

Overview

HP ProBook 450 G5 Notebook PC



Front

- | | |
|-----------------------|--|
| 1. Microphones (2) | 7. SD Card reader |
| 2. Webcam | 8. Headphone/microphone combo jack |
| 3. Webcam light | 9. USB 2.0 (power port) |
| 4. Fingerprint reader | 10. Power button |
| 5. Clickpad | 11. Security lock slot (Lock sold separately.) |
| 6. Hard drive LED | |

Overview



Rear

- | | |
|------------------------------|------------------------------------|
| 1. Power connector | 4. HDMI port (Cable not included.) |
| 2. Ethernet port (RJ-R45) | 5. USB 3.1 Gen 1 |
| 3. External VGA monitor port | 6. USB Type-C™ port |

Overview

At a Glance

1. Preinstalled with Windows 10 versions or FreeDOS 2.0
2. Choice of Intel® Core™ processors
3. Full size HP Premium Keyboard, spill-resistant keyboard with a thin layer of mylar film to prevent minor spills
4. Function keys provide control of features including: standby mode, display brightness, external display, microphone mute, volume down, volume up, and backlight toggle for backlit keyboard (Select models only.)
5. Large Clickpad with gestures support
6. Enhanced security features with preinstalled software and hardware options
7. Optional HD webcam with dual-microphone array for video conferencing ¹
8. HDMI port for connecting to high-resolution displays
9. Choice of displays
 - 39.6 cm (15.6") diagonal FHD UWVA anti-glare flat LED backlit non-touch; 220 cd/m²; 45% sRGB (1920 x 1080)
 - 39.6 cm (15.6") diagonal HD SVA anti-glare LED-backlit non-touch; 220 cd/m²; 45% sRGB (1366 x 768)
 - 39.6 cm (15.6") diagonal HD SVA LED-backlit touch screen; 220 cd/m², 45% sRGB (1366 x 768)
10. Flexible wireless connectivity options
11. Battery life up to 14 hours and 30 minutes ((i3, HD with SSD)
12. HP 3-cell, 48 WHr Li-ion battery
13. Passed MIL-STD testing ²
 1. Sold separately or as an optional feature.
 2. MIL-STD-810G testing is not intended to demonstrate fitness of U.S. Department of Defense (DoD) contract requirements or for military use. Test results are not a guarantee of future performance under these test conditions. Accidental damage requires an optional HP Accidental Damage Protection Care Pack.

NOTE: See important legal disclosures for all listed specs in their respective features sections.



Features

PRODUCT NAMES

HP Probook 450 G5 Notebook PC

OPERATING SYSTEMS

Preinstalled

Windows 10 Pro 64 ¹
 Windows 10 Pro 64 (National Academic License) ^{1,2}
 Windows 10 Home 64 ¹
 Windows 10 Home Single Language 64 ¹
 Windows 10 Home 64 (National Academic License) ^{1,2}
 FreeDOS 2.0

1. Not all features are available in all editions or versions of Windows. Systems may require upgraded and/or separately purchased hardware, drivers, software or BIOS update to take full advantage of Windows functionality. Windows 10 is automatically updated, which is always enabled. ISP fees may apply and additional requirements may apply over time for updates. See <http://www.windows.com/>.
2. Some devices for academic use will automatically be updated to Windows 10 Pro Education with the Windows 10 Anniversary Update. Features vary; see <https://aka.ms/ProEducation> for Windows 10 Pro Education feature information.

PROCESSORS

Intel® Core™ i7-8550U Intel® UHD graphics 620 (1.8 GHz, up to 4.0 GHz with Intel® Turbo Boost Technology 2.0, 8 MB cache, 4 cores) ^{3,4,5}
 Intel® Core™ i7-7500U with Intel® HD Graphics 620 (2.7 GHz, up to 3.5 GHz with Intel® Turbo Boost Technology, 4 MB cache, 2 cores) ^{3,4,5}
 Intel® Core™ i5-8250U Intel® UHD Graphics 620 (1.6 GHz, up to 3.4 GHz with Intel® Turbo Boost Technology 2.0, 6 MB cache, 4 cores) ^{3,4,5}
 Intel® Core™ i5-7200U with Intel® HD Graphics 620 (2.5GHz/3.1GHz Dual Core Turbo, 3MB L3 Cache 15W)
 Intel® Core™ i3-8130U Intel® UHD Graphics 620 (2.2 GHz, up to 3.4 GHz with Intel® Turbo Boost Technology 2.0, 4 MB cache, 2 cores)
 Intel® Core™ i3-8130U with Intel® HD Graphics 620 (2.2GHz/3.4GHz Dual Core Turbo, 4MB L3 Cache 15W)
 Intel® Core™ i3-7100U with Intel® HD Graphics 620 (2.4 GHz, 3 MB cache, 2 cores) ^{3,4,5}
 Intel® Core™ i3-7020U with Intel® HD Graphics 620 (2.3GHz, 3MB L3 cache 15W)
 Intel® Core™ i3-6006U with Intel® HD Graphics 520 (2 GHz, 3 MB cache, 2 cores) ^{3,4}
 Intel® Celeron® 3865U with Intel® HD Graphics (1.8 GHz, 2 MB cache, 2 cores) ^{3,4,5}

Processors Family

8th Generation Intel® Core™ i7 processor (i7-8550U model) ⁵
 8th Generation Intel® Core™ i5 processor (i5-8250U model) ⁵
 8th Generation Intel® Core™ i3 processor (i3-8130U model)
 7th Generation Intel® Core™ i7 processor (i7-7500U model)
 7th Generation Intel® Core™ i5 processor (i5-7200U model)
 7th Generation Intel® Core™ i3 processor (i3-7100U model) ⁵
 7th Generation Intel® Core™ i3 processor (i3-7020 model)
 6th Generation Intel® Core™ i3 processor (i3-6006U model)
 Intel® Celeron® processor (3865U is Windows 10 only) ⁵



Features

3. Multicore is designed to improve performance of certain software products. Not all customers or software applications will necessarily benefit from use of this technology. Performance and clock frequency will vary depending on application workload and your hardware and software configurations. Intel's numbering is not a measurement of higher performance.
 4. Processor speed denotes maximum performance mode; processors will run at lower speeds in battery optimization mode.
 5. **NOTE:** In accordance with Microsoft's support policy, HP does not support the Windows 8 or Windows 7 operating system on products configured with Intel and AMD 7th generation and forward processors or provide any Windows 8 or Windows 7 drivers on <http://www.support.hp.com>.
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CHIPSET

Integrated with processor

GRAPHICS

Integrated

Intel® UHD graphics 620 ⁶
Intel® HD graphics 620 ⁶
Intel® HD graphics 520 ⁶
Intel® HD graphics ⁶

Note: View processor section for details.

Discrete

NVIDIA® GeForce® 930MX (2 GB DDR3 dedicated, switchable) ⁷

Supports

Support HD decode, DX12, HDMI 1.4b

6. HD content required to view HD images.

7. NVIDIA® technology requires an Intel® processor, plus an NVIDIA® GeForce® discrete graphics configuration and is available on Windows 10 Professional OS. With NVIDIA® Optimus™ technology, full enablement of all discrete graphics video and display features may not be supported on all systems (e.g. OpenGL applications will run on the integrated GPU or the APU as the case may be).

DISPLAYS

Internal

eDP FHD Flat

39.6 cm (15.6") diagonal FHD UWVA anti-glare flat LED backlit, 220 cd/m², 45% sRGB (1920 x 1080) ^{6,8}

eDP HD Flat

39.6 cm (15.6") diagonal HD SVA anti-glare LED-backlit, 220 cd/m², 45% sRGB (1366 x 768) ^{6,8}

39.6 cm (15.6") diagonal HD SVA LED-backlit touch screen, 220 cd/m², 45% sRGB (1366 x 768) ^{6,8}

Display Size

15.6"

39.6 cm (15.6")



Features

6. HD content required to view HD images.
8. Resolutions are dependent upon monitor capability, and resolution and color depth settings.

Docking station model	Total number of supported displays (incl. the notebook display)	Max. resolutions supported	Dock Connect3ors	Technical limitations
HP UltraSlim Docking Station	3	Dual 2.5K @ 60Hz	2xDP, 1xVGA	Dual 2.5k only with both displays into DP
HP Thunderbolt Dock 120W G2	3	Dual 4k @60Hz	2xDP, 1xVGA, 1xTB, 1xUSB-C alt-mode	Dual 4k only with one display in to DP and + TB port or USB-C alt mode + TB port
HP USB-C Dock G4	3	Dual 2K @ 60Hz Single 4K @ 60Hz (3840 x 1440)	1xHDMI, 2xDP	
HP USB-C Universal Dock	3	Dual 4K @ 60Hz Single 5K @ 60Hz	2xDP	
HP USB-C Travel Dock	2	Single 2K @ 60Hz	1xHDMI, 1xVGA	Single external display Only HDMI or VGA at the time
HP USB-C Mini Dock	2	Single 4K @ 30Hz	1xHDMI, 1xVGA	Single external display Only HDMI or VGA at the time

STORAGE AND DRIVES

Hard Drives

500 GB SATA (7200 rpm) ⁹
 500 GB (8 GB cache) SATA SSHD (5400 rpm) ⁹
 1 TB SATA (5400 rpm) ⁹

Primary M.2 Storage

16 GB Intel® Optane™ Memory
 128 GB M.2 SATA TLC SSD ⁹
 256 GB M.2 PCIe NVMe Value SSD ⁹
 512 GB M.2 PCIe NVMe TLC SSD ⁹

Note: PCIe SSD not available for Celeron

9. For Solid State Drives or Hard Drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 30 GB (for Windows 10) is reserved for system recovery software.

MEMORY

16 GB DDR4-2400 SDRAM (1 x 16 GB) ¹⁰
 16 GB DDR4-2400 SDRAM (2 x 8 GB) ¹⁰
 12 GB DDR4-2400 SDRAM (4 and 8 GB) ¹⁰
 8 GB DDR4-2400 SDRAM (1 x 8 GB) ¹⁰



Features

8 GB DDR4-2400 SDRAM (2 x 4 GB) ¹⁰
 4 GB DDR4-2400 SDRAM (1 x 4 GB) ¹⁰

Maximum

32 GB DDR4-2400 SDRAM ¹⁰

Memory Slots

2 SODIMM

Both slots are customer accessible / upgradeable

DDR4 PC4 SODIMMS, system runs at 2133 (Intel®8th Gen CPU runs at 2400)

Supports Dual Channel Memory

10. Due to the non-industry standard nature of some third-party memory modules, we recommend HP branded memory to ensure compatibility. If you mix memory speeds, the system will perform at the lower memory speed.

NETWORKING/COMMUNICATIONS

Wireless LAN (WLAN)

Realtek 802.11ac (1x1) WiFi® and Bluetooth® 4.2 Combo ¹¹

Realtek 802.11ac (2x2) WiFi® and Bluetooth® 4.2 Combo ¹¹

Intel® Dual Band Wireless-AC 3168 802.11 a/b/g/n/ac (1x1) WiFi® and Bluetooth® 4.2 Combo (non-vPro™) ¹¹

Intel® Dual Band Wireless-AC 8265 802.11a/b/g/n/ac (2x2) WiFi® and Bluetooth® 4.2 Combo (non-vPro™) ¹¹

Broadband Wireless (WWAN)

HP lt4132 LTE/HSPA+ 4G Mobile Broadband ¹²

HP lt4210 LTE/HSPA+ 4G Mobile Broadband ¹²

Ethernet

Realtek RTL8111HSH Gigabit Ethernet

11. Wireless access point and Internet service required and sold separately. Availability of public wireless access points limited. The specifications for the 802.11ac WLAN are draft specifications and are not final. If the final specifications differ from the draft specifications, it may affect the ability of the notebook to communicate with other 802.11ac WLAN devices.
12. WWAN module requires separately purchased service contract. Check with service provider for coverage and availability in your area. Connection speeds will vary due to location, environment, network conditions, and other factors. 4G LTE not available on all products, in all regions.

AUDIO/MULTIMEDIA

Audio

2 Integrated stereo speakers

Integrated dual array microphone

Webcam

HD webcam ^{6,13}

HD IR webcam ^{6,13}

6. HD content required to view HD images.
13. Internet access required.



Features

KEYBOARDS/POINTING DEVICES/BUTTONS & FUNCTION KEYS

Keyboard

HP Premium Keyboard

Full-sized island-style, spill resistant

Pointing Device

Clickpad with multi-touch gesture support image sensor, taps enabled as default

Gestures

Enabled by default Win 10

2 Finger Scrolling

2 Finger Zoom (Pinch)

OSD (enable/disable)

3 finger tap = Cortana

3 finger flick = App switch

4 finger tap = Action Center

Disabled by default Win 10

3 Finger Flick

2 Finger Rotate

Momentum Motion

1 Finger Vertical Scroll

Function Keys

ESC: system information

F1 - Display Switching

F2 - Blank

F3 - Brightness Down

F4 - Brightness Up

F5 - Speaker Mute

F6 - Volume Down

F7 - Volume Up

F8 - Mic Mute

F9 - Backlight Toggle (for backlit keyboard) or Blank

F10 - NumLock

F11 - Wifi Toggle

F12 - Sleep

Hidden Functions

Fn+R = Break

Fn+S = Sys Rq

Fn+C = Scroll Lock

SOFTWARE AND SECURITY

BIOS

HP BIOSphere Gen4 ¹⁴

HP DriveLock & Automatic DriveLock

BIOS Update via Network

Master Boot Record Security



Features

Power On Authentication
Secure Erase¹⁵
Absolute Persistence Module¹⁶
Pre-boot Authentication

Software

HP Native Miracast Support¹⁷
HP LAN-Wireless Protection
HP Wireless Wakeup
HP Connection Optimizer
HP Velocity
HP 3D DriveGuard 6
HP ePrint + JetAdvantage¹⁸
HP Hotkey Support
HP Recovery Manager
HP Jumpstart
HP Support Assistant¹⁹
HP Noise Cancellation Software
Buy Office
Bing Search

Manageability Features

HP Driver Packs²⁰
HP System Software Manager
HP BIOS Config Utility (BCU)
HP Client Catalog
HP Management Integration Kit for Microsoft System Center Configuration Manager²¹
LANDESK Management²²

Client Security Software

HP Client Security Suite Gen3²³ including:
HP Security Manager (including Credential Manager and Password Manager)
HP DriveLock
HP Fingerprint Sensor
HP Password Manager²⁴
Microsoft Defender²⁵
TPM 2.0

14. HP BIOSphere Gen4 requires Intel® 7th or 8th Generation processors.
15. Secure Erase for the methods outlined in the National Institute of Standards and Technology Special Publication 800-88. Supported on Elite platforms with BIOS version F.03 or higher.
16. Absolute agent is shipped turned off, and will be activated when customers activate a purchased subscription. Subscriptions can be purchased for terms ranging multiple years. Service is limited,



Features

check with Absolute for availability outside the U.S. The Absolute Recovery Guarantee is a limited warranty. Certain conditions apply. For full details visit:

<http://www.absolute.com/company/legal/agreements/computrace-agreement>. Data Delete is an optional service provided by Absolute Software. If utilized, the Recovery Guarantee is null and void. In order to use the Data Delete service, customers must first sign a Pre-Authorization Agreement and either obtain a PIN or purchase one or more RSA SecurID tokens from Absolute Software.

17. Miracast is a wireless technology your PC can use to project your screen to TVs, projectors, and streaming media players that also support Miracast. You can use Miracast to share what you're doing on your PC and present a slide show. For more information: <http://windows.microsoft.com/en-us/windows-8/project-wireless-screen-miracast>
18. HP ePrint Drive requires an Internet connection to HP web-enabled printer and HP ePrint account registration (for a list of eligible printers, supported documents and image types and other HP ePrint details, see www.hp.com/go/eprintcenter). Print times and connection speeds may vary.
19. HP Support Assistant requires Windows and Internet access.
20. HP Driver Packs not preinstalled, however available for download at <http://www.hp.com/go/clientmanagement>.
21. HP Management Integration Kit can be downloaded from <http://www8.hp.com/us/en/ads/clientmanagement/overview.html>.
22. LANDESK Management subscription required.
23. HP Client Security Suite Gen3 requires Windows and Intel® or AMD 7th or 8th Generation processors.
24. HP Password Manager requires Internet Explorer or Chrome or FireFox. Some websites and applications may not be supported. User may need to enable or allow the add-on / extension in the internet browser.
25. Microsoft Defender Opt in and internet connection required for updates.

POWER

Power Supply

- 45 W HP Smart AC adapter ²⁶
- 45 W HP Smart AC adapter 2-prong (Japan only) ²⁶
- 65 W HP Smart AC adapter ²⁶
- 65 W EM Smart AC adapter ²⁶

Primary Battery

- 3-cell, 48 Wh Long Life Li-ion ²⁷

Power Cord

- 2-wire plug - 1m (2-prong Japan only) ²⁶
- 3-wire plug - 1m ²⁶
- 3-wire plug - 1.8m ²⁶

Battery life



Features

Up to 14 hours and 30 minutes (i3, HD with SSD) ²⁸

Up to 14 hours and 15 minutes (i5 quad core, HD with SSD) ²⁸

26. Availability may vary by country.

27. Battery is internal and not replaceable by customer. Serviceable by warranty.

28. Windows 10 MM14 battery life will vary depending on various factors including product model, configuration, loaded applications, features, use, wireless functionality, and power management settings. The maximum capacity of the battery will naturally decrease with time and usage. See www.bapco.com for additional details.

WEIGHTS & DIMENSIONS

Weight

Starting at 4.64 lb ²⁹

Starting at 2.02 kg ²⁹

Dimensions (w x d x h)

Non-touch

14.8 x 10.4 x 0.82 in

37.6 x 26.3 x 2.09 cm

Touch

14.8 x 10.4 x 0.89 in

37.6 x 26.3 x 2.28 cm

29. Weight will vary by configuration.

PORTS/SLOTS

1 USB 3.1 Type-C™

1 USB 2.0 (powered port)

2 USB 3.1 Gen 1

1 HDMI 1.4b ³⁰

1 RJ-45

1 VGA

1 AC power

1 headphone/microphone combo jack

Expansion Slots

1 multi-format digital media reader

Supports SD, SDHC, SDXC.

30. HDMI cable sold separately.



Features

ENVIRONMENTAL & INDUSTRY

Environmental Data	Eco-Label Certifications & declarations	<p>This product has received or is in the process of being certified to the following approvals and may be labeled with one or more of these marks:</p> <ul style="list-style-type: none"> IT ECO declaration US ENERGY STAR® EPEAT[®] Gold registered in the United States. See http://www.epeat.net for registration status in your country. Search keyword <i>generator</i> on HP's 3rd party option store for solar energy accessory at http://www.hp.com/go/options 		
	System Configuration	The configuration used for the Energy Consumption and Declared Noise Emissions data for the Notebook model is based on a "Typically Configured Notebook".		
	Energy Consumption (in accordance with US ENERGY STAR® test method)	115VAC, 60Hz	230VAC, 50Hz	100VAC, 60Hz
	Normal Operation (Short idle)	7.89 W	7.95 W	7.84 W
	Normal Operation (Long idle)	3.43 W	3.46 W	3.4 W
	Sleep	0.55 W	0.58 W	0.56 W
	Off	0.39 W	0.43 W	0.4 W
		<p>Note: Energy efficiency data listed is for an ENERGY STAR® compliant product if offered within the model family. HP computers marked with the ENERGY STAR® Logo are compliant with the applicable U.S. Environmental Protection Agency (EPA) ENERGY STAR® specifications for computers. If a model family does not offer ENERGY STAR® compliant configurations, then energy efficiency data listed is for a typically configured PC featuring a hard disk drive, a high efficiency power supply, and a Microsoft Windows® operating system.</p>		
	Heat Dissipation*	115VAC, 60Hz	230VAC, 50Hz	100VAC, 60Hz
	Normal Operation (Short idle)	27	27	27
	Normal Operation (Long idle)	12	12	12
	Sleep	2	2	2
	Off	1	1	1
		*NOTE: Heat dissipation is calculated based on the measured watts, assuming the service level is attained for one hour.		
	Declared Noise Emissions (in accordance with ISO 7779 and ISO 9296)	Sound Power (L _{WAd} , bels)	Sound Pressure (L _{pAm} , decibels)	
	Typically Configured – Idle	2.9	21	
	Fixed Disk – Random writes	2.9	21	



Features

	Longevity and Upgrading	<p>"This product can be upgraded, possibly extending its useful life by several years. Upgradeable features and/or components contained in the product may include:</p> <ul style="list-style-type: none"> • 3 USB ports • 1 PC card slot (type I/II) • 1 ExpressCard/54 slot • 1 IEEE 1394 Port • 2 SODIMM memory slots • Optional expansion base docking station • 1 multi-bay II storage port • Interchangeable HDD <p>Spare parts are available throughout the warranty period and or for up to "5" years after the end of production.</p>									
	Batteries	<p>"This battery(s) in this product comply with EU Directive 2006/66/EC</p> <p>Batteries used in the product do not contain: Mercury greater the 1ppm by weight Cadmium greater than 20ppm by weight</p> <p>Battery size: CR2032 (coin cell) Battery type: Lithium</p> <p>Battery size: CR2032 (coin cell) Battery type: Lithium"</p>									
	Additional Information	<ul style="list-style-type: none"> • "• This product is in compliance with the Restrictions of Hazardous Substances (RoHS) directive - 2011/65/EC. • • This HP product is designed to comply with the Waste Electrical and Electronic Equipment (WEEE) Directive – 2002/96/EC. • • This product is in compliance with California Proposition 65 (State of California; Safe Drinking Water and Toxic Enforcement Act of 1986). • • This product is in compliance with the IEEE 1680 (EPEAT) standard at the Gold level, see www.epeat.net • • Plastics parts weighing over 25 grams used in the product are marked per ISO11469 and ISO1043. • • This product contains 0% post-consumer recycled plastic (by wt.) • • This product is 94.4% recycle-able when properly disposed of at end of life." 									
	Packaging Materials	<table border="1"> <tr> <td>External:</td><td>PAPER/Corrugated</td><td>359 g</td></tr> <tr> <td>Internal:</td><td>PLASTIC/EPE (Expanded Polyethylene)</td><td>82 g</td></tr> <tr> <td></td><td>PLASTIC/Polyethylene low density</td><td>10 g</td></tr> </table> <p>The plastic packaging material contains at least 50% recycled content.</p> <p>The corrugated paper packaging materials contains at least 75% recycled content.</p>	External:	PAPER/Corrugated	359 g	Internal:	PLASTIC/EPE (Expanded Polyethylene)	82 g		PLASTIC/Polyethylene low density	10 g
External:	PAPER/Corrugated	359 g									
Internal:	PLASTIC/EPE (Expanded Polyethylene)	82 g									
	PLASTIC/Polyethylene low density	10 g									
	Material Usage	<p>This product does not contain any of the following substances in excess of regulatory limits (refer to the HP General Specification for the Environment at http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/gse.pdf):</p> <ul style="list-style-type: none"> • Asbestos • Certain Azo Colorants • Certain Brominated Flame Retardants – may not be used as flame retardants in plastics • Cadmium • Chlorinated Hydrocarbons 									



Features

		<ul style="list-style-type: none"> • Chlorinated Paraffins • Formaldehyde • Halogenated Diphenyl Methanes • Lead carbonates and sulfates • Lead and Lead compounds • Mercuric Oxide Batteries • Nickel – finishes must not be used on the external surface designed to be frequently handled or carried by the user. • Ozone Depleting Substances • Polybrominated Biphenyls (PBBs) • Polybrominated Biphenyl Ethers (PBBEs) • Polybrominated Biphenyl Oxides (PBBOs) • Polychlorinated Biphenyl (PCB) • Polychlorinated Terphenyls (PCT) • Polyvinyl Chloride (PVC) – except for wires and cables, has been voluntarily removed from most applications. • Radioactive Substances • Tributyl Tin (TBT), Triphenyl Tin (TPT), Tributyl Tin Oxide (TBT0)
	Packaging Usage	<p>HP follows these guidelines to decrease the environmental impact of product packaging:</p> <ul style="list-style-type: none"> • Eliminate the use of heavy metals such as lead, chromium, mercury and cadmium in packaging materials. • Eliminate the use of ozone-depleting substances (ODS) in packaging materials. • Design packaging materials for ease of disassembly. • Maximize the use of post-consumer recycled content materials in packaging materials. • Use readily recyclable packaging materials such as paper and corrugated materials. • Reduce size and weight of packages to improve transportation fuel efficiency. • Plastic packaging materials are marked according to ISO 11469 and DIN 6120 standards.
	End-of-life Management and Recycling	<p>Hewlett-Packard offers end-of-life HP product return and recycling programs in many geographic areas. To recycle your product, please go to: http://www.hp.com/go/reuse-recycle or contact your nearest HP sales office. Products returned to HP will be recycled, recovered or disposed of in a responsible manner.</p> <p>The EU WEEE directive (2002/95/EC) requires manufacturers to provide treatment information for each product type for use by treatment facilities. This information (product disassembly instructions) is posted on the Hewlett Packard web site at: http://www.hp.com/go/recyclers. These instructions may be used by recyclers and other WEEE treatment facilities as well as HP OEM customers who integrate and re-sell HP equipment.</p>

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	HP, Inc. Corporate Environmental Information	For more information about HP's commitment to the environment: Global Citizenship Report http://www.hp.com/hpinfo/globalcitizenship/gcreport/index.html Eco-label certifications http://www8.hp.com/us/en/hp-information/environment/ecolabels.html ISO 14001 certificates: http://h20195.www2.hp.com/V2/GetDocument.aspx?docname=c04755842 http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/cert.pdf
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SERVICE AND SUPPORT

3 year and 1 year limited warranties and 90-day software limited warranty options depending on country. Batteries have a default one year limited warranty except for Long Life batteries which will have same 1-year or 3-year limited warranty as the platform. On-site service and extended coverage is also available. HP Care Pack Services are optional extended service contracts that go beyond the standard limited warranties. To choose the right level of service for your HP product, use the HP Care Pack Services Lookup Tool at <http://www.hp.com/go/cpc> ³¹

31. HP Care Packs are sold separately. Service levels and response times for HP Care Packs may vary depending on your geographic location. Service starts on date of hardware purchase. Restrictions and limitations apply. For details, visit www.hp.com/go/cpc. HP services are governed by the applicable HP terms and conditions of service provided or indicated to Customer at the time of purchase. Customer may have additional statutory rights according to applicable local laws, and such rights are not in any way affected by the HP terms and conditions of service or the HP Limited Warranty provided with your HP Product.



Technical Specifications

SYSTEM UNIT

Stand-Alone Power Requirements (AC Power)

Nominal Operating Voltage	19V
Average Operating Power	Win 10
Integrated graphics	5.71W
Discrete Graphics	6.78W
Max Operating Power	Discrete < 65W UMA < 45W
Temperature	
Operating	32° to 95° F (0° to 35° C)

Non-operating	-4° to 140° F (-20° to 60° C)
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Relative Humidity

Operating	10% to 90%, non-condensing
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Non-operating	5% to 95%, 101.6° F (38.7° C) maximum wet bulb temperature
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Shock

Operating	40 G, 2 ms, half-sine
Non-operating	200 G, 2 ms, half-sine

Random Vibration

Operating	0.75 grms
Non-operating	1.50 grms

Altitude (unpressurized)

Operating	-50 to 10,000 ft (-15.24 to 3,048 m)
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Non-operating	-50 to 40,000 ft (-15.24 to 12,192 m)
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Planned Industry Standard Certifications

UL	Yes
CSA	Yes
FCC Compliance	Yes
ENERGY STAR 7.0®	Selected models ³⁴
EPEAT	

	Registered Gold in United States ³²
ICES	Yes
Australia /	Yes
NZ A-Tick Compliance	Yes
CCC	Yes



Technical Specifications

Japan VCCI Compliance

Yes

KC

Yes

BSMI

Yes

CE Marking Compliance

Yes

BNCI or BELUS

Yes

CIT

Yes

GOST

Yes

Saudi Arabian Compliance (ICCP)

Yes

SABS

Yes

UKRSERTCOMPUTER

Yes

32. EPEAT® registered where applicable. EPEAT registration varies by country. See <http://www.epeat.net> for registration status by country. Search keyword generator on HP's 3rd party option store for solar generator accessories at [HTTP://WWW.HP.COM/GO/OPTIONS](http://www.hp.com/go/options).

34. Configurations of the HP ProBook 450 G4 is ENERGY STAR® qualified are identified as HP ProBook 450 G4 ENERGY STAR on HP websites and on <http://www.energystar.gov>.

DISPLAYS

Note: All specifications represent the typical specifications provided by HP's component manufacturers; actual performance may vary either higher or lower.

15.6" diagonal FHD UWVA anti-glare flat LED backlit non-touch; 220 cd/m²; 45% sRGB (1920 x 1080)

Outline Dimensions (W x H x D)	360.0 x 224.3mm max
Active Area	344.16 x 193.59
Weight	360g max.
Diagonal Size	15.6 (inch)
Thickness	3.2mm max
Interface	eDP 1.2
LCD Mode	IPS
PPI	
Surface Treatment	Anti-Glare (AG)
Touch Enabled	None
Contrast Ratio	600:1 (typical)
Refresh Rate	60Hz
Brightness	220 nits
Pixel Resolution	1920 x 1080 (FHD)
Format	RGB
Backlight	LED
Color Gamut Coverage	45%
Color Depth	6 bits + FRC
Viewing Angle	UWVA 85/85/85/85



Technical Specifications

15.6" diagonal HD SVA anti-glare LED-backlit non-touch; 220 cd/m²; 45% sRGB (1366 x 768)	Outline Dimensions (W x H)	360 x 224.3 (mm) max
	Active Area	344.2 x 193.5 (mm)
	Weight	370 g max
	Diagonal Size	15.6 (inch)
	Thickness	3.2 (mm) max
	Interface	eDP 1.2
	LCD Mode	TN
	PPI	
	Surface Treatment	Anti-Glare (AG)
	Touch Enabled	None
	Contrast Ratio	300:1 (typical)
	Refresh Rate	60 Hz
	Brightness	220 nits
	Pixel Resolution	1366 x 768 (HD)
	Format	RGB
	Backlight	LED
	Color Gamut Coverage	45%
	Color Depth	6 bits + Hi FRC
	Viewing Angle	SVA 45/45/25/35

15.6" diagonal HD SVA LED-backlit touch; 220 cd/m²; 45% sRGB (1366 x 768)	Outline Dimensions (W x H x D)	360 x 224.3 (mm) max
	Active Area	344.2 x 193.5 (mm)
	Weight	370 g max
	Diagonal Size	15.6 (inch)
	Thickness	3.2 (mm) max
	Interface	eDP 1.2
	LCD Mode	TN
	PPI	
	Surface Treatment	
	Touch Enabled	None
	Contrast Ratio	300:1 (typical)
	Refresh Rate	60 Hz
	Brightness	220 nits
	Pixel Resolution	1366 x 768 (HD)
	Format	RGB
	Backlight	LED
	Color Gamut Coverage	45%
	Color Depth	6 bits + Hi FRC
	Viewing Angle	SVA 45/45/25/35



Technical Specifications

STORAGE AND DRIVES

HARD DRIVES

500 GB 7200 rpm SATA Hard Drive	Drive Weight	0.01 lb (6 g) ~ 0.02 lb (10 g)
	Rotation Speed	5400 rpm
	Cache Buffer	Up to 16MB
	NAND Type/Size	0.28 in (7 mm)
	Height	2.75 in (69.85 mm)
	Width	ATA-8, SATA 3.0
	Interface	600 MB/s
	Transfer Rate	0.01 lb (6 g) ~ 0.02 lb (10 g)
	Seek Time	
	Single Track	1.5 ~ 2 ms
	Average	11 ~ 13 ms
	Maximum	18 ~ 22 ms
	Logical Blocks	976,773,168
	Operating Temperature	976,773,168
	Security Features	32° to 158°F (0° to 70°C) [ambient temp]
	Other Features	ATA Security, NCQ

500 GB 5400 rpm SMART SATA Hybrid HDD/SSHD	Drive Weight	0.20 lbs (92 g) ~ 0.21 lbs (95 g)
	Rotation Speed	5400 rpm
	Cache Buffer	64 MB
	NAND Type/Size	TLC/8GB
	Height	0.28 in (7 mm)
	Width	2.75 in (69.85 mm)
	Interface	ATA-8, SATA 3.0
	Interface Transfer Rate	600 MB/s
	Seek Time	
	Single Track	2 ~ 1.5 ms;
	Average	11 ~ 13 ms
	Maximum	18 ~ 22 ms
	Logical Blocks	976,773,168
	Operating Temperature	976,773,168
	Security Features	32° to 158°F (0° to 70°C) [ambient temp]
	Other Features	ATA Security, NCQ



Technical Specifications

1TB 5400 rpm 7mm SATA Hard Drive	Drive Weight	0.21 lbs (94 g)
	Rotation Speed	5400 rpm
	Cache Buffer	Up to 32 MB
	NAND Type/Size	N/A
	Height	0.28 in (7.2 mm)
	Width	2.75 in (69.85 mm)
	Interface	ATA-8, SATA 3.0
	Interface Transfer Rate	600 MB/s
	Seek Time	
	Single Track	Single Track2 ms
	Average	Average12 ~ 13 ms
	Maximum	Maximum18 ~ 22 ms
	Logical Blocks	1,953,525,168
	Operating Temperature	32° to 140° F (0° to 60° C) [top cover temp]
	Security Features	ATA Security
	Other Features	S.M.A.R.T., NCQ, Ultra DMA

SOLID STATE DRIVES

128GB 2280 M2 SATA-3 TLC Solid State Drive	Form Factor	M.2 2280
	Capacity	128 GB
	NAND Type	TLC
	Height	0.09 in (2.3 mm)
	Width	0.87 in (22 mm)
	Weight	0.02 lb (10 g)
	Interface	ATA-8, SATA 3.0
	Maximum Sequential Read	Up To 520 MB/s
	Maximum Sequential Write	Up To 450 MB/s
	Logical Blocks	250,069,680
	Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]
	Features	DIPM; TRIM; DEVSLP

256GB 2280 PCIe NVMe Value Solid State Drive	Form Factor	M.2 2280
	Capacity	256 GB
	NAND Type	TLC
	Height	0.09 in (2.3 mm)
	Width	0.87 in (22 mm)
	Weight	0.02 lb (10 g)
	Interface	PCIe NVMe Gen3X4
	Maximum Sequential Read	Up To 1700 MB/s
	Maximum Sequential Write	Up To 600 MB/s



Technical Specifications

	Logical Blocks	500,118,192
	Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]
	Features	"TRIM; L1.2
<hr/>		
512GB 2280 M2 PCIe NVMe TLC Solid State Drive	Form Factor	M.2 2280
	Capacity	512 GB
	NAND Type	TLC
	Height	0.09 in (2.3 mm)
	Width	0.87 in (22 mm)
	Weight	0.02 lb (10 g)
	Interface	PCIe NVMe Gen3X4
	Maximum Sequential Read	Up To 2600 MB/s
	Maximum Sequential Write	Up To 1400 MB/s
	Logical Blocks	1,000,215,216
	Operating Temperature	32° to 158°F (0° to 70°C) [ambient temp]
	Features	TRIM; L1.2

NETWORKING/COMMUNICATIONS

WWAN

HP It4132 LTE/HSPA+ 4G Mobile Broadband Module¹	Technology/Operating bands	LTE: 2100 (Band 1), 1900 (Band 2), 1800 (Band 3) MHz, 850 (Band 5), 2600 (Band 7), 900 (Band 8) MHz, 800 (Band 20), 700 (Band 28) MHz. HSPA+: 2100 (Band 1), 1900 (Band 2), 850 (Band 5), 900 (Band 8) MHz E-GPRS: 1900 (Band 2), 1800 (Band 3), 850 (Band 5), 900 (Band 8) MHz
	Wireless protocol standards	3GPP Release 10 LTE Specification CAT.4, 20MHz BW WCDMA R99, 3GPP Release 5, 6, 7 and 8 UMTS Specification E-GPRS: Class B, Multi-slot class 12, coding schemes CS1 - CS4 and MSC1 - MSC9
	GPS	Standalone, A-GPS (MS-B and LTO)
	GPS bands	1575.42 MHz ± 1.023 MHz, GLONASS 1596-1607MHz
	Maximum data rates	LTE: 150 Mbps (Download), 50 Mbps (Upload) DC-HSPA+: 42 Mbps (Download), 5.76 Mbps (Upload) HSPA+: 21Mbps (Download), 5.76 Mbps (Upload) EDGE: 236.8 kbps (Download), 236.8 kbps (Upload) GPRS: 85.6 kbps(Download), 85.6 kbps (Upload)
	Maximum output power	LTE: 23 dBm HSPA+: 23.5 dBm E-GPRS 1900/1800: 26 dBm E-GPRS 900/850: 27 dBm GPRS 1900/1800: 29.5 dBm GPRS 900/850: 32.5 dBm
	Maximum power consumption	LTE: 1,200 mA (peak); 900 mA (average) HSPA+: 1,100 mA (peak); 800 mA (average) E-GPRS: 2,600 mA (peak); 500 mA (average)



Technical Specifications

Form Factor M.2, 3042-S3 Key B

Weight 6 g

Dimensions
(Length x Width x Thickness) 42 x 30 x 2.3 mm

1. Mobile Broadband is an optional feature. Connection requires wireless data service contract, network support, and is not available in all areas. Contact service provider to determine the coverage area and availability. Connection speeds will vary due to location, environment, network conditions, and other factors. 4G LTE not available on all products or in all countries.

HP It4210 LTEHSPA+ 4G Mobile Broadband Module¹

Technology/Operating bands FDD LTE:
LTE: 2100 (Band 1), 1900 (Band 2), 1800 (Band 3), 1700 (Band 4), 850 (Band 5), 2600 (Band 7), 900 (Band 8), 1400 (Band 11), 700 (Band 12), 700 (Band 13)
700 (Band 17), 850 (Band 18), 850 (Band 19), 800 (Band 20), 1450 (Band 21), 850 (Band 26)
700 (Band 28) MHz, 700 (Band 29), 2300 (Band 30), 2100 (Band 66) MHz
TDD LTE:
2600 (Band 38), 1900 (Band 39), 2300 (Band 40), 2500 (Band 41) MHz
HSPA+: 2100 (Band 1), 1900 (Band 2), 1700 (Band 4), 850 (Band 5), 900 (Band 8) MHz

Wireless protocol standards 3GPP Release 11 LTE Specification CAT.9, MAX 60MHz aggregation BW
WCDMA R99, 3GPP Release 5, 6, 7 and 8 UMTS Specification

GPS Standalone, A-GPS (MS-B and LTO)

GPS bands GPS 1575.42 MHz ± 1.023 MHz, GLONASS 1596-1607MHz, Beidou 1561.098 ± 2.046 MHz

Maximum data rates LTE: 450 Mbps (DL 3CA), 50 Mbps (Upload)
DC-HSPA+: 42 Mbps (Download), 5.76 Mbps (Upload)
HSPA+: 21Mbps (Download), 5.76 Mbps (Upload)

Maximum output power LTE: 23 dBm
HSPA+: 23.5 dBm

Maximum power consumption LTE: 1,200 mA (peak); 900 mA (average)
HSPA+: 1,100 mA (peak); 800 mA (average)

Form Factor M.2, 3042-S3 Key B

Weight 6 g

Dimensions
(Length x Width x Thickness) 42 x 30 x 2.3 mm

1. Mobile Broadband is an optional feature. Connection requires wireless data service contract, network support, and is not available in all areas. Contact service provider to determine the coverage area and availability. Connection speeds will vary due to location, environment, network conditions, and other factors. 4G LTE not available on all products or in all countries.

WLAN

Intel 802.11 a/b/g/n/AC (2x2) WiFi and Bluetooth® Combo **Wireless LAN Standards** IEEE 802.11a
IEEE 802.11b
IEEE 802.11g
IEEE 802.11n
IEEE 802.11ac



Technical Specifications

Interoperability	Wi-Fi certified
Frequency Band	802.11b/g/n <ul style="list-style-type: none"> • 2.402 – 2.482 GHz 802.11a/n <ul style="list-style-type: none"> • 4.9 – 4.95 GHz (Japan) • 5.15 – 5.25 GHz • 5.25 – 5.35 GHz • 5.47 – 5.725 GHz • 5.825 – 5.850 GHz
Data Rates	<ul style="list-style-type: none"> • 802.11b: 1, 2, 5.5, 11 Mbps • 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps • 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps • 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz) • 802.11ac : MCS0 ~ MCS7, (1SS) (20MHz, 40MHz, and 80MHz)
Modulation	Direct Sequence Spread Spectrum
Security¹	BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM <ul style="list-style-type: none"> • IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only • AES-CCMP: 128 bit in hardware • 802.1x authentication • WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES. • WPA2 certification • IEEE 802.11i • Cisco Certified Extensions, all versions through CCX4 and CCX Lite • WAPI
Network Architecture Models	Ad-hoc (Peer to Peer)
Roaming	Infrastructure (Access Point Required)
Output Power²	IEEE 802.11 compliant roaming between access points <ul style="list-style-type: none"> • 802.11b : +16dBm minimum • 802.11g : +14dBm minimum • 802.11a : +14dBm minimum • 802.11n HT20(2.4GHz) : +14dBm minimum • 802.11n HT40(2.4GHz) : +12dBm minimum • 802.11n HT20(5GHz) : +14dBm minimum • 802.11n HT40(5GHz) : +12dBm minimum • 802.11ac 80MHz(5GHz) : +11dBm minimum
Power Consumption	Transmit: 2.0 W (max) Receive: 1.6 W (max) Idle mode (PSP): 180 mW (WLAN Associated) Idle mode: 50 mW (WLAN unassociated) Connect Standby: 10 mW (WLAN+BT) Radio disabled: 5 mW
Power Management	ACPI and PCI Express compliant power management
Receiver Sensitivity³	802.11 compliant power saving mode <ul style="list-style-type: none"> 802.11b, 1Mbps : -93.5dBm maximum 802.11b, 11Mbps : -84dBm maximum 802.11a/g, 6Mbps : -86dBm maximum



Technical Specifications

	802.11a/g, 54Mbps : -72dBm maximum 802.11n, MCS07 : -67dBm maximum 802.11n, MCS15 : -64dBm maximum 802.11ac, MCS0 : -84dBm maximum 802.11ac, MCS9 : -59dBm maximum
Antenna type	High efficiency antenna with spatial diversity, mounted in the display enclosure Two embedded dual band 2.4/5 GHz antennas are provided to the card to support WLAN MIMO communications and Bluetooth communications
Form Factor	PCI-Express M.2 MiniCard
Dimensions	Type 2230 : 2.3 x 22.0 x 30.0 mm
Weight	Type 2230 : 2.8g
Operating Voltage	3.3v +/- 9%
Temperature	Operating 14° to 158° F (-10° to 70° C) Non-operating -40° to 176° F (-40° to 80° C)
Humidity	Operating 10% to 90% (non-condensing) Non-operating 5% to 95% (non-condensing)
Altitude	Operating 0 to 10,000 ft (3,048 m) Non-operating 0 to 50,000 ft (15,240 m)
LED Activity	LED Amber – Radio OFF; LED White – Radio ON
	<ol style="list-style-type: none"> 1. Check latest software/driver release for updates on supported security features. 2. Maximum output power may vary by country according to local regulations. 3. Receiver sensitivity is measured at a packet error rate of 8% for 802.11b (CKK modulation) and a packet error rate of 10% for 802.11a/g (OFDM modulation).

HP Integrated Module with Bluetooth 4.0/4.1/4.2 Wireless Technology

Bluetooth Specification	4.0/4.1/4.2 Compliant
Frequency Band	2402 to 2480 MHz
Number of Available Channels	Legacy : 0~79 (1 MHz/CH) BLE : 0~39 (2 MHz/CH)
Data Rates and Throughput	Legacy : 3 Mbps data rate; throughput up to 2.17 Mbps BLE : 1 Mbps data rate; throughput up to 0.2 Mbps Legacy : Synchronous Connection Oriented links up to 3, 64 kbps, voice channels Legacy : Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric (3-DH5) or 864 kbps symmetric (3-EV5)
Transmit Power	The Bluetooth component shall operate as a Class II Bluetooth device with a maximum transmit power of + 4 dBm for BR and EDR.
Power Consumption	Peak (Tx) 330 mW Peak (Rx) 230 mW Selective Suspend 17 mW
Electrical Interface	USB 2.0 compliant
Bluetooth Software Supported Link Topology	Microsoft Windows Bluetooth Software
Power Management	Microsoft Windows ACPI, and USB Bus Support
Certifications	FCC (47 CFR) Part 15C, Section 15.247 & 15.249



Technical Specifications

Power Management	ETS 300 328, ETS 300 826
Certifications	Low Voltage Directive IEC950
Bluetooth Profiles Supported	UL, CSA, and CE Mark BT4.1-ESR 5/6/7 Compliance LE Link Layer Ping LE Dual Mode LE Link Layer LE Low Duty Cycle Directed Advertising LE L2CAP Connection Oriented Channels Train Nudging & Interlaced Scan BT4.2 ESR08 Compliance LE Secure Connection- Basic/Full LE Privacy 1.2 –Link Layer Privacy LE Privacy 1.2 –Extended Scanner Filter Policies LE Data Packet Length Extension FAX Profile (FAX) Basic Imaging Profile (BIP)2 Headset Profile (HSP) Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP)

Intel 802.11 a/b/g/n/AC (1x1) WiFi and Bluetooth® Combo¹	Wireless LAN Standards	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac
	Interoperability	Wi-Fi certified
	Frequency Band	802.11b/g/n <ul style="list-style-type: none"> • 2.402 – 2.482 GHz 802.11a/n <ul style="list-style-type: none"> • 4.9 – 4.95 GHz (Japan) • 5.15 – 5.25 GHz • 5.25 – 5.35 GHz • 5.47 – 5.725 GHz • 5.825 – 5.850 GHz
	Data Rates	<ul style="list-style-type: none"> • 802.11b: 1, 2, 5.5, 11 Mbps • 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps • 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps • 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz) • 802.11ac : MCS0 ~ MCS7, (1SS) (20MHz, 40MHz, and 80MHz)
	Modulation	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM
	Security³	<ul style="list-style-type: none"> • IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only • AES-CCMP: 128 bit in hardware • 802.1x authentication • WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.



Technical Specifications

	<ul style="list-style-type: none"> • WPA2 certification • IEEE 802.11i • Cisco Certified Extensions, all versions through CCX4 and CCX Lite • WAPI
Network Architecture Models	Ad-hoc (Peer to Peer) Infrastructure (Access Point Required)
Roaming	IEEE 802.11 compliant roaming between access points
Output Power²	<ul style="list-style-type: none"> • 802.11b : +14dBm minimum • 802.11g : +12dBm minimum • 802.11a : +12dBm minimum • 802.11n HT20(2.4GHz) : +12dBm minimum • 802.11n HT40(2.4GHz) : +12dBm minimum • 802.11n HT20(5GHz) : +10dBm minimum • 802.11n HT40(5GHz) : +10dBm minimum • 802.11ac VHT80(5GHz) : +10dBm minimum
Power Consumption	Transmit: 2.0 W (max) Receive: 1.6 W (max) Idle mode (PSP): 180 mW (WLAN Associated) Idle mode: 50 mW (WLAN unassociated) Connect Standby: 10 mW (WLAN+BT) Radio disabled: 8 mW
Power Management	ACPI and PCI Express compliant power management 802.11 compliant power saving mode
Receiver Sensitivity³	802.11b, 1Mbps : -93.5dBm maximum 802.11b, 11Mbps : -84dBm maximum 802.11a/g, 6Mbps : -86dBm maximum 802.11a/g, 54Mbps : -72dBm maximum 802.11n, MCS07 : -67dBm maximum 802.11n, MCS15 : -64dBm maximum 802.11ac, MCS0 : -84dBm maximum 802.11ac, MCS9 : -59dBm maximum
Antenna type	High efficiency antenna with spatial diversity, mounted in the display enclosure Two embedded dual band 2.4/5 GHz antennas are provided to the card to support WLAN MIMO communications and Bluetooth communications
Form Factor	PCI-Express M.2 MiniCard
Dimensions	Type 2230 : 2.3 x 22.0 x 30.0 mm
Weight	Type 2230 : 2.8g
Operating Voltage	3.3v +/- 9%
Temperature	Operating 14° to 158° F (-10° to 70° C) Non-operating -40° to 176° F (-40° to 80° C)
Humidity	Operating 10% to 90% (non-condensing) Non-operating 5% to 95% (non-condensing)
Altitude	Operating 0 to 10,000 ft (3,048 m) Non-operating 0 to 50,000 ft (15,240 m)
LED Activity	LED Amber – Radio OFF; LED White – Radio ON

1. Check latest software/driver release for updates on supported security features.
2. Maximum output power may vary by country according to local regulations.
3. Receiver sensitivity is measured at a packet error rate of 8% for 802.11b (CKK modulation)



Technical Specifications

and a packet error rate of 10% for 802.11a/g (OFDM modulation).

HP Integrated Module with Bluetooth 4.0/4.1/4.2 Wireless Technology

Bluetooth Specification	4.0/4.1/4.2 Compliant
Frequency Band	2402 to 2480 MHz
Number of Available Channels	Legacy : 0~79 (1 MHz/CH) BLE : 0~39 (2 MHz/CH)
Data Rates and Throughput	Legacy : 3 Mbps data rate; throughput up to 2.17 Mbps BLE : 1 Mbps data rate; throughput up to 0.2 Mbps Legacy : Synchronous Connection Oriented links up to 3, 64 kbps, voice channels Legacy : Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric (3-DH5) or 864 kbps symmetric (3-EV5)
Transmit Power	The Bluetooth component shall operate as a Class II Bluetooth device with a maximum transmit power of + 4 dBm for BR and EDR.
Power Consumption	Peak (Tx) 330 mW Peak (Rx) 230 mW Selective Suspend 17 mW
Electrical Interface	USB 2.0 compliant
Bluetooth Software Supported	Microsoft Windows Bluetooth Software
Link Topology	
Power Management	Microsoft Windows ACPI, and USB Bus Support
Certifications	FCC (47 CFR) Part 15C, Section 15.247 & 15.249
Power Management	ETS 300 328, ETS 300 826
Certifications	Low Voltage Directive IEC950
Bluetooth Profiles Supported	UL, CSA, and CE Mark BT4.1-ESR 5/6/7 Compliance LE Link Layer Ping LE Dual Mode LE Link Layer LE Low Duty Cycle Directed Advertising LE L2CAP Connection Oriented Channels Train Nudging & Interlaced Scan BT4.2 ESR08 Compliance LE Secure Connection- Basic/Full LE Privacy 1.2 –Link Layer Privacy LE Privacy 1.2 –Extended Scanner Filter Policies LE Data Packet Length Extension FAX Profile (FAX) Basic Imaging Profile (BIP)2 Headset Profile (HSP) Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP)



Technical Specifications

Realtek 802.11a/b/g/n/AC (2x2) WiFi and Bluetooth® 4.2 Combo¹	Wireless LAN Standards	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac
	Interoperability	Wi-Fi certified
	Frequency Band	802.11b/g/n <ul style="list-style-type: none"> 2.402– 2.482 GHz 802.11a/n <ul style="list-style-type: none"> 5.15 – 4.95 GHz (Japan) 5.15 – 5.25 GHz 5.25 – 5.35 GHz 5.47 – 5.725 GHz 5.825 – 5.850 GHz
	Data Rates	802.11b: 1, 2, 5.5, 11 Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz) 802.11ac : MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, and 80MHz)
	Modulation	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM,
	Security¹	<ul style="list-style-type: none"> IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only AES-CCMP: 128 bit in hardware 802.1x authentication WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES. WPA2 certification IEEE 802.11i Cisco Certified Extensions, all versions through CCX4 and CCX Lite WAPI
	Network Architecture Models	Ad-hoc (Peer to Peer) Infrastructure (Access Point Required)
	Roaming	IEEE 802.11 compliant roaming between access points
	Output Power²	<ul style="list-style-type: none"> 802.11b : +16dBm minimum 802.11g : +14dBm minimum 802.11a : +14dBm minimum 802.11n HT20(2.4GHz) : +13dBm minimum 802.11n HT40(2.4GHz) : +13dBm minimum 802.11n HT20(5GHz) : +12dBm minimum 802.11n HT40(5GHz) : +12dBm minimum
	Power Consumption	Transmit mode 2.0 W Receive mode 1.6 W Idle mode (PSP) 180 mW (WLAN Associated) Idle mode 50 mW (WLAN unassociated)



Technical Specifications

	Connected Standby	10mW
	Radio disabled	8 mW
Power Management	ACPI and PCI Express compliant power management	
	802.11 compliant power saving mode	
Receiver Sensitivity³	802.11b, 1Mbps : -94dBm maximum	
	802.11b, 11Mbps : -86dBm maximum	
	802.11g, 6Mbps : -88dBm maximum	
	802.11g, 54Mbps : -74dBm maximum	
	802.11a, 6Mbps : -86dBm maximum	
	802.11a, 54Mbps : -72dBm maximum	
	802.11n, MCS07 : -69dBm maximum	
	802.11n, MCS15 : -66dBm maximum	
Antenna type	High efficiency antenna with spatial diversity, mounted in the display enclosure	
	Two embedded 2.4 GHz antennas are provided to the card to support WLAN and Bluetooth communications (Support Dual antenna or Single antenna, depend on platform requirement)	
Form Factor	PCI-Express M.2 MiniCard	
Dimensions	Type 2230 : 2.3 x 22.0 x 30.0 mm	
Weight	Type 2230 : 2.8g	
Operating Voltage	3.3v +/- 9%	
Temperature	Operating	14° to 158° F (-10° to 70° C)
	Non-operating	-40° to 176° F (-40° to 80° C)
Humidity	Operating	10% to 90% (non-condensing)
	Non-operating	5% to 95% (non-condensing)
Altitude	Operating	0 to 10,000 ft (3,048 m)
	Non-operating	0 to 50,000 ft (15,240 m)
LED Activity	LED Amber – Radio OFF; LED White – Radio ON	
	<ol style="list-style-type: none"> 1. Check latest software/driver release for updates on supported security features. 2. Maximum output power may vary by country according to local regulations. 3. Receiver sensitivity is measured at a packet error rate of 8% for 802.11b (CKK modulation) and a packet error rate of 10% for 802.11a/g (OFDM modulation). 	

HP Integrated Module with Bluetooth 4.0/4.1/4.2 Wireless Technology

Bluetooth Specification	4.0/4.1/4.2 Compliant
Frequency Band	2402 to 2480 MHz
Number of Available Channels	Legacy : 0~79 (1 MHz/CH) BLE : 0~39 (2 MHz/CH)
Data Rates and Throughput	Legacy : 3 Mbps data rate; throughput up to 2.17 Mbps BLE : 1 Mbps data rate; throughput up to 0.2 Mbps Legacy : Synchronous Connection Oriented links up to 3, 64 kbps, voice channels



Technical Specifications

Transmit Power	Legacy : Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric (3-DH5) or 864 kbps symmetric (3-EV5) The Bluetooth component shall operate as a Class II Bluetooth device with a maximum transmit power of + 4 dBm for BR and EDR.
Power Consumption	Peak (Tx) 330 mW Peak (Rx) 230 mW Selective Suspend 17 mW
Electrical Interface	USB 2.0 compliant
Bluetooth Software Supported	Microsoft Windows Bluetooth Software
Link Topology	
Power Management	Microsoft Windows ACPI, and USB Bus Support
Certifications	FCC (47 CFR) Part 15C, Section 15.247 & 15.249
Power Management	ETS 300 328, ETS 300 826
Certifications	Low Voltage Directive IEC950
Bluetooth Profiles Supported	UL, CSA, and CE Mark BT4.1-ESR 5/6/7 Compliance LE Link Layer Ping LE Dual Mode LE Link Layer LE Low Duty Cycle Directed Advertising LE L2CAP Connection Oriented Channels Train Nudging & Interlaced Scan BT4.2 ESR08 Compliance LE Secure Connection- Basic/Full LE Privacy 1.2 –Link Layer Privacy LE Privacy 1.2 –Extended Scanner Filter Policies LE Data Packet Length Extension FAX Profile (FAX) Basic Imaging Profile (BIP)2 Headset Profile (HSP) Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP)



Technical Specifications

Realtek 802.11a/b/g/n/ac (1x1) WiFi and Bluetooth® 4.2 Combo¹	Wireless LAN Standards	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n IEEE 802.11ac
	Interoperability Frequency Band	Wi-Fi certified 802.11b/g/n <ul style="list-style-type: none"> 2.402– 2.482 GHz 802.11a/n <ul style="list-style-type: none"> 5.15 – 4.95 GHz (Japan) 5.15 – 5.25 GHz 5.25 – 5.35 GHz 5.47 – 5.725 GHz 5.825 – 5.850 GHz
	Data Rates	802.11b: 1, 2, 5.5, 11 Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz) 802.11ac : MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, and 80MHz)
	Modulation	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM,
	Security¹	<ul style="list-style-type: none"> IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only AES-CCMP: 128 bit in hardware 802.1x authentication WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES. WPA2 certification IEEE 802.11i Cisco Certified Extensions, all versions through CCX4 and CCX Lite WAPI
	Network Architecture Models	Ad-hoc (Peer to Peer) Infrastructure (Access Point Required)
	Roaming	IEEE 802.11 compliant roaming between access points
	Output Power²	<ul style="list-style-type: none"> 802.11b : +14dBm minimum 802.11g : +12dBm minimum 802.11a : +12dBm minimum 802.11n HT20(2.4GHz) : +12dBm minimum 802.11n HT40(2.4GHz) : +12dBm minimum 802.11n HT20(5GHz) : +10dBm minimum 802.11n HT40(5GHz) : +10dBm minimum 802.11ac VHT80(5GHz) : +10dBm minimum
	Power Consumption	Transmit mode 2.0 W Receive mode 1.6 W Idle mode (PSP) 180 mW (WLAN Associated)



Technical Specifications

	Idle mode	50 mW (WLAN unassociated)
	Connected Standby	10mW
	Radio disabled	8 mW
Power Management	ACPI and PCI Express compliant power management	
	802.11 compliant power saving mode	
Receiver Sensitivity³	802.11b, 1Mbps : -93.5dBm maximum	
	802.11b, 11Mbps : -84dBm maximum	
	802.11a/g, 6Mbps : -86dBm maximum	
	802.11a/g, 54Mbps : -72dBm maximum	
	802.11n, MCS07 : -67dBm maximum	
	802.11n, MCS15 : -64dBm maximum	
	802.11ac, MCS0 : -84dBm maximum	
	802.11ac, MCS9 : -59dBm maximum	
Antenna type	High efficiency antenna with spatial diversity, mounted in the display enclosure	
	Two embedded 2.4 GHz antennas are provided to the card to support WLAN and Bluetooth communications (Support Dual antenna or Single antenna, depend on platform requirement)	
Form Factor	PCI-Express M.2 MiniCard	
Dimensions	Type 2230 : 2.3 x 22.0 x 30.0 mm	
Weight	Type 2230 : 2.8g	
Operating Voltage	3.3v +/- 9%	
Temperature	Operating	14° to 158° F (-10° to 70° C)
	Non-operating	-40° to 176° F (-40° to 80° C)
Humidity	Operating	10% to 90% (non-condensing)
	Non-operating	5% to 95% (non-condensing)
Altitude	Operating	0 to 10,000 ft (3,048 m)
	Non-operating	0 to 50,000 ft (15,240 m)
LED Activity	LED Amber – Radio OFF; LED White – Radio ON	
	<ol style="list-style-type: none"> 1. Check latest software/driver release for updates on supported security features. 2. Maximum output power may vary by country according to local regulations. 3. Receiver sensitivity is measured at a packet error rate of 8% for 802.11b (CKK modulation) and a packet error rate of 10% for 802.11a/g (OFDM modulation). 	

HP Integrated Module with Bluetooth 4.0/4.1/4.2 Wireless Technology

Bluetooth Specification	4.0/4.1/4.2 Compliant
Frequency Band	2402 to 2480 MHz
Number of Available Channels	Legacy : 0~79 (1 MHz/CH) BLE : 0~39 (2 MHz/CH)
Data Rates and Throughput	Legacy : 3 Mbps data rate; throughput up to 2.17 Mbps BLE : 1 Mbps data rate; throughput up to 0.2 Mbps Legacy : Synchronous Connection Oriented links up to 3, 64 kbps, voice



Technical Specifications

	channels
	Legacy : Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric (3-DH5) or 864 kbps symmetric (3-EV5)
Transmit Power	The Bluetooth component shall operate as a Class II Bluetooth device with a maximum transmit power of + 4 dBm for BR and EDR.
Power Consumption	Peak (Tx) 330 mW Peak (Rx) 230 mW Selective Suspend 17 mW
Electrical Interface	USB 2.0 compliant
Bluetooth Software Supported	Microsoft Windows Bluetooth Software
Link Topology	
Power Management	Microsoft Windows ACPI, and USB Bus Support
Certifications	FCC (47 CFR) Part 15C, Section 15.247 & 15.249
Power Management	ETS 300 328, ETS 300 826
Certifications	Low Voltage Directive IEC950
Bluetooth Profiles Supported	UL, CSA, and CE Mark BT4.1-ESR 5/6/7 Compliance LE Link Layer Ping LE Dual Mode LE Link Layer LE Low Duty Cycle Directed Advertising LE L2CAP Connection Oriented Channels Train Nudging & Interlaced Scan BT4.2 ESR08 Compliance LE Secure Connection- Basic/Full LE Privacy 1.2 –Link Layer Privacy LE Privacy 1.2 –Extended Scanner Filter Policies LE Data Packet Length Extension FAX Profile (FAX) Basic Imaging Profile (BIP)2 Headset Profile (HSP) Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP)



Technical Specifications

POWER

HP 45W Smart AC Adapter	Dimensions (H x W x D)	3.74 x 1.57 x 1.04 in (9.5 x 4.0 x 2.65 cm)
	Weight	0.386 lb (175g) max
	Input	90 to 265 VAC
		Input Efficiency 87.74% at 115Vac and 88.4% at 230Vac
		Input frequency range 47 to 63 Hz
	Output	Input AC current 1.4 A at 90 VAC
		Output power 45W
		DC output 19.5V
		Hold-up time 5 msec at 115 VAC input
		Output current limit <8.0A
	Connector	4.5mm Barrel Type, 3 pin/grounded, mates with interchangeable cords
	Environmental Design	Operating temperature 32° to 95° F (0° to 35° C)
		Non-operating (storage) temperature -4° to 185° F (-20° to 85° C)
		Altitude 0 to 16,400 ft (0 to 5,000 m)
		Humidity 20% to 95%
		Storage Humidity 10% to 95%
	EMI and Safety Certifications	*CE Mark - full compliance with LVD and EMC directives * Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, SELV; Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE. * MTBF - over 200,000 hours at 25°C ambient condition.

HP 65W AC Adapter	Dimensions	4.25 x 1.85 x 1.47 in (10.8 x 4.7 x 3.74 cm)
	Weight	1.81 lb (250g) max
	Input	100 to 240 VAC
		Input Efficiency 88% min at 115 VAC and 89% min at 230 VAC
		Input frequency range 47 to 63 Hz
	Output	Input AC current 1.7 A at 90 VAC
		Output power 65W
		DC output 19.5V
		Hold-up time 5 msec at 115 VAC input
		Output current limit <11A, Over voltage protection- 29V max automatic shutdown
	Connector	4.5mm Barrel Type, 3 pin/grounded, mates with interchangeable cords
	Environmental Design	Operating temperature 32° to 104° F (0° to 40° C)



Technical Specifications

EMI and Safety Certifications	Non-operating (storage) temperature	-4° to 149° F (-20° to 65° C)
	Altitude	0 to 10,000 ft (0 to 3,048 m)
	Humidity	20% to 80%
	Storage Humidity	10% to 90%
	*CE Mark - full compliance with LVD and EMC directives * Worldwide safety standards - IEC60950, EN60950, UL60950, Class1, SELV; Agency approvals - C-UL-US, NORDICS, DENAN, EN55022 Class B, FCC Class B, CISPR22 Class B, CCC, NOM-1 NYCE. * MTBF - over 200,000 hours at 25°C ambient condition.	

HP 3-cell, Long Life 48 WHr Li-ion	Dimensions (H x W x L)	7.0. x180.48x88.95 mm (0.273 x 7.09 x 3.49 inch)	
	Weight	0.22 kg (0.48lb)	
	Cells/Type	3cell Lithium-Ion	
	Energy	Voltage	11.4V/ 10.95V
		Amp-hour capacity	4.212Ah /4.385Ah
		Watt-hour capacity	48Wh
		Operating (Charging)	32° to 113° F (0° to 45° C)
	Temperature	Operating (Discharging)	14° to 122° F (-10° to 60° C)
		Non-operating	-4° to 122° F (-20° to 60° C)
		System in OFF or Standby Mode	<3 hours
	Battery Re-Charge Time		
	Fuel Gauge LED	No	
	Warranty	3-years ¹	
	Optional Travel Battery Available	No	

1. Batteries have a default one year limited warranty except for Long Life batteries which will have same 1-year or 3-year limited warranty as the platform.

Country of Origin

China



Options and Accessories (sold separately and availability may vary by country)

Type	Description	Part Number
Cases	HP Essential Top Load Case	H2W17AA
	HP Essential Backpack	H1D24AA
	HP Essential Messenger Case	H1D25AA
Docking	HP 3005pr USB3 Port Replicator	Y4H06AA
	HP Thunderbolt Dock 120W G2	TBD
	HP USB-C Travel Dock	TOK29AA
	HP USB Travel Dock	TOK30AA
	HP Elite USB-C Dock G3	2DW60AA
	HP USB-C Mini Dock	1PM64AA
	HP USB-C Universal Dock	1MK33AA
Input/Output	HP Slim USB Keyboard and Mouse	T6T83AA
	HP Slim Wireless Keyboard and Mouse	T6L04AA
	HP Ultra Mobile Wireless Mouse	H6F25AA
	HP Comfort Grip Wireless Mouse	H2L63AA
	HP 3-Button USB Laser Mouse	H4B81AA
	HP USB Travel Mouse	G1K28AA
	HP HDMI to DVI Adapter	F5A28AA
	HP USB-C to DP	N9K78AA
	HP USB-C to USB-A Hub	Z6A00AA
	HP Stereo 3.5mm Headset	T1A66AA
	HP Stereo USB Headset	T1A67AA
Memory	HP 4GB 2400MHz DDR4 Memory	Z4Y84AA
	HP 8GB 2400MHz DDR4 Memory	Z4Y85AA
	HP 16GB 2400MHz DDR4 Memory	Z4Y86AA
Power	HP 45W Smart AC Adapter 4.5mm	H6Y88AA
	HP 65W Smart AC Adapter	H6Y89AA
	HP 65W Slim AC Adapter	H6Y82AA
	HP 45W USB-C Power Adapter	1HE07AA
	HP 65W USB-C Power Adapter	1HE08AA
	HP Power Bank	N9F71AA
	HP USB-C Notebook Power Bank	1TZ86AA
	HP Notebook Power Bank	N9F71AA
Storage	HP External USB Optical Drive	F2B56AA
	HP 500GB 7200rpm HDD	F3B97AA
	HP External Portable USB3.0 HDD	K6A93AA
	HP 256GB Value 2280 M.2 SATA3 SSD	1DE47AA
	HP 512GB TLC PCI-e 3x4 NVMe M.2 SSD	1FU88AA



Options and Accessories (sold separately and availability may vary by country)

Security	HP Essential Combination Lock	TOY16AA
	HP Combination Lock	TOY15AA
	HP Keyed Cable lock	TOY14AA
	HP Keyed Cable Lock 10mm	T1A62AA
UCC	HP Conferencing Keyboard	K8P74AA
	HP USB Collaboration Keyboard	Z9N38AA
	HP Wireless Collaboration Keyboard	Z9N39AA
	HP UC Wireless Mono Headset	W3K08AA
	HP UC Wireless Duo Headset	W3K09AA
	HP UC Speaker Phone	K7V16AA
	HP UC Wired Headset	K7V17AA
Displays	HP EliteDisplay S140u USB Portable Monitor	G8R65AA
	HP ProDisplay P240VA 23.8-inch Monitor	N3H14AA
	HP ProDisplay P232 23-inch Monitor	K7X31AA
	HP ProDisplay P223 21.5-inch Monitor	X7R61AA
	HP EliteDisplay E230t 23-inch Touch Monitor	W2Z50AA
	HP EliteDisplay E240c 23.8-inch Collaboration Monitor	M1P00A8



Summary of Changes

Date of change:	Version History:		Description of change:
August 22, 2017	From V1 to V2	Update	Change battery life information TBD
September 7, 2017	From V2 to V3	Update	Change battery life information to current
October 6, 2017	From V3 to V4	Update	TPM 2.0 added to Client Security Software section
December 20, 2017	From V4 to V5	Update	HP Elite USB-C Dock removed
December 21, 2017	From V5 to V6	Update	Backlit keyboard available as an option removed
February 13, 2018	From V6 to V7	Update	Anti-glare (AG) removed from touch panel in Displays section
February 23, 2018	From V7 to V8	Update	HP Elite USB-C Docking Station (X7W54AA) removed from options section
April 5, 2018	From V8 to V9	Update	Processors added to Processors and processors family Dockings updated in options section
April 18, 2018	From V9 to V10	Update	At a Glance Section part 13
May 7, 2018	From V11 to V12	Added	Environmental tab
May 25, 2018	From V12 to V13	Added	Processors section updated
May 29, 2018	From V13 to V14	Update	Warranty
June 4, 2018	From V14 to V15	Update	Processors section
July 6, 2018	From V15 to V16	Update	Energy star, Hard drive
August 17, 2018	From V16 to V17	Update	Processors section
September 5, 2018	From V17 to V18	Update	Processors and Docking section
October 2, 2018	From V18 to V19	Update	Certification tab
November 29, 2018	From V19 to V20	Updated	Storage section

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