UNDER APPLICABLE STATE, NATIONAL, PROVINCIAL OR LOCAL LAW, APPLY ONLY TO YOU AS THE ORIGINAL PURCHASER OF THE PRODUCT.

#### Extent of Limited Warranty



Intel does not warrant that the Product, whether purchased stand-alone or integrated with other products, including without limitation, semi-conductor components, will be free from design defects or errors known as "errata." Current characterized errata are available upon request. Further, this Limited Warranty does NOT cover: (i) any costs associated with the replacement or repair of the Product, including labor, installation or other costs incurred by you, and in particular, any costs relating to the removal or replacement of any Product soldered or otherwise permanently affixed to any printed circuit board or integrated with other products; (ii) damage to the Product due to external causes, including accident, problems with electrical power, abnormal, mechanical or environmental conditions, usage not in accordance with product instructions, misuse, neglect, accident, abuse, alteration, repair, improper or unauthorized installation or improper testing, or (iii) any Product which has been modified or operated outside of Intel's publicly available specifications or where the original product identification markings (trademark or serial number) have been removed, altered or obliterated from the Product; or (iv) issues resulting from modification (other than by Intel) of software products provided or included in the Product, (v) incorporation of software products, other than those software products provided or included in the Product by Intel, or (vi) failure to apply Intel-supplied modifications or corrections to any software provided with or included in the Product.

### **How to Obtain Warranty Service**

To obtain warranty service for the Product, you may contact your original place of purchase in accordance with its instructions or you may contact Intel. To request warranty service from Intel, you must contact the Intel Customer Support ("ICS") center in your region (<http://www.intel.com/support/wireless/>) within the warranty period during normal business hours (local time), excluding holidays and return the Product to the designated ICS center. Please be prepared to provide: (1) your name, mailing address, email address, telephone numbers and, in the USA, valid credit card information; (2) proof of purchase; (3) model name and product identification number found on the Product; and (4) an explanation of the problem. The Customer Service Representative may need additional information from you depending on the nature of the problem. Upon ICS's verification that the Product is eligible for warranty service, you will be issued a Return Material Authorization ("RMA") number and provided with instructions for returning the Product to the designated ICS center. When you return the Product to the ICS center, you must include the RMA number on the outside of the package. Intel will not accept any returned Product without an RMA number, or that has an invalid RMA number, on the package. You must deliver the returned Product to the designated ICS center in the original or equivalent packaging, with shipping charges pre-paid (within the USA), and assume the risk of damage or loss during shipment. Intel may elect to repair or replace the Product with either a new or reconditioned Product or components, as Intel deems appropriate. The repaired or replaced product will be shipped to you at the expense of Intel within a reasonable period of time after receipt of the returned Product by ICS. The returned Product shall become Intel's property on receipt by ICS. The replacement product is warranted under this written warranty and is subject to the same limitations of liability and exclusions for ninety (90) days or the remainder of the original warranty period, whichever is longer. If Intel replaces the Product, the Limited Warranty period for the replacement Product is not extended.

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SYSTEMS, NUCLEAR SYSTEMS, OR FOR ANY OTHER MISSION CRITICAL APPLICATION IN WHICH THE FAILURE OF THE INTEL PRODUCT COULD CREATE A SITUATION WHERE PERSONAL INJURY OR DEATH MAY OCCUR.

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**WEEE**



## Glossary of Terms

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<b>Term</b>	<b>Definition</b>
802.11	The 802.11 standard refers to a family of specifications developed by the IEEE for wireless LAN technology. The 802.11 specifies an over-the-air interface between a wireless client and a base station or between two wireless clients and provides 1 or 2 Mbps transmission in the 2.4 GHz band using either frequency hopping spread spectrum (FHSS) or direct sequence spread spectrum (DSSS).
802.11a	The 802.11a standard specifies a maximum data transfer rate of 54 Mbps and an operating frequency of 5 GHz. The 802.11a standard uses the Orthogonal Frequency Division Multiplexing (OFDM) transmission method. Additionally, the 802.11a standard supports 802.11 features such as WEP encryption for security.
802.11b	802.11b is an extension to 802.11 that applies to wireless networks and provides 11 Mbps transmission (with a fallback to 5.5, 2 and 1 Mbps) in the 2.4 GHz band. 802.11b uses only DSSS. Throughput data rate 5+ Mbps in the 2.4 GHz band.
802.11g	The 802.11g standard specifies a maximum data transfer rate of 54 Mbps, an operating frequency of 2.4GHz, and WEP encryption for security. 802.11g networks are also referred to as Wi-Fi* networks.
802.11n	A task group of the IEEE 802.11 committee has defined a new draft specification that provides for increased throughput speeds of up to 540 Mbps. The specification provides for Multiple-Input-Multiple-Output (MIMO) technology, or using multiple receivers and multiple transmitters in both the client and access point, to achieve improved performance.

802.1X	802.1X is the IEEE Standard for Port-Based Network Access Control. This is used in conjunction with EAP methods to provide access control to wired and wireless networks.
AAA Server	Authentication, Authorization and Accounting Server. A system to control access to computer resources and track user activity.
Access Point (AP)	A device that connects wireless devices to another network. For example, a wireless LAN, Internet modem or others.
Ad Hoc Network	A communication configuration in which every computer has the same capabilities, and any computer can initiate a communication session. Also known as a peer-to-peer network, a device to device network or a computer-to-computer network.
AES-CCMP	Advanced Encryption Standard - Counter CBC-MAC Protocol is the new method for privacy protection of wireless transmissions specified in the IEEE 802.11i standard. AES-CCMP provides a stronger encryption method than TKIP. The AES algorithm is capable of using cryptographic keys of 128, 192, and 256 bits to encrypt and decrypt data in 128-bit blocks. AES-CCMP uses the AES block cipher, but restricts the key length to 128 bits. AES-CCMP incorporates two sophisticated cryptographic techniques (counter mode and CBC-MAC) to provide improved security between the mobile client and the access point.
Authentication	Verifies the identity of a user logging onto a network. Passwords, digital certificates, smart cards and biometrics are used to prove the identity of the client to the network. Passwords and digital certificates are also used to identify the network to the client.
Available network	One of the networks listed under Available networks on the Wireless Networks tab of the Wireless Network Connection Properties (Windows* XP environment). Any wireless network that is broadcasting and is within receiving range of the WiFi adapter appears on the list.
BER	Bit Error Rate. The ratio of errors to the total number of bits being sent in a data transmission from one location to another.
Bit Rate	The total number of bits (ones and zeros) per second that a network connection can support. Note that this bit rate will vary, under software control, with different signal path conditions.
Broadcast SSID	Used to allow an access point to respond to clients on a wireless network by sending probes.
BSSID	A unique identifier for each wireless client on a wireless network. The Basic Service Set Identifier (BSSID) is the Ethernet MAC address of each adapter on the network.
CA (Certificate Authority)	A corporate certification authority implemented on a server. In addition, Internet Explorer's certificate can import a certificate from a file. A trusted CA certificate is stored in the root store.
CCX (Cisco Compatible eXtension)	Cisco Compatible Extensions Program ensures that devices used on Cisco wireless LAN infrastructure meet the security, management and roaming requirements.

Certificate	Used for client authentication. A certificate is registered on the authentication server (for example, RADIUS server) and used by the authenticator.
CKIP	Cisco Key Integrity Protocol (CKIP) is a Cisco proprietary security protocol for encryption in 802.11 media. CKIP uses a key message integrity check and message sequence number to improve 802.11 security in infrastructure mode. CKIP is Cisco's version of TKIP.
Client computer	The computer that gets its Internet connection by sharing either the host computer's connection or the access point's connection.
DSSS	Direct Sequence Spread Spectrum. Technology used in radio transmission. Incompatible with FHSS.
EAP	Short for Extensible Authentication Protocol, EAP sits inside of Point-to-Point Protocol's (PPP) authentication protocol and provides a generalized framework for several different authentication methods. EAP is supposed to head off proprietary authentication systems and let everything from passwords to challenge-response tokens and public-key infrastructure certificates all work smoothly.
EAP-AKA	EAP-AKA (Extensible Authentication Protocol Method for UMTS Authentication and Key Agreement) is an EAP mechanism for authentication and session key distribution, using the Universal Mobile Telecommunications System (UMTS) Subscriber Identity Module (USIM). The USIM card is a special smart card used with cellular networks to validate a given user with the network.
	EAP-FAST, like EAP-TTLS and PEAP, uses tunneling to protect traffic. The main difference is that EAP-FAST does not use certificates to authenticate.
	Provisioning in EAP-FAST is negotiated solely by the client as the first communication exchange when EAP-FAST is requested from the server. If the client does not have a pre-shared secret Protected Access Credential (PAC), it can request to initiate a provisioning EAP-FAST exchange to dynamically obtain one from the server.
EAP-FAST	EAP-FAST documents two methods to deliver the PAC: manual delivery through an out-of-band secure mechanism, and automatic provisioning. <ul style="list-style-type: none"> <li>• Manual delivery mechanisms can be any delivery mechanism that the administrator of the network feels is sufficiently secure for their network.</li> <li>• Automatic provisioning establishes an encrypted tunnel to protect the authentication of the client and the delivery of the PAC to the client. This mechanism, while not as secure as a manual method may be, is more secure than the authentication method used in LEAP.</li> </ul>

	<p>The EAP-FAST method can be divided into two parts: provisioning, and authentication. The provisioning phase involves the initial delivery of the PAC to the client. This phase only needs to be performed once per client and user.</p>
EAP-GTC	<p>The EAP-GTC (Generic Token Card) is similar to the EAP-OTP except with hardware token cards. The request contains a displayable message, and the response contains the string read from the hardware token card.</p>
EAP-OTP	<p>EAP-OTP (One-Time Password) is similar to MD5, except it uses the OTP as the response. The request contains a displayable message. The OTP method is defined in RFC 2289.</p>
EAP-SIM	<p>Extensible Authentication Protocol-Subscriber Identity Module (EAP-SIM) authentication can be used with:</p> <ul style="list-style-type: none"> <li>• Network Authentication types: Open, Shared, and WPA*-Enterprise, WPA2*-Enterprise.</li> <li>• Data Encryption types: None, WEP and CKIP.</li> </ul>
EAP-TLS	<p>A SIM card is a special smart card that is used by Global System for Mobile Communications (GSM) based digital cellular networks. The SIM card is used to validate your credentials with the network</p> <p>A type of authentication method that uses EAP and a security protocol called the Transport Layer Security (TLS). EAP-TLS uses certificates that use passwords. EAP-TLS authentication supports dynamic WEP key management.</p>
EAP-TTLS	<p>A type of authentication method that uses EAP and Tunneled Transport Layer Security (TTLS). EAP-TTLS uses a combination of certificates and another security method such as passwords.</p>
Encryption	<p>Scrambling data so that only the authorized recipient can read it. Usually a key is needed to interpret the data.</p>
FHSS	<p>Frequency-Hop Spread Spectrum. Technology used in radio transmission. Incompatible with DSSS.</p>
File and printer sharing	<p>A capability that allows a number of people to view, modify, and print the same file(s) from different computers.</p>
Fragmentation threshold	<p>The threshold at which the wireless adapter breaks the packet into multiple frames. This determines the packet size and affects the throughput of the transmission.</p>
GHz (Gigahertz)	<p>A unit of frequency equal to 1,000,000,000 cycles per second.</p>
Host computer	<p>The computer that is directly connected to the Internet via a modem or network adapter.</p>
Infrastructure network	<p>A wireless network centered around an access point. In this environment, the access point not only provides communication with the wired network, but also mediates wireless network traffic in the immediate neighborhood.</p>

IEEE	Institute of Electrical and Electronics Engineers (IEEE) is an organization involved in defining computing and communications standards.
Internet Protocol (IP) address	The address of a computer that is attached to a network. Part of the address designates which network the computer is on, and the other part represents the host identification.
LAN (Local Area Network)	A high-speed, low-error data network covering a relatively small geographic area.
LEAP (Light Extensible Authentication Protocol)	A version of Extensible Authentication Protocol (EAP). LEAP is a proprietary extensible authentication protocol developed by Cisco that provides a challenge-response authentication mechanism and dynamic key assignment.
MAC (Media Access Control) Address	A hardwired address applied at the factory. It uniquely identifies network hardware, such as a wireless adapter, on a LAN or WAN.
Mbps (Megabits-per-second)	Transmission speed of 1,000,000 bits per second.
MHz (Megahertz)	A unit of frequency equal to 1,000,000 cycles per second.
MIC (Michael)	Message Integrity Check (commonly called Michael).
MS-CHAP	An EAP mechanism used by the client. Microsoft Challenge Authentication Protocol (MS-CHAP) Version 2, is used over an encrypted channel to enable server validation. The challenge and response packets are sent over a non-exposed TLS encrypted channel.
ns(Nanosecond)	1 billionth (1/1,000,000,000) of a second.
OFDM	Orthogonal Frequency Division Multiplexing.
Open authentication	Allows any device network access. If encryption is not enabled on the network, any device that knows the Service Set Identifier (SSID) of the access point can gain access to the network.
PEAP	Protected Extensible Authentication Protocol (PEAP) is an Internet Engineering Task Force (IETF) draft protocol sponsored by Microsoft, Cisco, and RSA Security. PEAP creates an encrypted tunnel similar to the tunnel used in secure web pages (SSL). Inside the encrypted tunnel, a number of other EAP authentication methods can be used to perform client authentication. PEAP requires a TLS certificate on the RADIUS server, but unlike EAP-TLS there is no requirement to have a certificate on the client. PEAP has not been ratified by the IETF. The IETF is currently comparing PEAP and TTLS (Tunneled TLS) to determine an authentication standard for 802.1X authentication in 802.11 wireless systems. PEAP is an authentication type designed to take advantage of server-side EAP-Transport Layer Security (EAP-TLS) and to support various authentication methods, including user passwords and one-time passwords, and Generic Token Cards.
Peer-to-Peer mode	A wireless network structure that allows wireless clients to communicate directly with each other without using an access point.

Power save mode	The state in which the radio is periodically powered down to conserve power. When the portable computer is in Power Save mode, received packets are stored in the access point until the wireless adapter wakes up.
Preferred network	One of the networks that has been configured. Such networks are listed under Preferred networks on the Wireless Networks tab of the Wireless Network Connection Properties (Windows* XP environment).
RADIUS (Remote Authentication Dial-In User Service)	RADIUS is an authentication and accounting system that verifies user's credentials and grants access to requested resources.
RF (Radio Frequency)	The international unit for measuring frequency is Hertz (Hz), which is equivalent to the older unit of cycles per second. One MegaHertz (MHz) is one million Hertz. One GigaHertz (GHz) is one billion Hertz. For reference: the standard US electrical power frequency is 60 Hz, the AM broadcast radio frequency band is 0.55 -1.6 MHz, the FM broadcast radio frequency band is 88-108 MHz, and microwave ovens typically operate at 2.45 GHz.
Roaming	Movement of a wireless node between two micro cells. Roaming usually occurs in infrastructure networks built around multiple access points. Current wireless network roaming is only supported in the same subnet of a network.
RTS threshold	The number of frames in the data packet at or above which an RTS/CTS (request to send/clear to send) handshake is turned on before the packet is sent. The default value is 2347.
Shared key	An encryption key known only to the receiver and sender of data. This is also referred to as a pre-shared key.
SIM (Subscriber Identity Module)	A SIM card is used to validate credentials with the network. A SIM card is a special smart card used by GSM-based digital cellular networks.
Silent mode	Silent Mode Access Points or Wireless Routers have been configured to not broadcast the SSID for the wireless network. This makes it necessary to know the SSID in order to configure the wireless profile to connect to the access point or wireless router.
Single Sign On	Single Sign On feature set allows the 802.1X credentials to match your Windows log on user name and password credentials for wireless network connections.
SSID (Service Set Identifier)	SSID or network name is a value that controls access to a wireless network. The SSID for your wireless network card must match the SSID for any access point that you want to connect with. If the value does not match, you are not granted access to the network. Each SSID may be up to 32 alphanumeric characters long and is case-sensitive.
stealth	A stealth access point is one that has the capability and is configured to not broadcast its SSID. This is the WiFi network name that appears when a DMU (Device Management Utility, such as Intel® PROSet/Wireless WiFi Connection Utility) scans for available wireless networks. Although this can enhance wireless network security, it is commonly considered a



weak security feature. To connect to a stealth access point, a user must specifically know the SSID and configure their DMU accordingly. The feature is not a part of the 802.11 specification, and is known by differing names by various vendors: closed mode, private network, SSID broadcasting.

TKIP (Temporal Key Integrity Protocol)

Temporal Key Integrity protocol improves data encryption. Wi-Fi Protected Access\* uses its TKIP. TKIP provides important data encryption enhancements including a re-keying method. TKIP is part of the IEEE 802.11i encryption standard for wireless networks. TKIP is the next generation of WEP, the Wired Equivalency Protocol, which is used to secure 802.11 wireless networks. TKIP provides per packet key mixing, a message integrity check and a re-keying mechanism, thus fixing the flaws of WEP.

TLS (Transport Layer Security)

A type of authentication method using the Extensible Authentication Protocol (EAP) and a security protocol called the Transport Layer Security (TLS). EAP-TLS uses certificates which use passwords. EAP-TLS authentication supports dynamic WEP key management. The TLS protocol is intended to secure and authenticate communications across a public network through data encryption. The TLS Handshake Protocol allows the server and client to provide mutual authentication and to negotiate an encryption algorithm and cryptographic keys before data is transmitted.

TTLS (Tunneled Transport Layer Security)

These settings define the protocol and the credentials used to authenticate a user. In TTLS, the client uses EAP-TLS to validate the server and create a TLS-encrypted channel between the client and server. The client can use another authentication protocol. Typically password-based protocols challenge over this encrypted channel to enable server validation. The challenge and response packets are sent over a non-exposed TLS encrypted channel. TTLS implementations today support all methods defined by EAP, as well as several older methods (CHAP, PAP, MS-CHAP and MS-CHAP-V2). TTLS can easily be extended to work with new protocols by defining new attributes to support new protocols.

WEP (Wired Equivalent Privacy)

Wired Equivalent Privacy, 64- and 128-bit (64-bit is sometimes referred to as 40-bit). This is a low-level encryption technique designed to give the user about the same amount of privacy that he would expect from a LAN. WEP is a security protocol for wireless local area networks (WLANs) defined in the 802.11b standard. WEP is designed to provide the same level of security as that of a wired LAN. WEP aims to provide security by data over radio waves so that it is protected as it is transmitted from one end point to another.

WEP Key

Either a pass phrase or hexadecimal key.  
The pass phrase must be 5 ASCII characters for 64-bit WEP or 13 ASCII characters for 128-bit WEP. For pass phrases, 0-9, a-z, A-Z, and ~!@#\$%^&\*()\_+|-={}|[]\:"';<>?.,/ are all valid characters.

	<p>The hex key must be 10 hexadecimal characters (0-9, A-F) for 64-bit WEP or 26 hexadecimal characters (0-9, A-F) for 128-bit WEP.</p>
Wi-Fi* (Wireless Fidelity)	<p>Is meant to be used generically when referring of any type to 802.11 network, whether 802.11b, 802.11a, or dual-band.</p>
WiMAX	<p>WiMAX, the Worldwide Interoperability for Microwave Access, is a telecommunications technology aimed at providing wireless data over long distances in a variety of ways, from point-to-point links to full mobile cellular type access. It is based on the IEEE 802.16 standard. The name WiMAX was created by the WiMAX Forum, which was formed in June 2001 to promote conformance and interoperability of the standard. The forum describes WiMAX as "a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL."</p>
Wireless router	<p>A stand-alone wireless hub that allows any computer that has a wireless network adapter to communicate with another computer within the same network and to connect to the Internet.</p>
WLAN (Wireless Local-Area Network)	<p>A type of local-area network that uses high-frequency radio waves rather than wires to communicate between nodes.</p>
WPA* (Wi-Fi Protected Access)	<p>This is a security enhancement that strongly increases the level of data protection and access control to a wireless network. WPA is an interim standard that will be replaced with the IEEE's 802.11i standard upon its completion. WPA consists of RC4 and TKIP and provides support for BSS (Infrastructure) mode only. WPA and WPA2 are compatible.</p>
WPA2* (Wi-Fi Protected Access 2)	<p>This is the second generation of WPA that complies with the IEEE TGi specification. WPA2 consists of AES encryption, pre-authentication and PMKID caching. It provides support for BSS (Infrastructure) mode and IBSS (ad hoc) mode. WPA and WPA2 are compatible.</p> <p>Wi-Fi Protected Access-Enterprise applies to corporate users. A new standards-based, interoperable security technology for wireless LAN (subset of IEEE 802.11i draft standard) that encrypts data sent over radio waves. WPA is a Wi-Fi standard that was designed to improve upon the security features of WEP as follows:</p>
WPA-Enterprise	<ul style="list-style-type: none"> <li>• Improved data encryption through the temporal key integrity protocol (TKIP). TKIP uses a hashing algorithm to scramble the encryption keys and adds an integrity-checking feature to ensure that the keys have not been tampered with.</li> <li>• User authentication, which is generally missing in WEP, through the extensible authentication protocol (EAP). WEP regulates access to a wireless network based on a computer's hardware-specific MAC address, which is relatively simple to be sniffed out and stolen. EAP is built on a more secure public-key encryption system to ensure that only authorized network users can access the network.</li> </ul>

WPA is an interim standard that will be replaced with the IEEE's 802.11i standard upon its completion.

WPA-Personal

Wi-Fi Protected Access-Personal provides a level of security in the small network or home environment.

WPA-PSK (Wi-Fi Protected-Access Pre-Shared Key)

WPA-PSK mode does not use an authentication server. It can be used with the data encryption types WEP or TKIP. WPA-PSK requires configuration of a pre-shared key (PSK). You must enter a pass phrase or 64 hex characters for a pre-shared key of length 256-bits. The data encryption key is derived from the PSK.

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