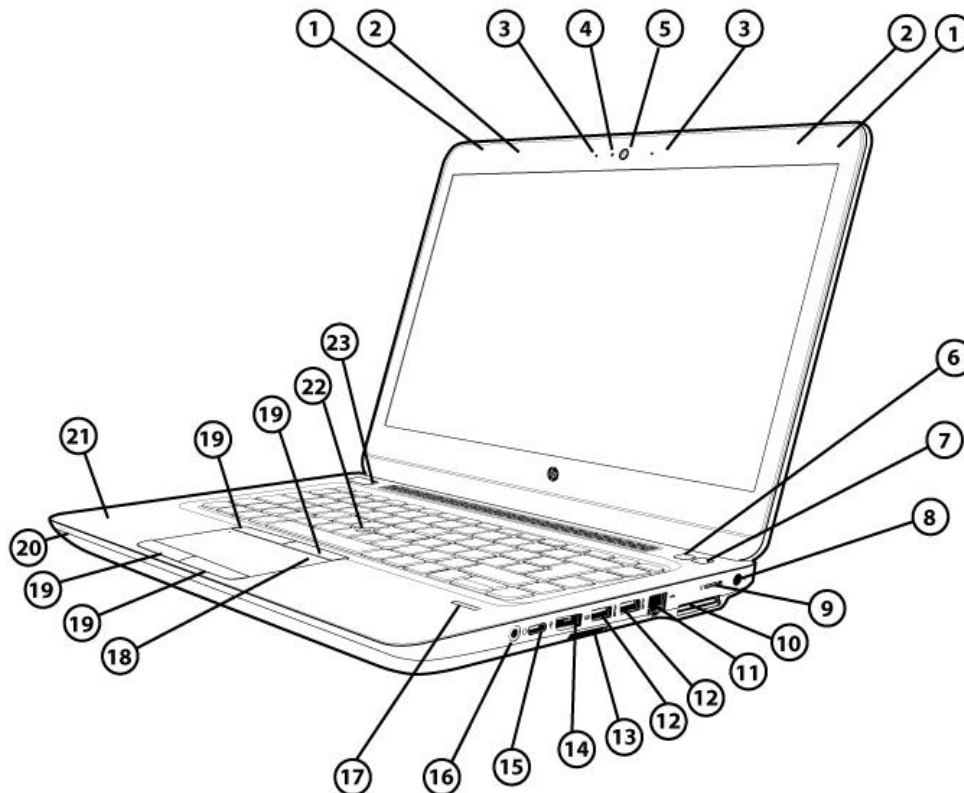


### Overview

#### HP ProBook 645 G2 Notebook PC



1. WLAN antennas (2)
2. WWAN antennas (2) (select models)
3. Internal microphones (2)
4. Webcam LED (select models)
5. Webcam (select models)
6. Wireless on/off button
7. Speaker mute button
8. Power connector
9. SIM card slot
10. Docking connector
11. Ethernet port
12. USB 3.0 ports (2)

#### Front/Right

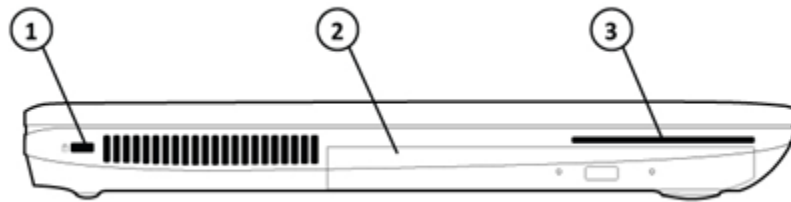
13. SD card slot
14. Display Port
15. USB-C port
16. Microphone/ headphones combo jack
17. Fingerprint reader (select models)
18. Touchpad
19. Touchpad buttons (4)
20. Indicator LEDs: Wireless Light, Power Light, AC Adapter/Battery Light, Storage Usage Light
21. NFC (select models)
22. Pointstick (select models)
23. Power button

**Note:** The antennas are not visible from the outside of the computer. For optimal transmission, keep the areas immediately around the antennas free from obstructions.

Models without optional webcam have single integrated microphone on left side of display panel.



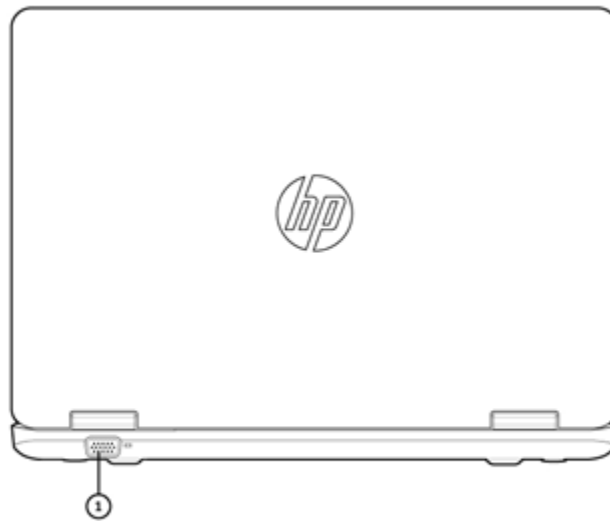
## Overview



- 1. Security lock slot
- 2. Optical drive

### Left

- 3. Smart Card Reader



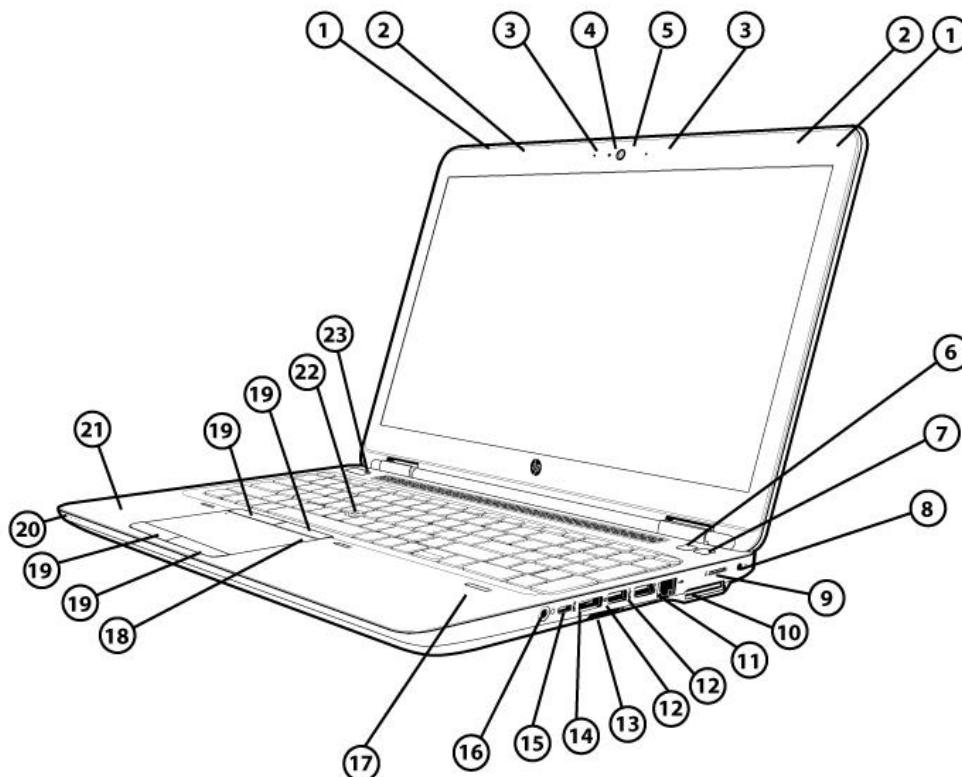
- 1. VGA port

### Back



### Overview

#### HP ProBook 655 G2 Notebook PC



1. WLAN antennas (2)
2. WWAN antennas (2) (select models)
3. Internal microphones (2)
4. Webcam LED (select models)
5. Webcam (select models)
6. Wireless on/off button
7. Speaker mute button
8. Power connector
9. SIM card slot
10. Docking connector
11. Ethernet port
12. USB 3.0 ports (2)

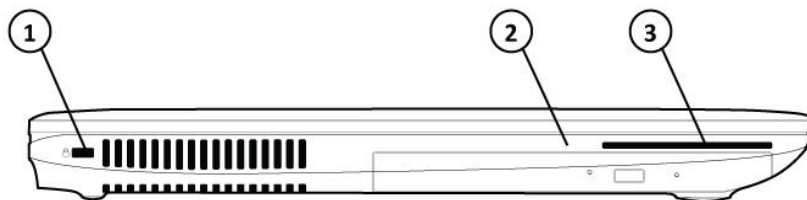
#### Front/Right

13. SD card slot
14. Display Port
15. USB-C port
16. Microphone/ headphones combo jack
17. Fingerprint reader (select models)
18. Touchpad
19. Touchpad buttons (4)
20. Indicator LEDs: Wireless Light, Power Light, AC Adapter/Battery Light, Storage Usage Light
21. NFC (select models)
22. Pointstick (select models)
23. Power button

Note: The antennas are not visible from the outside of the computer. For optimal transmission, keep the areas immediately around the antennas free from obstructions.  
Models without optional webcam have single integrated microphone on left side of display panel.

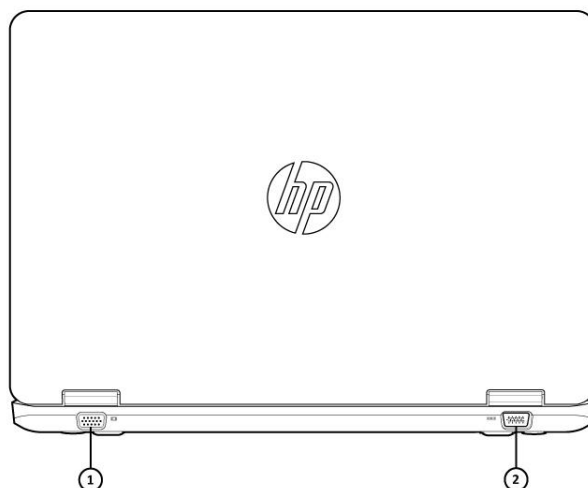


### Overview



#### Left

- 1. Security lock slot
- 2. Optical drive
- 3. Smart card reader



#### Back

- 1. VGA port
- 2. Serial port optional (655 only)



### Overview

#### AT A GLANCE

- Windows 10 versions, Windows 8.1 versions, Windows 7 versions, Ubuntu Linux , Ubuntu Kylin Linux or FreeDOS 2.0
- Thin and light design— PC-ABS (Polycarbonate–Acrylnitrile/Butadiene/Styrene) durable material is nearly 20% thinner; soft-touch, more durable 4-step paint process; larger buttons (power), revamped keyboard (arrow keys); latch/hook removal for clean palmrest design; top mounted speakers for optimized audio experience (compared to previous generation)
- The HP Premium keyboard is spill-resistant and offered with optional backlit design.
- Large Touchpad with gestures support, on/off button with LED indicator
- Enhanced security features including HP Fingerprint Reader and TPM 1.2 Embedded Security Chip
- Accelerated Processing Unit and graphics from AMD
- LED-backlit display
  - HP ProBook 645: 14.0” diagonal HD or FHD or Touch FHD with camera and with WWAN
  - HP ProBook 655: 15.6” diagonal HD or FHD or Touch FHD with camera and with WWAN
- Optional HD webcam with dual-microphone array for video conferencing
- DisplayPort 1.2 now native with integrated graphics
- One USB-C™ Charging Port, two USB 3.0 ports for fast data transfer from devices (1 charging)
- HD Audio with DTS Sound+™ optimized for high fidelity audio
- Wireless and speaker mute button to conveniently manage the connectivity and speaker.
- Flexible wireless connectivity options:
  - Broadband Wireless (WWAN)
  - Wireless LAN (WLAN)
  - Personal area network (WPAN Bluetooth®)
  - Near Field Communication (NFC)
- Choice of hard drives up to 1 TB or solid state drives up to 512 GB
- Passed MIL STD testing<sup>1</sup>

1. MIL STD 810G testing is not intended to demonstrate fitness for U.S. Department of Defense contract requirements or for military use. Test results are not a guarantee of future performance under these test conditions. Damage under the MIL STD test conditions or any 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.**



### Summary of Changes

#### PRODUCT NAMES

HP ProBook 645 G2 Notebook PC

HP ProBook 655 G2 Notebook PC

#### OPERATING SYSTEM

##### Preinstalled

Windows 10 Pro 64<sup>1</sup>  
Windows 10 Home 64<sup>1</sup>  
Windows 10 Home Single Language 64<sup>1</sup>  
Windows 8.1 Pro 64<sup>3</sup>  
Windows 8.1 64<sup>3</sup>  
Windows 7 Professional 32 (available through downgrade rights from Windows 10 Pro 64)<sup>2</sup>  
Windows 7 Professional 32 (Available through downgrade rights from Windows 10 Pro 64) (National Academic only)<sup>2</sup>  
Windows 7 Professional 64<sup>3</sup>  
Windows 7 Professional 32<sup>3</sup>  
Windows 7 Professional 32 (National Academic only)<sup>3</sup>  
FreeDOS 2.0

##### Web-only Support

Windows 10 Enterprise 64<sup>1</sup>  
Windows 8.1 Enterprise 64<sup>3</sup>  
Windows 7 Enterprise 64<sup>3</sup>  
Windows 7 Enterprise 32<sup>3</sup>

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.microsoft.com>.
2. This system is preinstalled with Windows 7 Professional software and also comes with a license and media for Windows 10 Pro software. You may only use one version of the Windows software at a time. Switching between versions will require you to uninstall one version and install the other version. You must back up all data (files, photos, etc.) before uninstalling and installing operating systems to avoid loss of your data
3. 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. See <http://www.microsoft.com>.

#### ACCELERATED PROCESSING UNIT

AMD PRO A10-8700B APU with Radeon™ R6 Graphics (1.8 GHz, up to 3.2 GHz, 2 MB cache, 4 cores)<sup>1</sup>  
AMD PRO A8-8600B APU with Radeon™ R6 Graphics (1.6 GHz, up to 3 GHz, 2 MB cache, 4 cores)<sup>1</sup>  
AMD PRO A6-8500B APU with Radeon™ R5 Graphics (1.6 GHz, up to 3 GHz, 2 MB cache, 2 cores)<sup>1</sup>

1. 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.

#### FUSION CONTROLLER HUB (FCH)



## Summary of Changes

Chipset is integrated with processor

### GRAPHICS

Radeon™ R5 Graphics

Radeon™ R6 Graphics

**NOTE:** Integrated with processors. Please see processor section for details.

### DISPLAY

#### HP ProBook 645

##### Internal

##### Non-Touch

14.0" diagonal LED backlight HD<sup>1</sup> Anti-glare 45% CG 220 nits (1366x768)

14.0" diagonal LED backlight HD<sup>1</sup> Anti-glare 45% CG 220 nits (1366x768) with camera

14.0" diagonal LED backlight HD<sup>1</sup> Anti-glare 45% CG 220 nits (1366x768) with WWAN

14.0" diagonal LED backlight HD<sup>1</sup> Anti-glare 45% CG 220 nits (1366x768) with camera and with WWAN

14.0" diagonal LED backlight FHD Anti-glare 60% CG 300 nits (1920x1080)

14.0" diagonal LED backlight FHD Anti-glare 60% CG 300 nits (1920x1080) with camera

14.0" diagonal LED backlight FHD Anti-glare 60% CG 300 nits (1920x1080) with WWAN

14.0" diagonal LED backlight FHD Anti-glare 60% CG 300 nits (1920x1080) with camera & WWAN

##### Touch

14.0" diagonal LED backlight FHD 60% CG 300 nits (1920x1080) with camera and with WWAN

##### External

Up to 32-bit per pixel color depth

##### VGA

Port supports resolutions up to 1920 x 1200 external resolution @60 Hz

##### DisplayPort 1.2

Supports resolutions up to 2560 x 1600, 30-bit color depth @60 Hz, and full HD (1920 x 1080) monitors, 24-bit color depth @ 120 Hz

#### Number of Displays Supported

HP Ultra Slim Docking	UMA Graphics
ProBook 645 with A10	3

#### HP ProBook 655

##### Internal

##### Non-Touch

15.6" diagonal LED backlight HD<sup>1</sup> Anti-glare 45% CG 220 nits (1366x768)

15.6" diagonal LED backlight HD<sup>1</sup> Anti-glare 45% CG 220 nits (1366x768) with camera

15.6" diagonal LED backlight HD<sup>1</sup> Anti-glare 45% CG 220 nits (1366x768) with WWAN

15.6" diagonal LED backlight HD<sup>1</sup> Anti-glare 45% CG 220 nits (1366x768) with camera and with WWAN

15.6" diagonal LED backlight FHD Anti-glare 60% CG 300 nits (1920x1080)

15.6" diagonal LED backlight FHD Anti-glare 60% CG 300 nits (1920x1080) with camera

15.6" diagonal LED backlight FHD Anti-glare 60% CG 300 nits (1920x1080) with WWAN

15.6" diagonal LED backlight FHD Anti-glare 60% CG 300 nits (1920x1080) with camera & WWAN



## Summary of Changes

### Touch

15.6" diagonal LED backlight FHD 60% CG 300 nits (1920 x 1080) with camera with WWAN

### External

Up to 32-bit per pixel color depth

### VGA

Port supports resolutions up to 1920 x 1200 external resolution @60 Hz

### DisplayPort 1.2

Supports resolutions up to 2560 x 1600, 30-bit color depth at 60 Hz, and full HD (1920 x 1080) monitors, 24-bit color depth at 120 Hz

### Number of Displays Supported

HP Ultra Slim Docking	UMA
ProBook 655 with A10	3

1. HD content required to view HD images.

**NOTE:** Resolutions are dependent upon monitor capability, and resolution and color depth settings.

## STORAGE AND DRIVES

### 500 GB 7200rpm Self Encrypting Drive (FIPS-140-2) (Opal 2)

<b>Drive Weight</b>	0.21 lbs (95 g)
<b>Capacity</b>	500 GB
<b>Height</b>	0.28 in (7 mm)
<b>Width</b>	2.75 in (69.85 mm)
<b>Interface</b>	ATA-8, SATA 3.0
<b>Transfer Rate</b>	<b>Synchronous</b> (maximum) 600 MB/s
<b>Seek Time</b>	<b>Single Track</b> 1.5 ms
(typical reads, including settling)	<b>Average</b> 12ms
	<b>Maximum</b> 18ms-22ms
<b>Cache</b>	32GB
<b>Rotational Speed</b>	7200 rpm
<b>Logical Blocks</b>	976,773,168
<b>Operating Temperature</b>	32° to 140° F (0° to 60° C) [top cover temp]
<b>Features</b>	ATA Security; TCG Opal 2.x, FIPS, S.M.A.R.T., NCQ, Ultra DMA

### 500 GB 7200rpm Hard Drive

<b>Drive Weight</b>	0.20 lbs (92 g)-0.21 lbs (95 g)
<b>Capacity</b>	500 GB
<b>Height</b>	0.28 in (7 mm)
<b>Width</b>	2.75 in (69.85 mm)
<b>Interface</b>	ATA-8, SATA 3.0
<b>Transfer Rate</b>	<b>Synchronous</b> (maximum) 600 MB/s
	<b>Single Track</b> 1.5ms-2.0ms





## Summary of Changes

	<b>Seek Time</b> (typical reads, including settling)	<b>Average</b>	11ms-13ms
		<b>Maximum</b>	18ms-22ms
	<b>Cache</b>		32GB
	<b>Rotational Speed</b>		7200 rpm
	<b>Logical Blocks</b>		976,773,168
	<b>Operating Temperature</b>		32° to 140° F (0° to 60° C) [case temp]
	<b>Features</b>		ATA Security
<b>500 GB 7200rpm Self-Encrypting Drive (Opal 2)</b>	<b>Drive Weight</b>		0.21 lbs (95 g)
	<b>Capacity</b>		500GB
	<b>Height</b>		0.28 in (7 mm)
	<b>Width</b>		2.75 in (69.85 mm)
	<b>Interface</b>		ATA-8, SATA 3.0
	<b>Transfer Rate</b>	<b>Synchronous (maximum)</b>	600 MB/s
	<b>Seek Time</b> (typical reads, including settling)	<b>Single Track</b>	1.5ms
		<b>Average</b>	12ms
		<b>Maximum</b>	18ms- 22ms
	<b>Cache</b>		32GB
	<b>Rotational Speed</b>		7200rpm
	<b>Logical Blocks</b>		976,773,168
	<b>Operating Temperature</b>		32° to 140° F (0° to 60° C) [top cover temp]
	<b>Features</b>		ATA Security; TCG Opal 2.x, S.M.A.R.T., NCQ, Ultra DMA
<b>1 TB 5400rpm Hard Drive</b>	<b>Drive Weight</b>		0.21 lbs (94 g)- 0.21 lbs (99 g)
	<b>Capacity</b>		1TB
	<b>Height</b>		0.28 in (7.2 mm)
	<b>Width</b>		2.75 in (69.85 mm)
	<b>Interface</b>		ATA-8, SATA 3.0
	<b>Transfer Rate</b>	<b>Synchronous (maximum)</b>	600 MB/s
	<b>Seek Time</b> (typical reads, including settling)	<b>Single Track</b>	2ms
		<b>Average</b>	12ms-13ms
		<b>Maximum</b>	18ms-23ms
	<b>Cache</b>		Up to 32GB
	<b>Rotational Speed</b>		5400rpm
	<b>Logical Blocks</b>		1,953,525,168
	<b>Operating Temperature</b>		32° to 140° F (0° to 60° C) [case temp]
	<b>Features</b>		S.M.A.R.T., NCQ, Ultra DMA
<b>500 GB Hybrid, 8 GB cache</b>	<b>Drive Weight</b>		0.21 lb (95 g)
	<b>Capacity</b>		500 GB
	<b>Height</b>		0.276 in (7 mm)



## Summary of Changes

	<b>Width</b>	2.76 in (70.1 mm)	
	<b>Interface</b>	ATA-8, SATA 2.6, 6.0 Gb/s, NCQ	
	<b>Transfer Rate</b>	<b>Synchronous</b> (maximum)	600 MB/s (Drive Capability)
	<b>Seek Time</b> (typical reads, including settling)	<b>Single Track</b>	2 ms
		<b>Average</b>	12 ms
		<b>Maximum</b>	NIL ms
	<b>Cache</b>	64GB	
	<b>Rotational Speed</b>	5400 rpm	
	<b>Logical Blocks</b>	976,773,168	
	<b>Operating Temperature</b>	32° to 140° F (0° to 60° C) [case temp]	
	<b>Features</b>	ATA Security	
<b>128 GB M2 2280 SATA-3 TLC Solid State Drive</b>	<b>Drive Weight</b>	0.019 lb (8.5 g)-0.022 lb (10 g)	
	<b>Capacity</b>	128 GB	
	<b>Height</b>	0.09 in (2.23 mm)- 0.14 in (3.58 mm)	
	<b>Width</b>	0.87 in (22 mm)	
	<b>Interface</b>	ATA-8, SATA 3.0	
	<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>
		Up to 540 MB/s	Up to 300 MB/s
	<b>Logical Blocks</b>	250,069,680	
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]	
	<b>Features</b>	ATA Security, DIPM; TRIM; DEVSLP	
<b>180 GB M2 2280 SATA-3 MLC Solid State Drive</b>	<b>Drive Weight</b>	0.022 lb (<10 g)	
	<b>Capacity</b>	180 GB	
	<b>Height</b>	0.09 in (2.23 mm)	
	<b>Width</b>	0.87 in (22 mm)	
	<b>Interface</b>	ATA-8, SATA 3.0	
	<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>
		Up to 540 MB/s (Compressible Performance)	UP to 490 MB/s (Compressible Performance)
	<b>Logical Blocks</b>	351,651,888	
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]	
	<b>Features</b>	ATA Security, DIPM; TRIM; DEVSLP	
<b>180 GB M2 2280 SATA-3 Self-Encrypting Drive (Opal 2) MLC Solid State Drive</b>	<b>Drive Weight</b>	0.022 lb (<10 g)	
	<b>Capacity</b>	180GB	
	<b>Height</b>	0.09 in (2.23 mm)	
	<b>Width</b>	0.87 in (22 mm)	
	<b>Interface</b>	ATA-8, SATA 3.0	
	<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>



### Summary of Changes

		Up to 540 MB/s (Compressible Performance)	UP to 490 MB/s (Compressible Performance)
	<b>Logical Blocks</b>	351,651,888	
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]	
	<b>Features</b>	ATA Security, TCG OPAL 2.x, DIPM; TRIM; DEVSLP	
<b>240 GB SATA-3 MLC Solid State Drive</b>	<b>Drive Weight</b>	0.02 lb (10 g)	
	<b>Capacity</b>	240 GB	
	<b>Height</b>	0.14 in (3.58 mm)	
	<b>Width</b>	0.87 in (22 mm)	
	<b>Interface</b>	ACS-3, SATA 3.2	
	<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>
		Up to 540 MB/s	UP to 490 MB/s
	<b>Logical Blocks</b>	468,862,128	
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]	
	<b>Features</b>	ATA Security, DIPM; TRIM; DEVSLP	
<b>256 GB 2280 SATA-3 TLC Solid State Drive</b>	<b>Drive Weight</b>	0.019 lb (8.5 g)- 0.022 lb (10 g)	
	<b>Capacity</b>	256GB	
	<b>Height</b>	0.09 in (2.3 mm)- 0.14 in (3.58 mm)	
	<b>Width</b>	0.87 in (22 mm)	
	<b>Interface</b>	ATA-8, SATA 3.0	
	<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>
		Up to 540 MB/s	Up to 455 MB/s
	<b>Logical Blocks</b>	500,118,192	
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]	
	<b>Features</b>	ATA Security, DIPM; TRIM; DEVSLP	
<b>256 GB PCIe-3x4 NVMe Solid State Drive</b>	<b>Drive Weight</b>	0.02 lb (10 g)	
	<b>Capacity</b>	256 GB	
	<b>Height</b>	0.09 in (2.3 mm)	
	<b>Width</b>	0.87 in (22 mm)	
	<b>Interface</b>	PCIe NVMe Gen3X4	
	<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>
		Up to 2,260 MB/s	UP to 1,260 MB/s
	<b>Logical Blocks</b>	500,118,192	
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]	
	<b>Features</b>	ATA Security, TRIM; L1.2	
<b>256 GB M2 2280 SATA-3 Self-Encrypting Drive</b>	<b>Drive Weight</b>	0.02 lb (10 g)	
	<b>Capacity</b>	256 GB	
	<b>Height</b>	0.14 in (3.58 mm)- 0.09 in (2.23 mm)	
	<b>Width</b>	0.87 in (22 mm)	



### Summary of Changes

<b>(Opal 2) MLC Solid State Drive</b>	<b>Interface</b>	ATA-8, SATA 3.0	
	<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>
		Up to 540 MB/s	UP to 460 MB/s
	<b>Logical Blocks</b>	500,118,192	
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]	
	<b>Features</b>	ATA Security; TCG Opal 2.0, DIPM; TRIM; DEVSLP	
<b>512 GB M2 2280 TLC Solid State Drive</b>	<b>Drive Weight</b>	0.019 lb (8.5 g)- 0.02 lb (10 g)	
	<b>Capacity</b>	512 GB	
	<b>Height</b>	0.09 in (2.3 mm)	
	<b>Width</b>	0.87 in (22 mm)	
	<b>Interface</b>	ATA-8, SATA 3.0	
	<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>
		Up to 540 MB/s	UP to 500 MB/s
	<b>Logical Blocks</b>	1,000,215,216	
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]	
	<b>Features</b>	ATA Security, DIPM; TRIM; DEVSLP	
<b>512 GB M2 2280 SATA-3 Self-Encrypting Drive (Opal 2) MLC Solid State Drive</b>	<b>Drive Weight</b>	0.019 lb (8.5 g)- 0.02 lb (10 g)	
	<b>Capacity</b>	512 GB	
	<b>Height</b>	0.09 in (2.3 mm)	
	<b>Width</b>	0.87 in (22 mm)	
	<b>Interface</b>	ATA-8, SATA 3.0	
	<b>Performance</b>	<b>Maximum Sequential Read</b>	<b>Maximum Sequential Write</b>
		Up to 540 MB/s	UP to 460 MB/s
	<b>Logical Blocks</b>	1,000,215,216	
	<b>Operating Temperature</b>	32° to 158°F (0° to 70°C) [ambient temp]	
	<b>Features</b>	ATA Security, DIPM; TRIM; DEVSLP; TCG Opal 2.0	

### OPTICAL DRIVES

#### Fixed 9.5 mm SATA

DVD-ROM Drive

DVD+/-RW SuperMulti DL<sup>1</sup>

Blu-ray ROM DVD+/-RW SuperMulti DL<sup>1</sup>

Weight saver<sup>2</sup>

1. For Blu-ray drives, certain disc, digital connection, compatibility and/or performance issues may arise, and do not constitute defects in the product. Flawless playback on all systems is not guaranteed. In order for some Blu-ray titles to play, they may require an HDMI digital connection and your display may require HDCP support. HD-DVD disks cannot be played on this drive. Note that DVD-RAM cannot read or write to 2.6 GB Single Sided/5.2 GB Double Sided – Version 1.0 media. Actual speeds may vary. Don't copy copyright-protected materials. Double Layer discs can store more data than single layer discs; discs burned with this drive may not be compatible with many existing single-layer DVD drives and



## Summary of Changes

players.

2. Not available on with Touch panel.

## MEMORY

### Standard

DDR3L PC3-12800 (Transfer rates up to 1600 MT/s)  
Two SODIMM slots supporting dual-channel memory

4096 MB Total System Memory (4096 MB x 1)  
8192 MB Total System Memory (4096 MB x 2)  
8192 MB Total System Memory (8192 MB x 1)  
16384 MB Total System Memory (8192 MB x 2)

### Maximum

Up to 16384 MB with optional 8192 MB SODIMMs in slots 1 and 2

### Dual-channel

Maximized dual-channel performance requires SODIMMs of the same size and speed in both memory slots.

**NOTE:** 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

### Broadband Wireless (WWAN)<sup>2,3</sup>

HP lt4120 Qualcomm® Snapdragon™ X5 LTE Mobile Broadband Module  
HP hs3110 HSPA+ Mobile Broadband Module

### Wireless LAN (WLAN)<sup>1,2</sup>

Options via Minicard

Intel® 802.11a/b/g/n/ac (2x2) and Bluetooth® 4.0 Combo  
Intel® 802.11a/b/g/n (2x2) and Bluetooth® 4.0 Combo  
Broadcom 802.11a/b/g/n (2x2) and Bluetooth® 4.0 Combo  
Realtek 802.11b/g/n (1x1) Wi-Fi

### Personal area network (WPAN Bluetooth)<sup>1,2</sup>

Bluetooth® 4.0 supported via all combo cards (Except for Intel® 802.11 ac and Intel® 802.11 a/b/g/Non-vPro)  
Bluetooth® 4.1 supported via Intel® 802.11 ac and Intel® 802.11 a/b/g/n Non-vPro only

### Near Field Communication (NFC) Optional<sup>2</sup>

HP Module with NXP NFC Controller NPC100

### Support for Miracast (Windows 8.1 and Windows 10)

1. Wireless access point and Internet service is required and is not included. Availability of public wireless access points limited.

2. Sold separately or as an optional feature.



## Summary of Changes

3. WWAN module is optional and 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.

### Communications

500 GB 7200 rpm Self Encrypting Drive (Opal 2) (FIPS)

1. The term "10/100/1000" or "Gigabit" Ethernet indicates compatibility with IEEE standard 802.3ab for Gigabit Ethernet, and does not connote actual operating speed of 1 Gb/s. For high-speed transmission, connection to a Gigabit Ethernet server and network infrastructure is required.

## AUDIO/MULTIMEDIA

### Audio

HD Audio with DTS Sound+™

(2) Integrated stereo speakers

Integrated digital microphone (Dual-microphone array when equipped with optional webcam)

Function keys for microphone mute, volume up, volume down

Stereo headphone/line out

Stereo microphone in

### Webcam

Optional 720p HD webcam <sup>1,2</sup>

- HD format (widescreen)
- Supports videoconferencing (non-HD) and still image capture
- High quality fixed focus lens
- Video capture at various resolutions up to 1280x720 resolution (720p) and up to 30fps
- M-JPEG compression supports higher frame rates for video capture and videoconferencing
- Improved low light sensitivity
- Improved dynamic range
- Skype-ready

1. Sold separately or as an optional feature.
2. HD content required to view HD images.

## KEYBOARDS/POINTING DEVICES/BUTTONS & FUNCTION KEYS

### HP Advanced Keyboard

The HP spill-resistant keyboard is designed using a thin layer of Mylar film under the keyboard. The 101/102-key compatible keyboard features a full-pitch key layout with desktop keyboard features, such as editing keys, both left and right control and alt keys, and function keys. DuraKeys only available with Backlit option.

### Touchpad

On/Off button

Enabled by default

2F Scrolling - On

2F Zoom (Pinch) - On

OSD (enable / disable) - On

Win 8 2F tap = right click - On



## Summary of Changes

Win 8 Edge Swipes – On

### Buttons and Function Keys

F1 - Sleep  
F2 - Blank  
F3 - Backlit  
F4 - Display Switch  
F5 - Brightness down  
F6 - Brightness up  
F7 - Blank  
F8 - Volume down  
F9 - Volume up  
F10 - Mic Mute  
F11 - Bank  
F12 - Num lock

## SOFTWARE AND SECURITY

### Preinstalled Software with Windows Operating System

#### BIOS

HP DriveLock | HP Automatic Drive Lock  
HP BIOS Protection<sup>1</sup>  
HP Disk Sanitizer<sup>2</sup>  
HP SpareKey<sup>3</sup>  
Update via Network  
Master Record Security  
Power On Authentication  
Pre-Boot Security  
Secure Erase<sup>4</sup>  
Hybrid Boot  
Measured Boot  
Secure Boot  
Absolute Persistence Module<sup>5</sup>

#### MultiMedia

CyberLink PowerDVD  
CyberLink Power2Go (Optical drives)  
CyberLink YouCam BE (Windows 7 only)

#### Communication

HP Connection Manager (Windows 7 only)  
HP GPS and Location<sup>6</sup> (Windows 7 only)  
HP Mobile Connect<sup>7</sup> (Windows 8 only)  
HP Wireless Hotspot<sup>8</sup> (Windows 8 only)  
Intel WiDi Software<sup>9</sup>  
HP Roaming Alert (Windows 8 only)  
Intel My WiFi and Wireless Drivers

#### HP Value Add Software

HP 3D DriveGuard (requires Windows)



### Summary of Changes

HP ePrint Driver<sup>10</sup> (HP Exclusive)  
HP PageLift (HP Exclusive)<sup>11</sup>  
HP Recovery Manager (Windows 7 only)  
HP Support Assistant  
HP Recovery Disc Creator (Windows 7 only)  
UEFI System Diagnostics W8

#### 3<sup>rd</sup> Party

Adobe Flash Player  
Skype<sup>12</sup> (subscription required and sold separately)  
Buy Office

#### Security Hardware

HP Client Security<sup>13</sup>  
HP Credential Manager  
HP Password Manager  
HP Drive Encryption (FIPS 140-2)<sup>14</sup>  
HP Device Access Manager with Just In Time Authentication  
HP File Sanitizer<sup>15</sup>  
HP Spare Key  
Integrated Smart Card Reader (FIPS 201)  
Security screw for bottom access door  
Microsoft Security Essentials (Windows 7)<sup>16</sup>  
Microsoft Defender (Windows 8)  
TPM 1.2/2.0<sup>17</sup>  
HP Fingerprint reader  
Security lock slot  
Integrated Smart Card Reader

1. HP Tools partition with an HP BIOS required for automatic recovery.
2. For the use cases outlined in the DOD 5220.22-M Supplement. Does not support Solid State Drives (SSDs). Initial setup required. Web history deleted only in Internet Explorer and Firefox browsers and must be user enabled.
3. Requires initial user set up.
4. For the methods outlined in the National Institute of Standards and Technology Special Publication 800-88.
5. The Absolute Persistence 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, 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.
6. GPS access requires an unobstructed path to multiple satellites. Performance may be affected if/when used inside of buildings, bridges or heavily congested metropolitan areas. Requires separately purchased GPS navigation software available from multiple GPS applications.
7. Internet access required.
8. The wireless hotspot application requires an active internet connection and separately purchased data plan. While HP wireless hotspot is active, on-device applications will continue to work and will use the same data plan as the wireless hotspot. Wireless hotspot data usage may incur additional charges. Check with your service provider for plan details. Requires Windows 8.1 or HP Connection Manager for Windows 7.
9. Integrated Intel Wi-Di feature is available on select configurations only and requires separately purchased projector, tv or computer monitor with an integrated or external Wi-Di receiver. External Wi-Di receivers connect to the projector, tv or computer monitor via a standard HDMI cable, also sold separately.





### Summary of Changes

- 10. 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](http://www.hp.com/go/eprintcenter)). Requires optional broadband module. Broadband use requires separately purchased service contract. Check with service provider for coverage and availability in your area. Separately purchased data plans or usage fees may apply. Print times and connection speeds may vary.
- 11. HP PageLift requires Windows 7 or higher edition.
- 12. Skype is not offered in China.
- 13. Not all features are remotely manageable.
- 14. Requires Windows. Data is protected prior to Drive Encryption login. Turning the PC off or into hibernate logs out of Drive Encryption and prevents data access. Drive encryption planned to be available in October 2013.
- 15. For the use cases outlined in the DOD 5220.22-M Supplement. Does not support Solid State Drives (SSDs). Initial setup required. Web history deleted only in Internet Explorer and Firefox browsers and must be user enabled.
- 16. Opt in and internet connection required for updates.  
For more information on HP security solutions refer to: <http://www.hp.com/go/security>.
- 17. This product ships with TPM 1.2 with option to upgrade to TPM 2.0. Upgrade utility is expected to be available by the end of 2015 via HP Customer Support.

### POWER

#### Power Supply

HP 45W Smart AC Adapter (UMA only)

HP 65W Smart AC Adapter

Power cord included is 1.8 m (+/- 0.1 m) or 1.0 m (+/- 0.1 m).

#### Primary Battery

HP 3-cell Long Life Prismatic (48 WHr)

#### Battery Life<sup>1</sup>

HP ProBook 645 Notebook PC	UMA Graphics	Discrete Graphics
3-cell (48 Whr) with SSD	Up to 8 hrs 15 mins	N/A
3-cell (48 Whr) with HDD	Up to 7 hrs 15 mins	N/A
HP ProBook 655 Notebook PC	UMA Graphics	Discrete Graphics
3-cell (48 Whr) with SSD	Up to 8 hrs	N/A
3-cell (48 Whr) with HDD	Up to 7 hrs 15 mins	N/A

#### System Standby Time<sup>2</sup>

	UMA Graphics	Discrete Graphics
HP ProBook 640 Notebook PC	Up to 186 hrs	N/A
HP ProBook 650 Notebook PC	Up to 186 hrs	N/A



### Summary of Changes

#### Battery recharge times

	ProBook 645 G2	ProBook 655 G2
Time to 90% Charge <sup>3</sup> (minutes)	109	109
Time to 100% Charge <sup>4</sup> (minutes)	167	167

1. 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](http://www.bapco.com) for additional details.
2. Standby life will vary depending on various factors including battery, Memory, CPU, EC and LAN chip. The maximum capacity of the battery will naturally decrease with time and usage.
3. Recharges your battery up to 90% within 109 minutes when the system is off. Applies to 3-cell 48Whr battery only. When the PC is powered on, charge time may increase and will vary based on the workload of the notebook PC.
4. Recharges your battery up to 100% within 167 minutes when the system is off. Applies to 3-cell 48Whr battery only. When the PC is powered on, charge time may increase and will vary based on the workload of the notebook PC.

## WEIGHTS & DIMENSIONS

### HP ProBook 645 Notebook PC

#### Weight

Starting at 4.30 lbs (1.95 kg)<sup>1</sup>

(3-cell battery, ODD weight saver, UMA, no FPR, 1 SODIMM, WLAN only, SSD, touchpad only, no camera, no WWAN)

#### Dimensions (w x d x h)

13.39 x 9.33 x 1.06 in (Front and rear)<sup>2</sup>

34.0 x 23.7 x 2.70 cm (Front and rear)

### HP ProBook 655 Notebook PC

#### Weight

Starting at 5.1 lbs (2.31 kg)<sup>1</sup>

(3-cell battery, ODD weight saver, UMA, no FPR, 1 SODIMM, WLAN only, SSD, touchpad only, no camera, no WWAN)

#### Dimensions (w x d x h)

14.88 x 10.11 x 1.07 in (Front and rear)<sup>2</sup>

37.8 x 25.7 x 2.74 cm (Front and rear)

1. Weight varies by configuration and components.
2. Height varies depending upon where on the notebook the measurement is made.

## PORTS/SLOTS

### Ports

USB TypeC™ - One



Not all configuration components are available in all regions/countries.  
Americas – HP ProBook 645 & 655 G2 – November 2016 - c04912055

## Summary of Changes

USB 3.0 port – One  
USB 3.0 port Charging – One  
RJ-45 / Ethernet - One  
Docking connector – One  
Headphone / Microphone (Combo jack) – One  
AC port ( 4.5mm ) – One  
DisplayPort -One  
VGA port – One  
Serial port optional – One (HP ProBook 655 Notebook PC only) <sup>1</sup>

### **SD Media Reader Slot**

Supports SD, SDHC, SDXC

1. Sold separately or as an optional feature.

## **SERVICE AND SUPPORT**

Limited 3-year, 1-year or 90-day limited warranty options available, 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. Optional<sup>1</sup> HP Care Pack Services<sup>2</sup> are extended service contracts which go beyond your 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/gp/cpc>.

1. Sold separately or as an optional feature.

2. 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. Consult the HP Customer Support Center for details.

<http://h20000.www2.hp.com/bizsupport/TechSupport/ProductRoot.jsp>



## Summary of Changes

### SYSTEM UNIT

TBD

### DISPLAYS\*

#### 14.0 FHD AG WLED SVA 60%cg 300nits eDP Slim

Panel	
Active Area (W x H)	309.40 x 173.95 (mm)
Dimensions (W x H)	320.9 x 205.6 (mm) max
Diagonal Size	14 (inch)
Thickness	3.0 (mm) max
Weight	270 g max
Interface	eDP 1.2
Surface Treatment	Anti-Glare (AG)
Contrast Ratio	300:1 (typical)
Refresh Rate	60 Hz
Brightness	300 nits
Pixel Resolution - Format	1920 x 1080 (FHD)
PPI	157
Pixel Resolution - Configuration	RGB
Backlight	LED
Color Gamut Coverage	60%
Color Depth	6 bits
Viewing Angle	SVA 45/45/25/35

#### 14.0 HD AG WLED SVA 45%cg 220nits eDP Flat



## Summary of Changes

Panel	
Active Area (W x H)	309.40 x 173.95 (mm)
Dimensions (W x H)	320.9 x 205.6 (mm) max
Diagonal Size	14 (inch)
Thickness	3.6 (mm) max
Weight	320 g max
Interface	eDP 1.2
Surface Treatment	Anti-Glare (AG)
Contrast Ratio	300:1 (typical)
Refresh Rate	60 Hz
Brightness	220 nits
Pixel Resolution - Format	1280 x 768 (HD)
PPI	112
Pixel Resolution - Configuration	RGB
Backlight	LED
Color Gamut Coverage	45%
Color Depth	6 bits + Hi FRC
Viewing Angle	SVA 45/45/25/35

### 14.0 FHD WLED SVA 60%cg 300nits eDP Slim touch

Panel	
Active Area (W x H)	309.40 x 173.95 (mm)
Dimensions (W x H)	320.9 x 205.6 (mm) max
Diagonal Size	14 (inch)



# QuickSpecs

**HP ProBook 645 G2 Notebook PC**  
**HP ProBook 655 G2 Notebook PC**

## Summary of Changes

Thickness	3.0 (mm) max
Weight	270 g max
Interface	eDP 1.2
Contrast Ratio	300:1 (typical)
Refresh Rate	60 Hz
Brightness	300 nits
Pixel Resolution - Format	1920 x 1080 (FHD)
PPI	157
Pixel Resolution - Configuration	RGB
Backlight	LED
Color Gamut Coverage	60%
Color Depth	6 bits
Viewing Angle	SVA 45/45/25/35
Touch Enabled	Optional
Touch Point Supported	10-point multi-touch
Other Features	AS
Pen Enabled	No

### 15.6 FHD AG WLED SVA 60%cg 300nits eDP Slim 3.2mm

Panel	
Active Area (W x H)	344.2 x 193.5 (mm)
Dimensions (W x H)	360 x 224.3 (mm) max
Diagonal Size	15.6 (inch)
Thickness	3.2 (mm) max



## Summary of Changes

<b>Weight</b>	360 g max
<b>Interface</b>	eDP 1.2
<b>Surface Treatment</b>	Anti-Glare (AG)
<b>Contrast Ratio</b>	400:1 (typical)
<b>Refresh Rate</b>	60 Hz
<b>Brightness</b>	300 nits
<b>Pixel Resolution - Format</b>	1920 x 1080 (FHD)
<b>PPI</b>	142
<b>Pixel Resolution - Configuration</b>	RGB
<b>Backlight</b>	LED
<b>Color Gamut Coverage</b>	60%
<b>Color Depth</b>	6 bits
<b>Viewing Angle</b>	SVA 45/45/25/35

### 15.6 HD AG WLED SVA 45%cg 220nits eDP Flat

<b>Panel</b>	
<b>Active Area (W x H)</b>	344.2 x 193.5 (mm)
<b>Dimensions (W x H)</b>	360 x 224.3 (mm) max
<b>Diagonal Size</b>	15.6 (inch)
<b>Thickness</b>	3.8 (mm) max
<b>Weight</b>	420 g max
<b>Interface</b>	eDP 1.2
<b>Surface Treatment</b>	Anti-Glare (AG)
<b>Contrast Ratio</b>	300:1 (typical)



## Summary of Changes

Refresh Rate	60 Hz
Brightness	220 nits
Pixel Resolution - Format	1280 x 768 (HD)
PPI	101
Pixel Resolution - Configuration	RGB
Backlight	LED
Color Gamut Coverage	45%
Color Depth	6 bits + Hi FRC
Viewing Angle	SVA 45/45/25/35

### 15.6 FHD WLED SVA 60%cg 300nits eDP Slim 3.2mm touch

Panel	
Active Area (W x H)	344.2 x 193.5 (mm)
Dimensions (W x H)	360 x 224.3 (mm) max
Diagonal Size	15.6 (inch)
Thickness	3.2 (mm) max
Weight	360 g max
Interface	eDP 1.2
Contrast Ratio	400:1 (typical)
Refresh Rate	60 Hz
Brightness	300 nits
Pixel Resolution - Format	1920 x 1080 (FHD)
PPI	142
Pixel Resolution - Configuration	RGB





## Summary of Changes

Backlight	LED
Color Gamut Coverage	60%
Color Depth	6 bits
Viewing Angle	SVA 45/45/25/35
Touch Enabled	Optional
Touch Point Supported	10-point multi-touch
Other Features	AS
Pen Enabled	No

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

## NETWORKING/COMMUNICATIONS

### HP It4120 Qualcomm® Snapdragon™ X5 LTE Mobile Broadband Module\*

<b>Technology/Operating bands</b>	LTE: 2100 (Band 1), 1900 (Band 2), 1800 (Band 3), 1700/2100 (Band 4), 850 (Band 5), 2600 (Band 7), 900 (Band 8), 700 (Band 12 lower), 700 (Band 13 upper), 700 (Band 17 lower), 800 (Band 20), 700 (Band 28). HSPA+: 2100 (Band 1), 1900 (Band 2), 1700/2100 (Band 4), 850 (Band 5), 900 (Band 8) MHz EV-DO: 850 (BC0), 1900 (BC1) MHz (Only work with Verizon network) E-GPRS: 1900 (Band 2), 1800 (Band 3), 850 (Band 5), 900 (Band 8) MHz
<b>Wireless protocol standards</b>	3GPP Release 10 LTE Specification CAT.4, 20MHz BW WCDMA R99, 3GPP Release 5, 6, 7 and 8 UMTS Specification 1xEVDO Release 0, A and B. E-GPRS: Class B, Multi-slot class 12, coding schemes CS1 - CS4 and MSC1 - MSC9
<b>GPS</b>	Standalone, A-GPS (MS-A, MS-B and XTRA)
<b>GPS bands</b>	1575.42 MHz ± 1.023 MHz, GLONASS 1596-1607MHz
<b>Maximum data rates</b>	LTE: 150 Mbps (Download), 50 Mbps (Upload) DC-HSPA+: 42 Mbps (Download), 5.76 Mbps (Upload) HSPA+: 21Mbps (Download), 5.76 Mbps (Upload) CDMA 1xRTT: 153.6 kbps (Download), 153.6 kbps (Upload) EVDO Rel.A: 3.1 Mbps (Download), 1.8 Mbps (Upload) EVDO Rel.B: 14.7 Mbps (Download), 5.4Mbps (Upload) EDGE: 236.8 kbps (Download), 236.8 kbps (Upload) GPRS: 85.6 kbps(Download), 85.6 kbps (Upload)
<b>Maximum output power</b>	LTE: 23 dBm



### Summary of Changes

	HSPA+: 23.5 dBm 1xRTT/EVDO: 24dBm E-GPRS 1900/1800: 26 dBm E-GPRS 900/850: 27 dBm GPRS 1900/1800: 29.5 dBm GPRS 900/850: 32.5 dBm
<b>Maximum power consumption</b>	LTE: 1,200 mA (peak); 900 mA (average) HSPA+: 1,100 mA (peak); 800 mA (average) 1xRTT/EVDO: 1,000 mA (peak); 700 mA (average) E-GPRS: 2,800 mA (peak); 500 mA (average)
<b>Form Factor</b>	M.2, 3042-S3 Key B
<b>Weight</b>	6.2 g
<b>Dimensions</b> (Length x Width x Thickness)	42 x 30 x 2.3 mm

\* 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.

	<b>HP hs3110 HSPA+ Intel® Mobile Broadband Module*</b>
<b>Technology/Operating bands</b>	HSPA+: 2100 (Band 1), 1900 (Band 2), 1700 (Band 4), 850 (Band 5), 900 (Band 8) MHz E-GPRS: 1900 (Band 2), 1800 (Band 3), 850 MHz (Band 5), 900 (Band 8) MHz
<b>Wireless protocol standards</b>	WCDMA R99, 3GPP Release 5, 6 and 7 UMTS Specification E-GPRS: Class B, Multi-slot class 33, coding schemes CS1 - CS4 and MSC1 - MSC9
<b>GPS</b>	Standalone, A-GPS
<b>GPS bands</b>	1575.42 MHz ± 1.023 MHz
<b>Maximum data rates</b>	HSPA+: 21.6 Mbps (Download), 5.76 Mbps (Upload)  E-GPRS: 296 kbps (Download), 236.8 kbps (Upload) GPRS: 107 kbps (Download), 85.6 kbps (Upload)
<b>Maximum output power</b>	HSPA+: 24 dBm E-GPRS 1800/1900: 26 dBm E-GPRS 850/900: 27 dBm GPRS 1800/1900: 30 dBm GPRS 850/900: 33 dBm
<b>Maximum power consumption</b>	HSPA+: 1,100 mA (peak); 800 mA (average) E-GPRS: 2,800 mA (peak); 700 mA (average)
<b>Form Factor</b>	M.2, 3042-S3 Key B
<b>Weight</b>	6 g
<b>Dimensions</b> (Length x Width x Thickness)	1.65 x 1.18 x 0.09 in (42 x 30 x 2.3 mm)

\* 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.



### Summary of Changes

#### Intel® 802.11a/b/g/n/ac (2x2) and Bluetooth® 4.1 Combo

<b>Wireless LAN Standards</b>	IEEE 802.11a  IEEE 802.11b IEEE 802.11g  IEEE 802.11n  IEEE 802.11ac
<b>Interoperability</b>	Wi-Fi certified
<b>Frequency Band</b>	802.11b/g/n <ul style="list-style-type: none"><li>• 2.402 – 2.482 GHz</li></ul> Note:  The FCC has declared as of January 1, 2015 products that utilize passive scanning on channel 12/13 and are capable of transmitting must fully comply with requirements of 15.247 or otherwise disable those channels.  802.11a/n <ul style="list-style-type: none"><li>• 4.9 – 4.95 GHz (Japan)</li><li>• 5.15 – 5.25 GHz</li><li>• 5.25 – 5.35 GHz</li><li>• 5.47 – 5.725 GHz</li><li>• 5.825 – 5.850 GHz</li></ul> Note: Indonesia no support this band)
<b>Data Rates</b>	<ul style="list-style-type: none"><li>• 802.11b: 1, 2, 5.5, 11 Mbps</li><li>• 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li><li>• 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li><li>• 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)</li><li>• 802.11ac : MCS0 ~ MCS9, (1SS, and 2SS) (20MHz, 40MHz, and 80MHz)</li></ul>
<b>Modulation</b>	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM
<b>Security<sup>1</sup></b>	<ul style="list-style-type: none"><li>• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only</li><li>• AES-CCMP: 128 bit in hardware</li><li>• 802.1x authentication</li></ul>



### Summary of Changes

	<ul style="list-style-type: none"><li>• WPA, WPA2: 802.1x, WPA-PSK, WPA2-PSK, TKIP, and AES.</li><li>• WPA2 certification</li><li>• IEEE 802.11i</li><li>• Cisco Certified Extensions, all versions through CCX4 and CCX Lite</li><li>• WAPI</li></ul>
<b>Network Architecture Models</b>	Ad-hoc (Peer to Peer) Infrastructure (Access Point Required)
<b>Roaming</b>	IEEE 802.11 compliant roaming between access points
<b>Output Power<sup>2</sup></b>	<ul style="list-style-type: none"><li>• 802.11b : +16dBm minimum</li><li>• 802.11g : +14dBm minimum</li><li>• 802.11a : +14dBm minimum</li><li>• 802.11n HT20(2.4GHz) : +14dBm minimum</li><li>• 802.11n HT40(2.4GHz) : +12dBm minimum</li><li>• 802.11n HT20(5GHz) : +14dBm minimum</li><li>• 802.11n HT40(5GHz) : +12dBm minimum</li></ul>
<b>Power Consumption</b>	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
<b>Power Management</b>	ACPI and PCI Express compliant power management 802.11 compliant power saving mode
<b>Receiver Sensitivity<sup>3</sup></b>	802.11b, 1Mbps : -94dBm maximum  802.11b, 11Mbps : -86dBm maximum  802.11g, 6Mbps : -88dBm maximum  802.11g, 54Mbps : -74dBm maximum  802.11a, 6Mbps : -88dBm maximum  802.11a, 54Mbps : -74dBm maximum  802.11n, MCS07 : -69dBm maximum



### Summary of Changes

	802.11n, MCS15 : -66dBm maximum
	802.11ac, 1SS, MCS-0 : -86dBm maximum
	802.11ac, 1SS, MCS-9 : -61dBm maximum
	802.11ac, 2SS, MCS-0 : -83dBm maximum
	802.11ac, 2SS, MCS-9 : -58dBm maximum
<b>Antenna type</b>	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
<b>Form Factor</b>	PCI-Express M.2 MiniCard
<b>Dimensions</b>	Type 2230 : 2.3 x 22.0 x 30.0 mm
	Or
	Type 1630 : 2.3 x 16.0 x 30.0 mm
<b>Weight</b>	Type 2230 : 2.8g
	Or
	Type 1630 : 2g
<b>Operating Voltage</b>	3.3v +/- 9%
<b>Temperature</b>	Operating 14° to 158° F (-10° to 70° C) Non-operating -40° to 176° F (-40° to 80° C)
<b>Humidity</b>	Operating 10% to 90% (non-condensing) Non-operating 5% to 95% (non-condensing)
<b>Altitude</b>	Operating 0 to 10,000 ft (3,048 m) Non-operating 0 to 50,000 ft (15,240 m)
<b>LED Activity</b>	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) 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



## Summary of Changes

<b>Bluetooth Specification</b>	4.0/4.1/4.2 Compliant												
<b>Frequency Band</b>	2402 to 2480 MHz												
<b>Number of Available Channels</b>	Legacy : 0~79 (1 MHz/CH) BLE : 0~39 (2 MHz/CH)												
<b>Data Rates and Throughput</b>	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)												
<b>Transmit Power</b>	The Bluetooth component shall operate as a Class II Bluetooth device with a maximum transmit power of + 4 dBm for BR and EDR.												
<b>Receiver Sensitivity</b>	<table border="1"> <thead> <tr> <th>Modulation</th> <th>0.01% BER</th> <th>0.001% BER</th> </tr> </thead> <tbody> <tr> <td>GFSK</td> <td>-80 dBm</td> <td>-70 dBm</td> </tr> <tr> <td><math>\pi/4</math>-DQPSK</td> <td>-80 dBm</td> <td>-70 dBm</td> </tr> <tr> <td>8DPSK</td> <td>-80 dBm</td> <td>-70 dBm</td> </tr> </tbody> </table>	Modulation	0.01% BER	0.001% BER	GFSK	-80 dBm	-70 dBm	$\pi/4$ -DQPSK	-80 dBm	-70 dBm	8DPSK	-80 dBm	-70 dBm
Modulation	0.01% BER	0.001% BER											
GFSK	-80 dBm	-70 dBm											
$\pi/4$ -DQPSK	-80 dBm	-70 dBm											
8DPSK	-80 dBm	-70 dBm											
<b>Power Consumption</b>	Peak (Tx) 330 mW Peak (Rx) 230 mW Selective Suspend 17 mW												
<b>Range</b>	Legacy Up to 33 ft (10 m)  BLE Up to 99 ft (30 m)												
<b>Electrical Interface</b>	USB 2.0 compliant												
<b>Bluetooth Software Supported</b>	Microsoft Windows Bluetooth Software												
<b>Link Topology</b>													
<b>Electrical Interface</b>	Point to Point, Multipoint Pico Nets up to 7 slaves												
<b>Bluetooth Software Supported</b>	Full support of Bluetooth Security Provisions												



## Summary of Changes

**Security**

**Power Management**

Microsoft Windows ACPI, and USB Bus Support

**Certifications**

Self-configurable to optimize power conservation in all operating modes, including Standby, Hold, Park, and Sniff

**Security**

All necessary regulatory approvals for supported countries, including:

**Certifications**

FCC (47 CFR) Part 15C, Section 15.247 & 15.249

**Bluetooth Profiles Supported**

**Power Management**

ETS 300 328, ETS 300 826

**Certifications**

Low Voltage Directive IEC950

UL, CSA, and CE Mark

Serial Port Profile (SPP)<sup>1</sup>

Service Discovery Application Profile (SDAP)

Dial-Up Networking (DUN)<sup>1,2</sup>

Generic Object Exchange Profile (GOEP)<sup>1,2</sup>

Object Push Profile (OPP)<sup>1,2</sup>

Hard Copy Cable Replacement (HCRP)<sup>1,2</sup>

Personal Area Networking Profile (PAN)<sup>1,2</sup>

Human Interface Device Profile (HID)<sup>1,2</sup>

Hands Free Profile (HFP)

Advanced Audio Distribution Profile (A2DP)

Audio Video Remote Control Profile (AVRCP)

**Certifications**

**Bluetooth Profiles Supported**

**Bluetooth V4.1/V4.2 support feature**

V4.1: ESR5/6/7 compliant

V4.2: ESR8 compliant, LE Secure Connection – Basic.

**Intel® 802.11a/b/g/n (2x2) and Bluetooth® 4.0 Combo**



### Summary of Changes

<b>Wireless LAN Standards</b>	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n
<b>Interoperability</b>	Wi-Fi certified
<b>Frequency Band</b>	802.11b/g/n <ul style="list-style-type: none"><li>• 2.402 – 2.482 GHz</li></ul> Note: <p>The FCC has declared as of January 1, 2015 products that utilize passive scanning on channel 12/13 and are capable of transmitting must fully comply with requirements of 15.247 or otherwise disable those channels.</p>
	802.11a <ul style="list-style-type: none"><li>• 4.9 – 4.95 GHz (Japan)</li><li>• 5.15 – 5.25 GHz</li><li>• 5.25 – 5.35 GHz</li><li>• 5.47 – 5.725 GHz</li><li>• 5.825 – 5.850 GHz</li></ul> Note: <p>Indonesia only supports 5.725 - 5.825 GHz (CH149 - CH161)</p>
<b>Antenna Structure</b>	2 transmit; 2 receive (2x2)
<b>Data Rates</b>	802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11b: 1, 2, 5.5, 11 Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)
<b>Modulation</b>	Direct Sequence Spread Spectrum CCK, BPSK, QPSK, 16-QAM, 64-QAM
<b>Security<sup>1</sup></b>	<ul style="list-style-type: none"><li>• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only</li><li>• AES-CCMP: 128 bit in hardware</li><li>• 802.1x authentication</li><li>• WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.</li></ul>





### Summary of Changes

	<ul style="list-style-type: none"><li>• WPA2 certification</li><li>• IEEE 802.11i</li><li>• Cisco Certified Extensions, all versions through CCX4 and CCX Lite</li><li>• WAPI</li></ul>
<b>Sub-channels</b>	Multinational support with frequency bands and channels compliant to local regulations.
<b>Network Architecture Models</b>	Ad-hoc (Peer to Peer) Infrastructure (Access Point Required)
<b>Roaming</b>	IEEE 802.11 compliant roaming between band Access Points
<b>Output Power<sup>2</sup></b>	<ul style="list-style-type: none"><li>• 802.11b : +16dBm minimum</li><li>• 802.11g : +14dBm minimum</li><li>• 802.11a : +14dBm minimum</li><li>• 802.11n HT20(2.4GHz) : +13dBm minimum</li><li>• 802.11n HT40(2.4GHz) : +13dBm minimum</li><li>• 802.11n HT20(5GHz) : +12dBm minimum</li><li>• 802.11n HT40(5GHz) : +12dBm minimum</li></ul>
<b>Power Consumption</b>	Transmit: 2.0 W (max)  Receive: 1.6 W (max)  Idle mode (PSP): 180 mW (WLAN Associated)  Idle mode: 60 mW (WLAN unassociated)  Radio disabled: 30 mW
<b>Power Management</b>	ACPI and PCI Express compliant power management 802.11 compliant power saving mode
<b>Receiver Sensitivity<sup>3</sup></b>	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
<b>Antenna type</b>	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 and Bluetooth communications



### Summary of Changes

<b>Form Factor</b>	PCI-Express M.2 MiniCard	
<b>Dimensions</b>	Type 2230 : 2.3 x 22.0 x 30.0 mm	
	Or	
	Type 1630 : 2.3 x 16.0 x 30.0 mm	
<b>Weight</b>	Type 2230 : 2.8g	
	Or	
	Type 1630 : 2g	
<b>Operating Voltage</b>	3.3v +/- 9%	
<b>Temperature</b>	Operating	14° to 158° F (-10° to 70° C)
	Non-operating	-40° to 176° F (-40° to 80° C)
<b>Humidity</b>	Operating	10% to 90% (non-condensing)
	Non-operating	5% to 95% (non-condensing)
<b>Altitude</b>	Operating	0 to 10,000 ft (3,048 m)
	Non-operating	0 to 50,000 ft (15,240 m)
<b>LED Activity</b>	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) and a packet error rate of 10% for 802.11a/g (OFDM modulation).

#### HP Integrated Module with Bluetooth 4.0+EDR Wireless Technology

<b>Bluetooth Specification</b>	4.0+EDR Compliant
<b>Frequency Band</b>	2402 to 2480 MHz
<b>Number of Available Channels</b>	79 (1 MHz) available channels
<b>Data Rates and Throughput</b>	3 Mbps data rate; throughput up to 2.17 Mbps
	Synchronous Connection Oriented links up to 3, 64 kbps, voice channels



### Summary of Changes

Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric or 1306.9 kbps symmetric

**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.

**Receiver Sensitivity**

Modulation	0.01% BER	0.001% BER
GFSK	-80 dBm	-70 dBm
$\pi/4$ -DQPSK	-80 dBm	-70 dBm
8DPSK	-80 dBm	-70 dBm

**Power Consumption**

Peak (Tx) 330 mW  
Peak (Rx) 230 mW  
Selective Suspend 17 mW

**Range**

Up to 33 ft (10 m)

**Electrical Interface**

USB 2.0 compliant

**Bluetooth Software Supported**

Microsoft Windows Bluetooth Software

**Link Topology**

**Electrical Interface**

Point to Point, Multipoint Pico Nets up to 7 slaves

**Bluetooth Software Supported**

Full support of Bluetooth Security Provisions

**Security**

**Power Management**

Microsoft Windows ACPI, and USB Bus Support

**Power Management**

Self-configurable to optimize power conservation in all operating modes, including Standby, Hold, Park, and Sniff

**Certifications**

**Security**

All necessary regulatory approvals for supported countries, including:

**Certifications**

FCC (47 CFR) Part 15C, Section 15.247 & 15.249

**Bluetooth Profiles Supported**

**Power Management**

ETS 300 328, ETS 300 826

**Certifications**

Low Voltage Directive IEC950



## Summary of Changes

	UL, CSA, and CE Mark
<b>Certifications</b>	Serial Port Profile (SPP) <sup>1</sup> Service Discovery Application Profile (SDAP) Dial-Up Networking (DUN) <sup>1,2</sup> Generic Object Exchange Profile (GOEP) <sup>1,2</sup> Object Push Profile (OPP) <sup>1,2</sup> File Transfer Profile (FTP) Synchronization Profile (SYNC) Hard Copy Cable Replacement (HCRP) <sup>1,2</sup> Personal Area Networking Profile (PAN) <sup>1,2</sup>
<b>Bluetooth Profiles Supported</b>	Human Interface Device Profile (HID) <sup>1,2</sup> FAX Profile (FAX) Basic Imaging Profile (BIP) <sup>2</sup> Headset Profile (HSP) Hands Free Profile (HFP) Advanced Audio Distribution Profile (A2DP)

<b>Bluetooth V4.1/V4.2 support feature</b>	V4.1: ESR5/6/7 compliant
	V4.2: ESR8 compliant, LE Secure Connection – Basic.

### Broadcom 802.11a/b/g/n (2x2) and Bluetooth® 4.0 Combo

<b>Wireless LAN Standards</b>	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n
<b>Interoperability</b>	Wi-Fi certified
<b>Frequency Band</b>	802.11b/g/n <ul style="list-style-type: none"> <li>• 2.402 – 2.482 GHz</li> </ul>



### Summary of Changes

Note:

The FCC has declared as of January 1, 2015 products that utilize passive scanning on channel 12/13 and are capable of transmitting must fully comply with requirements of 15.247 or otherwise disable those channels.

#### 802.11a

- 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

Note:

Indonesia only supports 5.725 - 5.825 GHz (CH149 - CH161)

<b>Antenna Structure</b>	2 transmit; 2 receive (2x2)
<b>Data Rates</b>	802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11b: 1, 2, 5.5, 11 Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n: MCS 0 ~ MCS 15, (20MHz, and 40MHz)
<b>Modulation</b>	Direct Sequence Spread Spectrum CCK, BPSK, QPSK, 16-QAM, 64-QAM
<b>Security<sup>1</sup></b>	<ul style="list-style-type: none"><li>• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only</li><li>• AES-CCMP: 128 bit in hardware</li><li>• 802.1x authentication</li><li>• WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.</li><li>• WPA2 certification</li><li>• IEEE 802.11i</li><li>• Cisco Certified Extensions, all versions through CCX4 and CCX Lite</li><li>• WAPI</li></ul>
<b>Sub-channels</b>	Multinational support with frequency bands and channels compliant to local regulations.
<b>Network Architecture Models</b>	Ad-hoc (Peer to Peer) Infrastructure (Access Point Required)



### Summary of Changes

<b>Roaming</b>	IEEE 802.11 compliant roaming between band Access Points
<b>Output Power<sup>2</sup></b>	<ul style="list-style-type: none"> <li>• 802.11b : +16dBm minimum</li> <li>• 802.11g : +14dBm minimum</li> <li>• 802.11a : +14dBm minimum</li> <li>• 802.11n HT20(2.4GHz) : +13dBm minimum</li> <li>• 802.11n HT40(2.4GHz) : +13dBm minimum</li> <li>• 802.11n HT20(5GHz) : +12dBm minimum</li> <li>• 802.11n HT40(5GHz) : +12dBm minimum</li> </ul>
<b>Power Consumption</b>	<p>Transmit: 2.0 W (max)</p> <p>Receive: 1.6 W (max)</p> <p>Idle mode (PSP): 180 mW (WLAN Associated)</p> <p>Idle mode: 60 mW (WLAN unassociated)</p> <p>Radio disabled: 30 mW</p>
<b>Power Management</b>	ACPI and PCI Express compliant power management 802.11 compliant power saving mode
<b>Receiver Sensitivity<sup>3</sup></b>	<p>802.11b, 1Mbps : -94dBm maximum</p> <p>802.11b, 11Mbps : -86dBm maximum</p> <p>802.11g, 6Mbps : -88dBm maximum</p> <p>802.11g, 54Mbps : -74dBm maximum</p> <p>802.11a, 6Mbps : -86dBm maximum</p> <p>802.11a, 54Mbps : -72dBm maximum</p> <p>802.11n, MCS07 : -69dBm maximum</p> <p>802.11n, MCS15 : -66dBm maximum</p>
<b>Antenna type</b>	<p>High efficiency antenna with spatial diversity, mounted in the display enclosure</p> <p>Two embedded dual band 2.4/5 GHz antennas are provided to the card to support WLAN MIMO and Bluetooth communications</p>
<b>Form Factor</b>	PCI-Express M.2 MiniCard
<b>Dimensions</b>	<p>Type 2230 : 2.3 x 22.0 x 30.0 mm</p> <p>Or</p> <p>Type 1630 : 2.3 x 16.0 x 30.0 mm</p>
<b>Weight</b>	<p>Type 2230 : 2.8g</p> <p>Or</p>



### Summary of Changes

	Type 1630 : 2g	
<b>Operating Voltage</b>	3.3v +/- 9%	
<b>Temperature</b>	Operating	14° to 158° F (-10° to 70° C)
	Non-operating	-40° to 176° F (-40° to 80° C)
<b>Humidity</b>	Operating	10% to 90% (non-condensing)
	Non-operating	5% to 95% (non-condensing)
<b>Altitude</b>	Operating	0 to 10,000 ft (3,048 m)
	Non-operating	0 to 50,000 ft (15,240 m)
<b>LED Activity</b>	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) and a packet error rate of 10% for 802.11a/g (OFDM modulation).

#### HP Integrated Module with Bluetooth 4.0+EDR Wireless Technology

<b>Bluetooth Specification</b>	4.0+EDR Compliant
<b>Frequency Band</b>	2402 to 2480 MHz
<b>Number of Available Channels</b>	79 (1 MHz) available channels
<b>Data Rates and Throughput</b>	3 Mbps data rate; throughput up to 2.17 Mbps
	Synchronous Connection Oriented links up to 3, 64 kbps, voice channels
	Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric or 1306.9 kbps symmetric
<b>Transmit Power</b>	The Bluetooth component shall operate as a Class II Bluetooth device with a maximum transmit power of +4 dBm for BR and EDR.

#### Receiver Sensitivity

Modulation	0.01% BER	0.001% BER
GFSK	-80 dBm	-70 dBm
$\pi/4$ -DQPSK	-80 dBm	-70 dBm



### Summary of Changes

	8DPSK	-80 dBm	-70 dBm
<b>Power Consumption</b>	Peak (Tx) 330 mW Peak (Rx) 230 mW Selective Suspend 17 mW		
<b>Range</b>	Up to 33 ft (10 m)		
<b>Electrical Interface</b>	USB 2.0 compliant		
<b>Bluetooth Software Supported</b>	Microsoft Windows Bluetooth Software		
<b>Link Topology</b>			
<b>Electrical Interface</b>	Point to Point, Multipoint Pico Nets up to 7 slaves		
<b>Bluetooth Software Supported</b>	Full support of Bluetooth Security Provisions		
<b>Security</b>			
<b>Power Management</b>	Microsoft Windows ACPI, and USB Bus Support		
<b>Power Management</b>	Self-configurable to optimize power conservation in all operating modes, including Standby, Hold, Park, and Sniff		
<b>Certifications</b>			
<b>Security</b>	All necessary regulatory approvals for supported countries, including:		
<b>Certifications</b>	FCC (47 CFR) Part 15C, Section 15.247 & 15.249		
<b>Bluetooth Profiles Supported</b>			
<b>Power Management</b>	ETS 300 328, ETS 300 826		
<b>Certifications</b>	Low Voltage Directive IEC950		
	UL, CSA, and CE Mark		
<b>Certifications</b>	Serial Port Profile (SPP) <sup>1</sup> Service Discovery Application Profile (SDAP) Dial-Up Networking (DUN) <sup>1,2</sup>		
<b>Bluetooth Profiles Supported</b>	Generic Object Exchange Profile (GOEP) <sup>1,2</sup> Object Push Profile (OPP) <sup>1,2</sup> File Transfer Profile (FTP) Synchronization Profile (SYNC) Hard Copy Cable Replacement (HCRP) <sup>1,2</sup> Personal Area Networking Profile (PAN) <sup>1,2</sup> Human Interface Device Profile (HID) <sup>1,2</sup>		





## Summary of Changes

FAX Profile (FAX)  
 Basic Imaging Profile (BIP)<sup>2</sup>  
 Headset Profile (HSP)  
 Hands Free Profile (HFP)  
 Advanced Audio Distribution Profile (A2DP)

### Broadcom 802.11b/g/n (1x1) WiFi and Bluetooth® 4.0 Combo

<b>Wireless LAN Standards</b>	IEEE 802.11b IEEE 802.11g  IEEE 802.11n
<b>Interoperability</b>	Wi-Fi certified
<b>Frequency Band</b>	802.11b/g/n <ul style="list-style-type: none"> <li>• 2.402 – 2.482 GHz</li> </ul> <p>Note: The FCC has declared as of September 1, 2014 products that utilize passive scanning on channel 12/13 and are capable of transmitting must fully comply with requirements of 15.247 or otherwise disable those channels.</p>
<b>Data Rates</b>	802.11b: 1, 2, 5.5, 11 Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n: MCS 0 ~ MCS 07, (20MHz)
<b>Modulation</b>	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM,
<b>Security<sup>1</sup></b>	<ul style="list-style-type: none"> <li>• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only</li> <li>• AES-CCMP: 128 bit in hardware</li> <li>• 802.1x authentication</li> <li>• WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.</li> <li>• WPA2 certification</li> <li>• IEEE 802.11i</li> <li>• Cisco Certified Extensions, all versions through CCX4 and CCX Lite</li> <li>• WAPI</li> </ul>
<b>Network Architecture Models</b>	Ad-hoc (Peer to Peer) Infrastructure (Access Point Required)
<b>Roaming</b>	IEEE 802.11 compliant roaming between access points



### Summary of Changes

<b>Output Power<sup>2</sup></b>	<ul style="list-style-type: none"><li>• 802.11b : +16dBm minimum</li><li>• 802.11g : +14dBm minimum</li><li>• 802.11n HT20(2.4GHz) : +13dBm minimum</li><li>• 802.11n HT40(2.4GHz) : +13dBm minimum</li><li>• 802.11n HT20(5GHz) : +12dBm minimum</li><li>• 802.11n HT40(5GHz) : +12dBm minimum</li></ul>
<b>Power Consumption</b>	Transmit: 2.0 W (max) Receive: 1.6 W (max) Idle mode (PSP): 180 mW (WLAN Associated) Idle mode: 60 mW (WLAN unassociated)  Radio disabled: 30 mW
<b>Power Management</b>	ACPI and PCI Express compliant power management 802.11 compliant power saving mode
<b>Receiver Sensitivity<sup>3</sup></b>	802.11b, 1Mbps : -94dBm maximum  802.11b, 11Mbps : -86dBm maximum  802.11g, 6Mbps : -88dBm maximum  802.11g, 54Mbps : -74dBm maximum  802.11n, MCS07 : -69dBm maximum  802.11n, MCS15 : -66dBm maximum
<b>Antenna type</b>	High efficiency antenna with spatial diversity, mounted in the display enclosure  Two embedded antennas for 2.4GHz are provided to the card to support WLAN and Bluetooth communications. (Support Dual antenna or Single antenna, depend on platform requirement)
<b>Form Factor</b>	PCI-Express M.2 MiniCard
<b>Dimensions</b>	Type 2230 : 2.3 x 22.0 x 30.0 mm  Or Type 1630 : 2.3 x 16.0 x 30.0 mm
<b>Weight</b>	Type 2230 : 2.8g  Or



### Summary of Changes

	Type 1630 : 2g	
<b>Operating Voltage</b>	3.3v +/- 9%	
<b>Temperature</b>	Operating	14° to 158° F (–10° to 70° C)
	Non-operating	–40° to 176° F (–40° to 80° C)
<b>Humidity</b>	Operating	10% to 90% (non-condensing)
	Non-operating	5% to 95% (non-condensing)
<b>Altitude</b>	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

4. Check latest software/driver release for updates on supported security features.
5. Maximum output power may vary by country according to local regulations.
6. 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+EDR Wireless Technology

<b>Bluetooth Specification</b>	4.0+EDR Compliant
<b>Frequency Band</b>	2402 to 2480 MHz
<b>Number of Available Channels</b>	79 (1 MHz) available channels
<b>Data Rates and Throughput</b>	3 Mbps data rate; throughput up to 2.17 Mbps
	Synchronous Connection Oriented links up to 3, 64 kbps, voice channels
	Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric or 1306.9 kbps symmetric
<b>Transmit Power</b>	The Bluetooth component shall operate as a Class II Bluetooth device with a maximum transmit power of +4 dBm for BR and EDR.

#### Receiver Sensitivity

Modulation	0.01% BER	0.001% BER
GFSK	-80 dBm	-70 dBm
$\pi/4$ -DQPSK	-80 dBm	-70 dBm
8DPSK	-80 dBm	-70 dBm



## Summary of Changes

<b>Power Consumption</b>	Peak (Tx) 330 mW Peak (Rx) 230 mW Selective Suspend 17 mW
<b>Range</b>	Up to 33 ft (10 m)
<b>Electrical Interface</b>	USB 2.0 compliant
<b>Bluetooth Software Supported</b>	Microsoft Windows Bluetooth Software
<b>Link Topology</b>	
<b>Electrical Interface</b>	Point to Point, Multipoint Pico Nets up to 7 slaves
<b>Bluetooth Software Supported</b>	Full support of Bluetooth Security Provisions
<b>Security</b>	
<b>Power Management</b>	Microsoft Windows ACPI, and USB Bus Support
<b>Power Management</b>	Self-configurable to optimize power conservation in all operating modes, including Standby, Hold, Park, and Sniff
<b>Certifications</b>	
<b>Security</b>	All necessary regulatory approvals for supported countries, including:
<b>Certifications</b>	FCC (47 CFR) Part 15C, Section 15.247 & 15.249
<b>Bluetooth Profiles Supported</b>	
<b>Power Management</b>	ETS 300 328, ETS 300 826
<b>Certifications</b>	Low Voltage Directive IEC950  UL, CSA, and CE Mark
<b>Certifications</b>	Serial Port Profile (SPP) <sup>1</sup> Service Discovery Application Profile (SDAP) Dial-Up Networking (DUN) <sup>1,2</sup> Generic Object Exchange Profile (GOEP) <sup>1,2</sup> Object Push Profile (OPP) <sup>1,2</sup> File Transfer Profile (FTP) Synchronization Profile (SYNC) Hard Copy Cable Replacement (HCRP) <sup>1,2</sup> Personal Area Networking Profile (PAN) <sup>1,2</sup> Human Interface Device Profile (HID) <sup>1,2</sup> FAX Profile (FAX) Basic Imaging Profile (BIP) <sup>2</sup>
<b>Bluetooth Profiles Supported</b>	



## Summary of Changes

Headset Profile (HSP)  
 Hands Free Profile (HFP)  
 Advanced Audio Distribution Profile (A2DP)

### Realtek 802.11b/g/n (1x1) Wi-Fi

<b>Wireless LAN Standards</b>	IEEE 802.11b IEEE 802.11g  IEEE 802.11n
<b>Interoperability</b>	Wi-Fi certified
<b>Frequency Band</b>	802.11b/g/n <ul style="list-style-type: none"> <li>• 2.402 – 2.482 GHz</li> </ul> <p>Note: The FCC has declared as of September 1, 2014 products that utilize passive scanning on channel 12/13 and are capable of transmitting must fully comply with requirements of 15.247 or otherwise disable those channels.</p>
<b>Data Rates</b>	802.11b: 1, 2, 5.5, 11 Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n: MCS 0 ~ MCS 07, (20MHz)
<b>Modulation</b>	Direct Sequence Spread Spectrum BPSK, QPSK, CCK, 16-QAM, 64-QAM,
<b>Security<sup>1</sup></b>	<ul style="list-style-type: none"> <li>• IEEE and WiFi compliant 64 / 128 bit WEP encryption for a/b/g mode only</li> <li>• AES-CCMP: 128 bit in hardware</li> <li>• 802.1x authentication</li> <li>• WPA, WPA2: 802.1x. WPA-PSK, WPA2-PSK, TKIP, and AES.</li> <li>• WPA2 certification</li> <li>• IEEE 802.11i</li> <li>• Cisco Certified Extensions, all versions through CCX4 and CCX Lite</li> <li>• WAPI</li> </ul>
<b>Network Architecture Models</b>	Ad-hoc (Peer to Peer) Infrastructure (Access Point Required)
<b>Roaming</b>	IEEE 802.11 compliant roaming between access points
<b>Output Power<sup>2</sup></b>	<ul style="list-style-type: none"> <li>• 802.11b : +16dBm minimum</li> <li>• 802.11g : +14dBm minimum</li> </ul>



### Summary of Changes

- 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: 2.0 W (max)  
Receive: 1.6 W (max)  
Idle mode (PSP): 180 mW (WLAN Associated)  
Idle mode: 60 mW (WLAN unassociated)  
  
Radio disabled: 30 mW

**Power Management**

ACPI and PCI Express compliant power management  
802.11 compliant power saving mode

**Receiver Sensitivity<sup>3</sup>**

802.11b, 1Mbps : -94dBm maximum  
  
802.11b, 11Mbps : -86dBm maximum  
  
802.11g, 6Mbps : -88dBm maximum  
  
802.11g, 54Mbps : -74dBm 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 antennas for 2.4GHz 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  
  
Or  
Type 1630 : 2.3 x 16.0 x 30.0 mm

**Weight**

Type 2230 : 2.8g  
  
Or  
Type 1630 : 2g



### Summary of Changes

<b>Operating Voltage</b>	3.3v +/- 9%	
<b>Temperature</b>	Operating	14° to 158° F (–10° to 70° C)
	Non-operating	–40° to 176° F (–40° to 80° C)
<b>Humidity</b>	Operating	10% to 90% (non-condensing)
	Non-operating	5% to 95% (non-condensing)
<b>Altitude</b>	Operating	0 to 10,000 ft (3,048 m)
	Non-operating	0 to 50,000 ft (15,240 m)
<b>LED Activity</b>	LED Amber – Radio OFF; LED White – Radio ON	

7. Check latest software/driver release for updates on supported security features.
8. Maximum output power may vary by country according to local regulations.
9. 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+EDR Wireless Technology

<b>Bluetooth Specification</b>	4.0+EDR Compliant
<b>Frequency Band</b>	2402 to 2480 MHz
<b>Number of Available Channels</b>	79 (1 MHz) available channels
<b>Data Rates and Throughput</b>	3 Mbps data rate; throughput up to 2.17 Mbps
	Synchronous Connection Oriented links up to 3, 64 kbps, voice channels
	Asynchronous Connection Less links 2178.1 kbps/177.1 kbps asymmetric or 1306.9 kbps symmetric
<b>Transmit Power</b>	The Bluetooth component shall operate as a Class II Bluetooth device with a maximum transmit power of +4 dBm for BR and EDR.

#### Receiver Sensitivity

Modulation	0.01% BER	0.001% BER
GFSK	-80 dBm	-70 dBm
$\pi/4$ -DQPSK	-80 dBm	-70 dBm
8DPSK	-80 dBm	-70 dBm



## Summary of Changes

<b>Power Consumption</b>	Peak (Tx) 330 mW Peak (Rx) 230 mW Selective Suspend 17 mW
<b>Range</b>	Up to 33 ft (10 m)
<b>Electrical Interface</b>	USB 2.0 compliant
<b>Bluetooth Software Supported</b>	Microsoft Windows Bluetooth Software
<b>Link Topology</b>	
<b>Electrical Interface</b>	Point to Point, Multipoint Pico Nets up to 7 slaves
<b>Bluetooth Software Supported</b>	Full support of Bluetooth Security Provisions
<b>Security</b>	
<b>Power Management</b>	Microsoft Windows ACPI, and USB Bus Support
<b>Power Management</b>	Self-configurable to optimize power conservation in all operating modes, including Standby, Hold, Park, and Sniff
<b>Certifications</b>	
<b>Security</b>	All necessary regulatory approvals for supported countries, including:
<b>Certifications</b>	FCC (47 CFR) Part 15C, Section 15.247 & 15.249
<b>Bluetooth Profiles Supported</b>	
<b>Power Management</b>	ETS 300 328, ETS 300 826
<b>Certifications</b>	Low Voltage Directive IEC950  UL, CSA, and CE Mark
<b>Certifications</b>	Serial Port Profile (SPP) <sup>1</sup> Service Discovery Application Profile (SDAP) Dial-Up Networking (DUN) <sup>1,2</sup> Generic Object Exchange Profile (GOEP) <sup>1,2</sup> Object Push Profile (OPP) <sup>1,2</sup> File Transfer Profile (FTP) Synchronization Profile (SYNC) Hard Copy Cable Replacement (HCRP) <sup>1,2</sup> Personal Area Networking Profile (PAN) <sup>1,2</sup> Human Interface Device Profile (HID) <sup>1,2</sup> FAX Profile (FAX) Basic Imaging Profile (BIP) <sup>2</sup>
<b>Bluetooth Profiles Supported</b>	





## Summary of Changes

Headset Profile (HSP)  
 Hands Free Profile (HFP)  
 Advanced Audio Distribution Profile (A2DP)

### ENVIRONMENTAL TBD

### COUNTRY OF ORIGIN

China

Type	Description	Part Number
Docking	HP 3001pr USB 3.0 Port Replicator	F3S42AA
	HP 3005pr USB 3.0 Port Replicator	H1L08AA#xxx
	HP Display and Notebook Stand II	E8G00AA#xxx
	Universal Port Replicator	E6D70AA#xxx
	HP UltraSlim Docking Station	D9Y32AA#xxx
Input/Output/Audio	HP USB Travel Mouse	G1K28AA#xxx
	HP Ultrathin Wireless Mouse SE	L9V77AA
	HP Ultrathin Wireless Mouse	L9V78AA
	HP Stereo USB Headset	T1A67AA
	DisplayPort to HDMI Adapter	F3W43AA
	DisplayPort to DVI Adapter	F7W96AA
	Power	HP 45W Smart AC Adapter (4.5mm)
	HP 65W Smart AC Adapter	H6Y89AA#xxx
Storage - External Storage	HP USB External DVDRW Drive	F2B56AA
Security	HP UltraSlim Keyed Cable Lock	H4D73AA
	HP USB Smart Card Reader	F6V67AA



### Summary of Changes

	HP Docking Station Cable Lock	AU656AA#XXX
Display	HP ProDisplay P232	K7X31AA
	HP ProDisplay P222va	K7X30AA
	HP ProDisplay P222c	L4J08AA

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