



Benchmark test results: Copilot+ PCs from Dell compared to MacBook laptops and older Dell devices

In this report, we assessed the following devices:

- Copilot+ PCs running Windows 11 Pro
 - Dell Inspiron™ 5441 with Qualcomm Snapdragon X Plus - X1P42100
 - Dell Inspiron Plus 7441 with Qualcomm Snapdragon X Plus - X1P64100
 - Dell™ Latitude™ 5455 with Qualcomm Snapdragon X Plus - X1P42100*
 - Dell Latitude 7455 with Qualcomm Snapdragon X Elite - X1E80100*
 - Dell Latitude 7455 with Qualcomm Snapdragon X Plus - X1P64100*
 - Dell XPS 13 9345 with Qualcomm Snapdragon X Elite - X1E80100*
 - Dell XPS 13 9345 with Qualcomm Snapdragon X Plus - X1P64100*
- Older Dell laptops running Windows 10 Pro or Windows 10 Home
 - Dell Inspiron 13" 5000 2-in-1 (5379) with Intel® Core™ i5-8250U
 - 2 x Dell Inspiron 15 (3520) with Intel Core i5-1155G7
 - Dell Inspiron 15 7000 2-in-1 (7590) with Intel Core i7-8565U
 - Dell Latitude 5400 with Intel Core i5-8365U
 - Dell Latitude 7400 with Intel Core i7-8665U
 - Dell XPS™ 13" 9365 2-in-1 with Intel Core i5-8200Y
- Apple® MacBook® laptops running macOS® Sequoia
 - Apple MacBook Air® 13" with Apple M2
 - Apple MacBook Air 15" with Apple M2
 - Apple MacBook Air 13" with Apple M3
 - Apple MacBook Air 15" with Apple M3
 - Apple MacBook Pro® 14" with Apple M3

We used three benchmarks for performance testing:

- Cinebench 2024
- Geekbench 6 Pro v6.2.2
- Speedometer 2.1 on Microsoft Edge v128.0.2739.67

We tested battery life with four different tests:

- Windows ADK battery test – Web browsing, which Microsoft created and has used extensively (Windows devices only)
- Windows ADK battery test – Local video playback, which Microsoft created and has used extensively (Windows devices only)
- Custom battery test – Web browsing, which PT created and has used extensively
- Custom battery test – Local video playback, which PT created and has used extensively

We ran each benchmark on each device three times; here, we report the average scores we saw across the three runs. Because the Windows ADK test uses Windows features, it does not run on macOS, so we ran it on only the Windows devices. For all results, higher is better. (The Time to shut down metric in Windows ADK battery life is a projection of how long the battery should last before the system shuts down.) Note that for some devices, we tested multiples of the same device, so in some tables, you may see multiple devices with the same name. For complete results and hardware/software disclosures, see the [science behind the report](#).

*We tested these laptops in May 2024.

Test results

Copilot+ PCs running Windows 11 Pro

Table 1: Results of our testing on the Dell CoPilot+ PCs. For all results, higher is better. For complete results, see the science behind the report.

	Dell Inspiron 5441 Qualcomm Snapdragon X Plus - X1P42100	Dell Inspiron Plus 7441 Qualcomm Snapdragon X Plus - X1P64100	Dell Latitude 5455 Qualcomm Snapdragon X Plus - X1P42100	Dell Latitude 7455 Qualcomm Snapdragon X Elite - X1E80100	Dell Latitude 7455 Qualcomm Snapdragon X Plus - X1P64100	Dell XPS 13 9345 Qualcomm Snapdragon X Elite - X1E80100	Dell XPS 13 9345 Qualcomm Snapdragon X Plus X1P64100
Cinebench 2024							
Multi-core – Average	751.3	794.3	701.0	744.3	709.6	943.3	812.6
Single-core – Average	107.6	108.6	108.3	116.3	109.0	120.3	109.0
Geekbench 6 Pro v6.2.2							
Multi-core – Average	11,445.0	13,323.0	11,465.0	14,925.6	13,453.6	14,799.0	13,205.6
Single-core – Average	2,421.6	2,455.0	2,440.6	2,754.6	2,437.6	2,735.0	2,433.6
Speedometer 2.1 on Edge v128.0.2739.67							
Runs per minute – Average	448.9	439.3	453.0	449.0	423.6	448.0	431.3
Windows ADK battery test – Web browsing (Battery Saver Dim OFF)							
Total duration (min) – Average	877.4	177.1	788.4	158.3	162.9	124.5	192.4
Projected time to shut down (min) – Average	919.0	821.0	842.0	719.6	792.6	577.6	947.6
Windows ADK battery test – Local video playback (Battery Saver Dim OFF)							
Total duration (min) – Average	1,027.9	187.7	972.7	167.3	179.4	176.8	249.5
Projected time to shut down (min) – Average	1,074.6	931.6	1,016.6	783.6	817.3	823.3	1,255.6
Custom battery test – Web browsing							
Total duration (min) – Average	809.0	692.8	753.1	641.0	631.3	530.3	873.7
Custom battery test – Local video playback							
Total duration (min) – Average	1,105.7	847.2	1,053.8	845.0	748.4	822.4	1,302.6

Older Dell devices

Table 2: Results of our testing on the older Dell devices. For all results, higher is better. For complete results, see the science behind the report.

	Dell Inspiron 13" 5000 2-in-1 (5379) Intel Core i5-8250U	Dell Inspiron 15 (3520) Intel Core i5-1155G7	Dell Inspiron 15 (3520) Intel Core i5-1155G7	Dell Inspiron 15 7000 2-in-1 (7590) Intel Core i7-8565U	Dell Latitude 5400 Intel Core i5-8365U	Dell Latitude 7400 Intel Core i7-8665U	Dell XPS 13" 9365 2-in-1 Intel Core i5-8200Y
Cinebench 2024							
Multi-core – Average	165.0	211.0	219.0	199.6	185.0	194.6	68.0
Single-core – Average	52.6	80.6	82.0	66.0	62.0	64.0	37.0
Geekbench 6 Pro v6.2.2							
Multi-core – Average	2,999.6	4,312.0	4,374.0	3,709.3	3,431.0	3,624.0	1,502.6
Single-core – Average	1,195.0	1,918.0	1,928.0	1,501.3	1,363.3	1,412.0	940.3
Speedometer 2.1 on Edge v128.0.2739.67							
Runs per minute – Average	168.0	295.6	293.0	189.3	206.3	224.0	125.6
Windows ADK battery test – Web browsing (Battery Saver Dim OFF)							
Total duration (min) – Average	81.3	65.2	75.8	75.2	148.5	98.6	71.8
Projected time to shut down (min) – Average	354.3	318.0	347.6	363.0	678.3	490.3	337.0
Windows ADK battery test – Local video playback (Battery Saver Dim OFF)							
Total duration (min) – Average	106.3	123.4	121.3	131.6	239.1	193.3	116.4
Projected time to shut down (min) – Average	406.0	491.0	482.3	523.3	938.6	755.0	457.6
Custom battery test – Web browsing							
Total duration (min) – Average	288.2	297.2	295.4	311.6	551.1	388.6	256.8
Custom battery test – Local video playback							
Total duration (min) – Average	390.2	450.3	443.0	499.8	822.6	661.9	565.8

Apple MacBook laptops

Table 3: Results of our testing on the Apple devices we tested. For all results, higher is better. For complete results, see the science behind the report.

	Apple MacBook Pro 14" Apple M3	Apple MacBook Pro 14" Apple M3	Apple MacBook Air 15" Apple M2	Apple MacBook Air 15" Apple M2	Apple MacBook Air 13" Apple M2	Apple MacBook Air 13" Apple M3	Apple MacBook Air 13" Apple M3	Apple MacBook Air 15" Apple M3	Apple MacBook Air 15" Apple M3
Cinebench 2024									
Multi-core – Average	708.6	704.0	558.3	557.3	542.6	575.6	592.0	637.0	635.3
Single-core – Average	142.0	142.0	118.0	118.0	118.0	142.0	142.0	141.6	141.0
Geekbench 6 Pro v6.2.2									
Multi-core – Average	12,044.3	12,049.0	12,044.3	12,049.0	10,150.6	12,038.0	12,004.6	12,044.0	12,029.3
Single-core – Average	3,125.0	3,133.0	2,623.6	2,622.0	2,613.0	3,039.3	3,037.0	3,047.0	3,061.3
Speedometer 2.1 on Edge v128.0.2739.67									
Runs per minute – Average	739.6	744.6	640.2	646.3	643.0	729.3	726.0	728.4	719.0
Custom battery test – Web browsing									
Total duration (min) – Average	745.2	709.5	671.4	715.3	656.9	703.9	710.2	699.2	688.9
Custom battery test – Local video playback									
Total duration (min) – Average	1,091.5	1,043.8	803.0	838.7	805.4	901.8	904.0	841.3	820.3

Comparing the Copilot+ PCs to the older PCs and the Apple MacBook laptops

Table 4: For all benchmarks, the lowest average result, the highest average result, and the average of average results for the two Copilot+ PCs we tested, the older Dell systems we tested, the M2 processor-powered MacBook Air devices we tested, the M3 processor-powered MacBook Air devices we tested, and the M3 processor-powered MacBook Pro devices we tested. For all results, higher is better.

	Copilot+ PC (Dell) devices we tested	Older Dell systems we tested	M2 processor-powered MacBook Air systems we tested	M3 processor-powered MacBook Air systems we tested	M3 processor-powered MacBook Pro systems we tested
Cinebench 2024					
Multi-core – Lowest average across the group of devices	701.0	68.0	542.6	575.6	704.0
Multi-core – Highest average across the group of devices	943.3	219.0	558.3	637.0	708.6
Multi-core – Average of averages across the group of devices	779.5	177.4	552.7	610.0	706.3
Single-core – Lowest average across the group of devices	107.6	37.0	118.0	141.0	142.0
Single-core – Highest average across the group of devices	120.3	82.0	118.0	142.0	142.0
Single-core – Average of averages across the group of devices	111.3	63.4	118.0	141.6	142.0
Geekbench 6 Pro v6.2.2					
Multi-core – Lowest average across the group of devices	11,445.0	1,502.6	10,150.6	12,004.6	12,044.3
Multi-core – Highest average across the group of devices	14,925.6	4,374.0	12,049.0	12,044.0	12,049.0
Multi-core – Average of averages across the group of devices	13,231.0	3,421.8	11,414.6	12,029.0	12,046.6
Single-core – Lowest average across the group of devices	2,421.6	940.3	2,613.0	3,037.0	3,125.0
Single-core – Highest average across the group of devices	2,754.6	1,928.0	2,623.6	3,061.3	3,133.0
Single-core – Average of averages across the group of devices	2,525.4	1,465.4	2,619.5	3,046.1	3,129.0
Speedometer 2.1 on Edge v128.0.2739.67					
Runs per minute – Lowest average across the group of devices	423.6	125.6	640.2	719.0	739.6
Runs per minute – Highest average across the group of devices	453.0	295.6	646.3	729.3	744.6
Runs per minute – Average of averages across the group of devices	441.8	214.5	643.2	725.6	742.1

	Copilot+ PC (Dell) devices we tested	Older Dell systems we tested	M2 processor-powered MacBook Air systems we tested	M3 processor-powered MacBook Air systems we tested	M3 processor-powered MacBook Pro systems we tested
Windows ADK battery test – Web browsing (Battery Saver Dim OFF)					
Total duration (min) – Lowest average across the group of devices	124.5	65.2			
Total duration (min) – Highest average across the group of devices	877.4	148.5			
Total duration (min) – Average of averages across the group of devices	354.4	88.0			
Projected time to shut down (min) – Lowest average across the group of devices	577.6	318.0			
Projected time to shut down (min) – Highest average across the group of devices	947.6	678.3			
Projected time to shut down (min) – Average of averages across the group of devices	802.8	412.6			
Windows ADK battery test – Local video playback (Battery Saver Dim OFF)					
Total duration (min) – Lowest average across the group of devices	167.3	106.3			
Total duration (min) – Highest average across the group of devices	1,027.9	239.1			
Total duration (min) – Average of averages across the group of devices	423.1	147.3			
Projected time to shut down (min) – Lowest average across the group of devices	783.6	406.0			
Projected time to shut down (min) – Highest average across the group of devices	1,255.6	938.6			
Projected time to shut down (min) – Average of averages across the group of devices	957.5	579.1			
Custom battery test – Web browsing					
Total duration (min) – Lowest average across the group of devices	530.3	256.8	656.9	688.9	709.5
Total duration (min) – Highest average across the group of devices	873.7	551.1	715.3	710.2	745.2
Total duration (min) – Average of averages across the group of devices	704.5	341.3	681.2	700.5	727.4
Custom battery test – Local video playback					
Total duration (min) – Lowest average across the group of devices	748.4	390.2	803.0	820.3	1,043.8
Total duration (min) – Highest average across the group of devices	1,302.6	822.6	838.7	904.0	1,091.5
Total duration (min) – Average of averages across the group of devices	960.7	547.6	815.7	866.8	1,067.6

The science behind the report

In this section, we list our complete results and describe the solutions on which we tested and our test methodologies.

We concluded our hands-on testing on October 14, 2024. During testing, we determined the appropriate hardware and software configurations and applied updates as they became available. The results in this report reflect configurations that we finalized on September 16, 2024 or earlier. Unavoidably, these configurations may not represent the latest versions available when this report appears.

Our results

To learn more about how we have calculated the wins in this report, go to <http://facts.pt/calculating-and-highlighting-wins>. Unless we state otherwise, we have followed the rules and principles we outline in that document.

Copilot+ PCs running Windows 11 Pro

Table 5: Results of our testing on the Dell Copilot+ PCs. For all results, higher is better.

	Dell Inspiron 5441 Qualcomm Snapdragon X Plus - X1P42100	Dell Inspiron Plus 7441 Qualcomm Snapdragon X Plus - X1P64100	Dell Latitude 5455 Qualcomm Snapdragon X Plus - X1P42100	Dell Latitude 7455 Qualcomm Snapdragon X Elite - X1E80100	Dell Latitude 7455 Qualcomm Snapdragon X Plus - X1P64100	Dell XPS 13 9345 Qualcomm Snapdragon X Elite - X1E80100	Dell XPS 13 9345 Qualcomm Snapdragon X Plus X1P64100
Cinebench 2024							
Multi-core – Run 1	751.0	779.0	712.0	739.0	698.0	943.0	811.0
Multi-core – Run 2	749.0	803.0	692.0	767.0	724.0	948.0	822.0
Multi-core – Run 3	754.0	801.0	699.0	727.0	707.0	939.0	805.0
Single-core – Run 1	108.0	109.0	108.0	116.0	109.0	121.0	109.0
Single-core – Run 2	108.0	109.0	108.0	116.0	109.0	119.0	109.0
Single-core – Run 3	107.0	108.0	109.0	117.0	109.0	121.0	109.0
Multi-core – Average	751.3	794.3	701.0	744.3	709.6	943.3	812.6
Single-core – Average	107.6	108.6	108.3	116.3	109.0	120.3	109.0

	Dell Inspiron 5441 Qualcomm Snapdragon X Plus - X1P42100	Dell Inspiron Plus 7441 Qualcomm Snapdragon X Plus - X1P64100	Dell Latitude 5455 Qualcomm Snapdragon X Plus - X1P42100	Dell Latitude 7455 Qualcomm Snapdragon X Elite - X1E80100	Dell Latitude 7455 Qualcomm Snapdragon X Plus - X1P64100	Dell XPS 13 9345 Qualcomm Snapdragon X Elite - X1E80100	Dell XPS 13 9345 Qualcomm Snapdragon X Plus X1P64100
Geekbench 6 Pro v6.2.2							
Multi-core – Run 1	11,351.0	13,149.0	11,485.0	14,928.0	13,382.0	14,805.0	13,176.0
Multi-core – Run 2	11,526.0	13,333.0	11,448.0	14,970.0	13,542.0	14,849.0	13,299.0
Multi-core – Run 3	11,458.0	13,487.0	11,462.0	14,879.0	13,437.0	14,743.0	13,142.0
Single-core – Run 1	2,414.0	2,450.0	2,432.0	2,753.0	2,410.0	2,743.0	2,378.0
Single-core – Run 2	2,423.0	2,456.0	2,441.0	2,757.0	2,442.0	2,719.0	2,458.0
Single-core – Run 3	2,428.0	2,459.0	2,449.0	2,754.0	2,461.0	2,743.0	2,465.0
Multi-core – Average	11,445.0	13,323.0	11,465.0	14,925.6	13,453.6	14,799.0	13,205.6
Single-core – Average	2,421.6	2,455.0	2,440.0	2,754.6	2,437.6	2,735.0	2,433.6
Speedometer 2.1 on Edge v128.0.2739.67							
Runs per minute – Run 1	446.0	437.0	453.0	453.0	426.0	457.0	435.0
Runs per minute – Run 2	448.7	439.0	454.0	446.0	427.0	442.0	428.0
Runs per minute – Run 3	452.0	442.0	452.0	448.0	418.0	445.0	431.0
Runs per minute – Average	448.9	439.3	453.0	449.0	423.6	448.0	431.3

	Dell Inspiron 5441 Qualcomm Snapdragon X Plus - X1P42100	Dell Inspiron Plus 7441 Qualcomm Snapdragon X Plus - X1P64100	Dell Latitude 5455 Qualcomm Snapdragon X Plus - X1P42100	Dell Latitude 7455 Qualcomm Snapdragon X Elite - X1E80100	Dell Latitude 7455 Qualcomm Snapdragon X Plus - X1P64100	Dell XPS 13 9345 Qualcomm Snapdragon X Elite - X1E80100	Dell XPS 13 9345 Qualcomm Snapdragon X Plus X1P64100
Windows ADK battery test – Web browsing (Battery Saver Dim OFF)							
Total duration (min) - Run 1	889.0	158.9	796.4	159.5	171.0	120.8	165.6
Projected time to shut down (min) - Run 1	931.0	806.0	849.0	720.0	794.0	578.0	751.0
Total duration (min) - Run 2	869.1	212.6	762.8	168.3	155.6	135.8	204.0
Projected time to shut down (min) - Run 2	911.0	844.0	833.0	693.0	787.0	567.0	1,035.0
Total duration (min) - Run 3	874.4	159.7	806.2	146.9	162.3	117.0	207.6
Projected time to shut down (min) - Run 3	915.0	813.0	844.0	746.0	797.0	588.0	1,057.0
Total duration (min) – Average	877.4	177.1	788.4	158.3	162.9	124.5	192.4
Projected time to shut down (min) – Average	919.0	821.0	842.0	719.6	792.6	577.6	947.6
Windows ADK battery test – Local video playback (Battery Saver Dim OFF)							
Total duration (min) - Run 1	1,027.3	187.6	974.7	183.3	168.8	196.88	252.9
Projected time to shut down (min) - Run 1	1,074.0	917.0	1,018.0	736.0	812.0	800.0	1,260.0
Total duration (min) - Run 2	1,029.3	185.6	974.1	160.2	212.1	163.8	246.1
Projected time to shut down (min) - Run 2	1,076.0	925.0	1,019.0	811.0	844.0	809.0	1,255.0
Total duration (min) - Run 3	1,027.5	189.9	969.5	158.5	157.3	169.9	249.4
Projected time to shut down (min) - Run 3	1,074.0	953.0	1,013.0	804.0	796.0	861.0	1,252.0
Total duration (min) – Average	1,027.9	187.7	972.7	167.3	179.4	176.8	249.5
Projected time to shut down (min) – Average	1,074.6	931.6	1,016.6	783.6	817.3	823.3	1,255.6

	Dell Inspiron 5441 Qualcomm Snapdragon X Plus - X1P42100	Dell Inspiron Plus 7441 Qualcomm Snapdragon X Plus - X1P64100	Dell Latitude 5455 Qualcomm Snapdragon X Plus - X1P42100	Dell Latitude 7455 Qualcomm Snapdragon X Elite - X1E80100	Dell Latitude 7455 Qualcomm Snapdragon X Plus - X1P64100	Dell XPS 13 9345 Qualcomm Snapdragon X Elite - X1E80100	Dell XPS 13 9345 Qualcomm Snapdragon X Plus X1P64100
Custom battery test – Web browsing							
Total duration (min) - Run 1	807.7	702.1	744.4	718.0	676.0	529.9	879.1
Total duration (min) - Run 2	821.7	653.2	758.4	562.4	563.2	531.3	872.2
Total duration (min) - Run 3	797.7	723.1	756.5	642.6	654.8	529.9	870.0
Total duration (min) – Average	809 .0	692.8	753.1	641.0	631.3	530.3	873.7
Custom battery test – Local video playback							
Total duration (min) - Run 1	1,102.4	808.2	1,055.2	793.5	763.8	813.3	1,292.5
Total duration (min) - Run 2	1,108.5	856.8	1,051.1	863.6	824.2	827.6	1,311.9
Total duration (min) - Run 3	1,106.5	876.7	1,055.2	878.0	657.4	826.3	1,303.5
Total duration (min) – Average	1,105.7	847.2	1,053.8	845.0	748.4	822.4	1,302.6

Older Dell devices

Table 6: Results of our testing on the older Dell devices we tested. For all results, higher is better.

	Dell Inspiron 13" 5000 2-in-1 (5379) Intel Core i5-8250U	Dell Inspiron 15 (3520) Intel Core i5-1155G7	Dell Inspiron 15 (3520) Intel Core i5-1155G7	Dell Inspiron 15 7000 2-in-1 (7590) Intel Core i7-8565U	Dell Latitude 5400 Intel Core i5-8365U	Dell Latitude 7400 Intel Core i7-8665U	Dell XPS 13" 9365 2-in-1 Intel Core i5-8200Y
Cinebench 2024							
Multi-core – Run 1	166	209	219	199	184	198	68
Multi-core – Run 2	166	211	218	198	185	194	69
Multi-core – Run 3	163	213	220	202	186	192	67
Single-core – Run 1	53	81	82	66	63	64	37
Single-core – Run 2	53	81	82	66	62	64	37
Single-core – Run 3	52	80	82	66	61	64	37
Multi-core – Average	165.0	211.0	219.0	199.6	185.0	194.6	68.0
Single-core – Average	52.6	80.6	82.0	66.0	62.0	64.0	37.0
Geekbench 6 Pro v6.2.2							
Multi-core – Run 1	2,954	4,351	4,390	3,724	3,385	3,639	1,484
Multi-core – Run 2	3,020	4,324	4,361	3,693	3,452	3,624	1,512
Multi-core – Run 3	3,025	4,261	4,371	3,711	3,456	3,609	1,512
Single-core – Run 1	1,197	1,917	1,931	1,498	1,347	1,395	938
Single-core – Run 2	1,195	1,922	1,930	1,500	1,370	1,422	940
Single-core – Run 3	1,193	1,915	1,923	1,506	1,373	1,419	943
Multi-core – Average	2,999.6	4,312.0	4,374.0	3,709.3	3,431.0	3,624.0	1,502.6
Single-core – Average	1,195.0	1,918.0	1,928.0	1,501.3	1,363.3	1,412.0	940.3
Speedometer 2.1 on Edge v128.0.2739.67							
Runs per minute – Run 1	167	295	294	190	207	224	125
Runs per minute – Run 2	169	297	291	190	206	224	126
Runs per minute – Run 3	168	295	294	188	206	224	126
Runs per minute – Average	168.0	295.6	293.0	189.3	206.3	224.0	125.6

	Dell Inspiron 13" 5000 2-in-1 (5379) Intel Core i5-8250U	Dell Inspiron 15 (3520) Intel Core i5-1155G7	Dell Inspiron 15 (3520) Intel Core i5-1155G7	Dell Inspiron 15 7000 2-in-1 (7590) Intel Core i7-8565U	Dell Latitude 5400 Intel Core i5-8365U	Dell Latitude 7400 Intel Core i7-8665U	Dell XPS 13" 9365 2-in-1 Intel Core i5-8200Y
Windows ADK battery test – Web browsing (Battery Saver Dim OFF)							
Total duration (min) - Run 1	91.9	63.7	70.7	73.9	134.1	98.0	69.0
Projected time to shut down (min) - Run 1	353.0	318.0	340.0	361.0	670.0	484.0	327.0
Total duration (min) - Run 2	76.6	65.3	77.7	76.5	134.2	98.6	70.6
Projected time to shut down (min) - Run 2	357.0	313.0	353.0	362.0	674.0	492.0	336.0
Total duration (min) - Run 3	75.4	66.4	79.0	75.2	177.2	99.3	75.7
Projected time to shut down (min) - Run 3	353.0	323.0	350.0	366.0	691.0	495.0	348.0
Total duration (min) – Average	81.3	65.2	75.8	75.2	148.5	98.6	71.8
Projected time to shut down (min) – Average	354.3	318.0	347.6	363.0	678.3	490.3	337.0
Windows ADK battery test – Local video playback (Battery Saver Dim OFF)							
Total duration (min) - Run 1	107.0	123.8	124.0	131.5	236.9	184.2	118.0
Projected time to shut down (min) - Run 1	408.0	490.0	492.0	522.0	930.0	719.0	464.0
Total duration (min) - Run 2	105.1	123.0	120.2	129.4	238.4	193.7	115.0
Projected time to shut down (min) - Run 2	403.0	493.0	481.0	517.0	936.0	757.0	453.0
Total duration (min) - Run 3	106.8	123.6	119.7	133.9	242.0	202.1	116.1
Projected time to shut down (min) - Run 3	407.0	490.0	474.0	531.0	950.0	789.0	456.0
Total duration (min) – Average	106.3	123.4	121.3	131.6	239.1	193.3	116.4
Projected time to shut down (min) – Average	406.0	491.0	482.3	523.3	938.6	755.0	457.6

	Dell Inspiron 13" 5000 2-in-1 (5379) Intel Core i5-8250U	Dell Inspiron 15 (3520) Intel Core i5-1155G7	Dell Inspiron 15 (3520) Intel Core i5-1155G7	Dell Inspiron 15 7000 2-in-1 (7590) Intel Core i7-8565U	Dell Latitude 5400 Intel Core i5-8365U	Dell Latitude 7400 Intel Core i7-8665U	Dell XPS 13" 9365 2-in-1 Intel Core i5-8200Y
Custom battery test – Web browsing							
Total duration (min) - Run 1	285.0	297.4	296.5	311.3	549.9	375.5	255.5
Total duration (min) - Run 2	289.8	297.6	297.1	312.2	555.6	388.3	260.9
Total duration (min) - Run 3	290.0	296.8	292.6	311.3	547.9	402.1	254.2
Total duration (min) – Average	288.2	297.2	295.4	311.6	551.1	388.6	256.8
Custom battery test – Local video playback							
Total duration (min) - Run 1	387.6	434.6	449.6	543.9	821.0	661.4	602.5
Total duration (min) - Run 2	389.9	453.0	436.0	478.7	826.6	667.0	483.6
Total duration (min) - Run 3	393.1	463.3	443.4	477.0	820.2	657.5	611.3
Total duration (min) – Average	390.2	450.3	443.0	499.8	822.6	661.9	565.8

Apple MacBook laptops

Table 7: Results of our testing on the Apple devices we tested. For all results, higher is better.

	Apple MacBook Pro 14" Apple M3	Apple MacBook Pro 14" Apple M3	Apple MacBook Air 15" Apple M2	Apple MacBook Air 15" Apple M2	Apple MacBook Air 13" Apple M2	Apple MacBook Air 13" Apple M3	Apple MacBook Air 13" Apple M3	Apple MacBook Air 15" Apple M3	Apple MacBook Air 15" Apple M3
Cinebench 2024									
Multi-core – Run 1	704.0	700.0	559.0	558.0	545.0	581.0	600.0	637.0	635.0
Multi-core – Run 2	709.0	702.0	555.0	554.0	546.0	583.0	599.0	641.0	636.0
Multi-core – Run 3	713.0	710.0	561.0	560.0	537.0	563.0	577.0	633.0	635.0
Single-core – Run 1	142.0	142.0	118.0	118.0	118.0	142.0	142.0	141.0	141.0
Single-core – Run 2	142.0	142.0	118.0	118.0	118.0	142.0	142.0	142.0	141.0
Single-core – Run 3	142.0	142.0	118.0	118.0	118.0	142.0	142.0	142.0	141.0
Multi-core – Average	708.6	704.0	558.3	557.3	542.6	575.6	592.0	637.0	635.3
Single-core – Average	142.0	142.0	118.0	118.0	118.0	142.0	142.0	141.6	141.0
Geekbench 6 Pro v6.2.2									
Multi-core – Run 1	12,078.0	12,054.0	10,135.0	10,170.0	10,152.0	12,006.0	12,029.0	11,969.0	12,054.0
Multi-core – Run 2	12,076.0	12,027.0	10,131.0	10,134.0	10,166.0	12,029.0	11,948.0	12,079.0	12,017.0
Multi-core – Run 3	11,979.0	12,066.0	10,100.0	10,141.0	10,134.0	12,079.0	12,037.0	12,084.0	12,017.0
Single-core – Run 1	3,122.0	3,135.0	2,626.0	2,624.0	2,610.0	3,033.0	3,028.0	3,045.0	3,049.0
Single-core – Run 2	3,134.0	3,137.0	2,623.0	2,622.0	2,610.0	3,043.0	3,043.0	3,046.0	3,065.0
Single-core – Run 3	3,119.0	3,127.0	2,622.0	2,620.0	2,619.0	3,042.0	3,040.0	3,050.0	3,070.0
Multi-core – Average	12,044.3	12,049.0	12,044.3	12,049.0	10,150.6	12,038.0	12,004.6	12,044.0	12,029.3
Single-core – Average	3,125.0	3,133.0	2,623.6	2,622.0	2,613.0	3,039.3	3,037.0	3,047.0	3,061.3

	Apple MacBook Pro 14" Apple M3	Apple MacBook Pro 14" Apple M3	Apple MacBook Air 15" Apple M2	Apple MacBook Air 15" Apple M2	Apple MacBook Air 13" Apple M2	Apple MacBook Air 13" Apple M3	Apple MacBook Air 13" Apple M3	Apple MacBook Air 15" Apple M3	Apple MacBook Air 15" Apple M3
Speedometer 2.1 on Edge v128.0.2739.67									
Runs per minute – Run 1	737.0	744.0	643.0	645.0	643.0	726.0	721.0	728.3.0	722.0
Runs per minute – Run 2	744.0	745.0	640.0	648.0	647.0	732.0	731.0	728.0	716.0
Runs per minute – Run 3	738.0	745.0	637.8	646.0	639.0	730.0	726.0	729.0	719.0
Runs per minute – Average	739.6	744.6	640.2	646.3	643.0	729.3	726.0	728.4	719.0
Custom battery test – Web browsing									
Total duration (min) - Run 1	747.6	709.6	672.2	719.6	663.5	697.6	705.6	706.6	696.6
Total duration (min) - Run 2	752.5	717.5	670.6	709.6	647.5	709.5	714.5	687.5	674.5
Total duration (min) - Run 3	735.6	701.5	671.6	716.6	659.5	704.5	710.5	703.5	695.5
Total duration (min) – Average	745.2	709.5	671.4	715.3	656.9	703.9	710.2	699.2	688.9
Custom battery test – Local video playback									
Total duration (min) - Run 1	1,073.8	1,042.8	807.9	844.7	800.6	918.7	913.7	851.7	829.7
Total duration (min) - Run 2	1,121.8	1,059.7	801.6	838.7	812.7	903.9	899.6	848.6	805.6
Total duration (min) - Run 3	1,078.8	1,028.8	799.7	832.7	803.0	882.7	898.7	823.6	825.6
Total duration (min) – Average	1,091.5	1,043.8	803.0	838.7	805.4	901.8	904.0	841.3	820.3

System configuration information

Table 8: Detailed information on the systems we tested.

System configuration information	Dell Inspiron 5441	Dell Inspiron 14 Plus 7441	Dell Latitude 5455	Dell Latitude 7455	Dell Latitude 7455	Dell XPS 13 9345	Dell XPS 13 9345
Processor							
Vendor	Intel	Qualcomm	Intel	Qualcomm	Qualcomm	Qualcomm	Qualcomm
Model number	Snapdragon X Plus – X1P-42-100	Snapdragon X Plus - X1P-64-100	Snapdragon X Plus – X1P-42-100	Snapdragon X Elite - X1E-80-100	Snapdragon X Plus - X1P-64-100	Snapdragon X Elite - X1E-80-100	Snapdragon X Plus - X1P-64-100
Core frequency (GHz)	3.2	3.4	3.2	3.4	3.4	3.4	3.4
Number of cores	8	10	8	12	10	12	10
Memory							
Amount (GB)	16	16	16	32	16	64	16
Type	LPDDR5x	LPDDR5X-8448	LPDDR5X	LPDDR5X-8448	LPDDR5X-8448	LPDDR5X-8448	LPDDR5X-8448
Graphics							
Vendor	Qualcomm	Qualcomm	Qualcomm	Qualcomm	Qualcomm	Qualcomm	Qualcomm
Model number	Adreno X1-45 GPU	Adreno GPU	Adreno X1-45 GPU	Adreno GPU	Adreno GPU	Adreno GPU	Adreno GPU
Storage							
Amount	512GB	1TB	512GB	512GB	512GB	2TB	2TB
Type	SSD	Samsung PM9C1a	SSD	Western Digital PC SN740	Western Digital PC SN740	Samsung PM9A1	Samsung PM9A1
Connectivity/expansion							
Wireless internet	Qualcomm FastConnect 7800 Wi-Fi 7 Dual Band Simultaneous Network Adapter	Qualcomm FastConnect 7800 Wi-Fi 7 Dual Band Simultaneous Network Adapter	Qualcomm FastConnect 7800 Wi-Fi 7 Dual Band Simultaneous Network Adapter	Qualcomm FastConnect 7800 Wi-Fi 7 Dual Band Simultaneous Network Adapter	Qualcomm FastConnect 7800 Wi-Fi 7 Dual Band Simultaneous Network Adapter	Qualcomm FastConnect 7800 Wi-Fi 7 Dual Band Simultaneous Network Adapter	Qualcomm FastConnect 7800 Wi-Fi 7 Dual Band Simultaneous Network Adapter
Battery							
Rated capacity (Wh)	54	54	54	54	54	55	55
Display							
Size (inches)	14	14	14	14	14	13.4	13.4
Resolution	1,920 x 1,200	2,560 x 1,600	1,920 x 1,200	2,560 x 1,600	2,560 x 1,600	2,880 x 1,800	1,920 x 1,200

System configuration information	Dell Inspiron 5441	Dell Inspiron 14 Plus 7441	Dell Latitude 5455	Dell Latitude 7455	Dell Latitude 7455	Dell XPS 13 9345	Dell XPS 13 9345
Operating system							
Vendor	Microsoft	Microsoft	Microsoft	Microsoft	Microsoft	Microsoft	Microsoft
Name	Windows 11 Pro	Windows Pro Insider Preview	Windows 11 Pro	Windows Pro Insider Preview	Windows Pro Insider Preview	Windows Pro Insider Preview	Windows Pro Insider Preview
Version	24H2 Build 26100.1742	24H2 Build 26097.5003	24H2 Build 26100.1591	24H2 Build 26097.5003	24H2 Build 26097.5003	24H2 Build 26097.5003	24H2 Build 26097.5003
BIOS							
BIOS name and version	Dell Inc. 1.1.0	Dell 1.0.1	Dell Inc. 1.0.0	Dell Inc. 1.0.1	Dell Inc. 1.0.1	Dell Inc. 1.0.3	Dell Inc. 1.0.3
Dimensions							
Height (inches)	0.60 - 0.63	0.58-0.67	0.60 - 0.63	0.67	0.67	0.58	0.58
Width (inches)	12.36	12.36	12.36	12.36	12.36	11.62	11.62
Depth (inches)	8.81	8.81	8.81	8.81	8.81	7.84	7.84
Weight (lbs.)	3.37	3.17	3.37	3.17	3.17	2.61	2.6

Table 9: Detailed information on the older systems we tested.

System configuration information	Dell Inspiron 13" 5000 2-in-1 (5379)	Dell Inspiron 15 (3520)	Dell Inspiron 15 7000 2-in-1 (7590)	Dell Latitude 5400	Dell Latitude 7400	Dell XPS 13" 9365 2-in-1
Processor						
Vendor	Intel	Intel	Intel	Intel	Intel	Intel
Model number	Core i5-8250U	Core i5-1155G7	Core i7-8565U	Core i5-8365U	Core i7-8665U	Core i5-8200Y
Core frequency (GHz)	1.6-3.4	2.5-4.5	1.8-4.6	1.6-4.1	1.9-4.8	1.3-3.9
Number of cores	4	4	4	4	4	2
Number of Threads	8	8	8	8	8	4
Memory						
Amount (GB)	8 GB	8 GB	16 GB	16 GB	16 GB	8 GB
Type	DDR4-2400	DDR4-3200	DDR4-2667	DDR4-2400	DDR4-2400	DDR3-1866
Graphics						
Vendor	Intel	Intel	NVIDIA	Intel	Intel	Intel
Model number	UHD Graphics 620	Iris Xe Graphics	GeForce MX250	UHD Graphics 620	UHD Graphics 620	UHD Graphics 615

System configuration information	Dell Inspiron 13" 5000 2-in-1 (5379)	Dell Inspiron 15 (3520)	Dell Inspiron 15 7000 2-in-1 (7590)	Dell Latitude 5400	Dell Latitude 7400	Dell XPS 13" 9365 2-in-1
Storage						
Amount	256 GB	512 GB	512 GB	512 GB	512 GB	256 GB
Type	SK Hynix SC311 SATA	KIOXIA KXG80ZNV512G NVMe	Intel H10 HBRPEKKNX0202A NVMe	Samsung MZVLB512HAJQ-000L7	PC501 NVMe SK hynix	SK Hynix PC401 NVMe
Connectivity/expansion						
Wireless internet	Qualcomm QCA61x4A	Realtek 8821CE	Intel Wireless-AC 9560	Intel Wireless-AC 9560	Intel Wireless-AC 9560	Intel 8265
Battery						
Rated capacity (Wh)	42	41	68	68	60	46
Display						
Size (inches)	13.3	15.6	15.6	14	14	13.3
Resolution	1920x1080	1920 x 1080	3840x2160	1920 x 1080	1920 x 1080	1920x1080
Operating system						
Vendor	Microsoft	Microsoft	Microsoft	Microsoft	Microsoft	Microsoft
Name	Windows 10 Home	Windows 10 Home	Windows 10 Home	Windows 10 Pro	Windows 10 Pro	Windows 10 Home
Version	22H2	22H2	22H2	22H2	22H2	22H2
BIOS						
BIOS name and version	Dell 1.19.0	Dell 1.22.0	Dell 1.19.0	Dell Inc. 1.28.0	Dell Inc. 1.28.0	Dell 2.24.0
Dimensions						
Height (inches)	0.77	0.67 - 0.83	0.71 - 0.78	0.82	0.72	0.32 - 0.54
Width (inches)	12.76	14.11	14.08	12.7	12.65	11.98
Depth (inches)	8.85	9.27	9.4	8.5	8.42"	7.8
Weight (lbs.)	3.7	3.65	3.99	3.26	3.11	2.7

Table 10: Detailed information on the Apple systems we tested.

System configuration information	Apple MacBook Pro 14" Apple M3	Apple MacBook Pro 14" Apple M3	Apple MacBook Air 15" Apple M2	Apple MacBook Air 15" Apple M2	Apple MacBook Air 13" Apple M2	Apple MacBook Air 13" Apple M3	Apple MacBook Air 13" Apple M3	Apple MacBook Air 15" Apple M3	Apple MacBook Air 15" Apple M3
Processor									
Vendor	Apple	Apple	Apple	Apple	Apple	Apple	Apple	Apple	Apple
Model number	M3	M3	M2	M2	M2	M3	M3	M3	M3
Core frequency (GHz)	4.05	4.05	3.49	3.49	3.49	4.05	4.05	4.05	4.05
Number of cores	8	8	8	8	8	8	8	8	8
Memory									
Amount (GB)	8	8	8	8	8	8	8	8	8
Type	Unified	Unified	Unified	Unified	Unified	Unified	Unified	Unified	Unified
Graphics									
Vendor	Apple	Apple	Apple	Apple	Apple	Apple	Apple	Apple	Apple
Model number	M3 10-core GPU	M3 10-core GPU	M2 10-core GPU	M2 10-core GPU	M2 8-core GPU	M3 8-core GPU	M3 8-core GPU	M3 10-core GPU	M3 10-core GPU
Storage									
Amount (GB)	512	512	256	256	256	256	256	256	256
Type	SSD	SSD	SSD	SSD	SSD	SSD	SSD	SSD	SSD
Connectivity/expansion									
Wireless internet	Wi-Fi 6E	Wi-Fi 6E	Wi-Fi 6	Wi-Fi 6	Wi-Fi 6	Wi-Fi 6E	Wi-Fi 6E	Wi-Fi 6E	Wi-Fi 6E
Battery									
Rated capacity (Wh)	70	70	66.5	66.5	52.6	52.6	52.6	66.5	66.5
Display									
Size (inches)	14.2	14.2	15.3	15.3	13.6	13.6	13.6	15.3	15.3
Resolution	3,024 x 1,964	3,024 x 1,964	2,880 x 1,864	2,880 x 1,864	2,560 x 1,664	2,560 x 1,664	2,560 x 1,664	2,880 x 1,864	2,880 x 1,864
Operating system									
Vendor	Apple	Apple	Apple	Apple	Apple	Apple	Apple	Apple	Apple
Name	macOS Sequoia	macOS Sequoia	macOS Sequoia	macOS Sequoia	macOS Sequoia	macOS Sequoia	macOS Sequoia	macOS Sequoia	macOS Sequoia
Version	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0

System configuration information	Apple MacBook Pro 14" Apple M3	Apple MacBook Pro 14" Apple M3	Apple MacBook Air 15" Apple M2	Apple MacBook Air 15" Apple M2	Apple MacBook Air 13" Apple M2	Apple MacBook Air 13" Apple M3	Apple MacBook Air 13" Apple M3	Apple MacBook Air 15" Apple M3	Apple MacBook Air 15" Apple M3
BIOS									
BIOS name and version	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dimensions									
Height (inches)	0.61	0.61	0.45	0.45	0.44	0.44	0.44	0.45	0.45
Width (inches)	12.31	12.31	13.40	13.40	11.97	11.97	11.97	13.40	13.40
Depth (inches)	8.71	8.71	9.35	9.35	8.46	8.46	8.46	9.35	9.35
Weight (lbs.)	3.4	3.4	3.3	3.3	2.7	2.7	2.7	3.3	3.3

How we tested

Setting up the systems (Windows)

Setting up and updating the OEM image

1. Boot the system.
2. Follow the on-screen instructions to complete installation, using the default selections when appropriate.
3. Set the Windows (plugged in) Power Mode to Best Performance.
4. Set Screen and Sleep options to Never:
 - Right-click the desktop, and select Display settings.
 - Select System from the left-hand column.
 - Click Power & Battery.
 - For all power options listed under Screen and Sleep, select Never.
5. Disable User Account Control notifications.
 - Select Windows Start, type UAC and press Enter.
 - Move the slider control to Never notify, and click OK.
6. Run Windows Update, and install all updates available.
7. Verify the date and time are correct, and synchronize the system clock with the time server.
8. Pause Automatic Windows Updates.
 - Click the Windows Start button.
 - Type Windows Update settings and press Enter.
 - From the Pause updates drop-down menu, select Pause for 5 weeks.

Measuring performance (Windows)

Cinebench 2024 benchmark

Setting up the test

1. Download and install Cinebench from <https://www.maxon.net/en/downloads/cinebench-2024-downloads>.

Running the benchmark

1. Launch Cinebench.
2. Select File→Advanced benchmark.
3. Set the Minimum Test Duration to Off.
4. Select CPU (Multi Core), CPU (Single Core), or GPU, and click Start
5. Record the result.
6. Wait 15 minutes before re-running.
7. Repeat steps 1 through 6 twice more, and report the averages of the results.

Geekbench 6 Pro

Setting up the test

1. Purchase a Pro license, and download and install Geekbench 6 Pro from <https://www.geekbench.com/download/>.

Running the test

1. Launch Geekbench.
2. Click Run CPU Benchmark.
3. Record the result.
4. Wait 5 minutes before re-running.
5. Repeat steps 1 through 4 twice more, and report the averages of the results.

3DMark

Setting up the test

1. Download 3DMark from <http://www.futuremark.com/benchmarks/3dmark/all>.
2. To install 3DMark with the default options, double-click the 3DMark installer.exe file.
3. To launch 3DMark, double-click the 3DMark desktop icon.
4. Enter the registration code, and click Register.
5. Exit 3DMark.

Running the test

1. Launch the 3Dmark benchmark.
2. At the 3DMark Home screen, underneath the Wild Life Extreme Benchmark, click Run.
3. When the benchmark run completes, record the results.
4. Perform steps 2 through 3 twice more, and report the averages of the results.

Speedometer 2.1

Running the test

1. In a browser, navigate to <https://browserbench.org/Speedometer2.1/>.
2. Click Start Test.
3. When the benchmark run completes, record the results.
4. Perform steps 2 through 3 twice more, and report the averages of the results.

Measuring battery life (Windows)

Windows ADK: Local video playback battery rundown

Setting up the test

1. Verify that the displays will remain constant during the test:
 - Right-click the desktop and select Display settings.
 - Uncheck the box next to Change brightness automatically when lighting changes, if available.
 - Uncheck the box next to Change brightness based on content, if available.
 - Select System from the left-hand column.
 - Click Power & Battery.
 - For all power options listed under Screen and Sleep, select Never.
 - Set Turn battery saver on automatically at 20%.
 - Uncheck the box next to Lower screen brightness when user battery saver.
2. Create a folder on the root of C:\ named data
3. Create a folder on the root of C:\ named adk
4. Place adk test files into the C:\data\ folder.
5. Move the contents of the EE_LFSVP_ToS folder into the C:\adk\ folder.
6. Using a nit meter, adjust the screen brightness to as close to 150 nits as possible.
7. Open PowerShell as administrator and run `Set-ExecutionPolicy bypass`
8. Type A to choose yes to all, and press enter.
9. Run `Get-ChildItem -Path 'C:\adk' -Recurse | Unblock-File`
10. Navigate to C:\data\prep\.
11. Enter `runme.bat` to run the system prep command.

Running the test

1. After the prep command completes, wait 2 minutes before proceeding.
2. Open an elevated command prompt.
3. Navigate to C:\adk\
4. With the system plugged in and charged to 100%, enter `runjob.cmd` to run the local video playback battery rundown test.
5. Click Run job on this computer.
6. Click Start.
7. At the Assessment is Beginning screen, click next.
8. When prompted to unplug the system, do so.
9. When the test completes, record the results.
10. Plug the system in and charge back to 100%.
11. Repeat steps 2 through 10 twice more, and report the averages of the results.

Windows ADK: Web Browsing battery rundown

Setting up the test

1. Verify that the displays will remain constant during the test:
 - Right-click the desktop, and select Display settings.
 - Uncheck the box next to Change brightness automatically when lighting changes, if available.
 - Uncheck the box next to Change brightness based on content, if available.
 - Select System from the left column.
 - Click Power & Battery.
 - For all power options listed under Screen and Sleep, select Never.
 - Set Turn battery saver on automatically at 20%.
 - Uncheck the box next to Lower screen brightness when user battery saver.
2. Using a nit meter, adjust the screen brightness to as close to 150 nits as possible.
3. Open Edge, and navigate to `edge://settings/help` to identify the version number for the Edge browser.
4. Apply any Edge updates that are available.
5. Open Device Manager, and make sure there are no yellow bangs or unknown devices.
6. Open the Microsoft Store, and update all applications.
7. Open PowerShell as administrator, and run `Set-ExecutionPolicy bypass`
8. Type A to choose yes to all, and press Enter.
9. Run `winget upgrade -all -include-unknown`
10. Open the system settings, and make sure the date and time are synchronized on the system under test.
11. Disable any keyboard backlights.
12. Make sure the Microsoft Edge language is set to English at `edge://settings/languages`
13. In the Edge settings, remove any profiles that have been added.
14. Open an elevated command prompt.
15. Navigate to C:\data\prep\
16. Enter `runme.bat` to run the system prep command.

Running the test

1. After the prep command completes, wait 2 minutes before proceeding.
2. Create a folder on the root of C:\ named data.
3. Place adk test files into the C:\data\ folder.
4. Navigate to <https://developer.microsoft.com/en-us/microsoft-edge/tools/webdriver/>
5. Download the appropriate x64 or ARM64 version of the webdriver that matches the current Edge version number.
6. Extract `msedgedriver.exe` to C:\data\test\bin\
7. Open the `parameters.abl.credentials.json` file located in C:\data\asmt\Assessment2\scenarios in notepad and enter the credentials for the outlook.com account used.
8. Open an elevated command prompt.
9. Run `Get-ChildItem -Path 'C:\data' -Recurse | Unblock-File`
10. Navigate to C:\data\asmt\
11. Run `RunJobABLTraining.cmd`

12. Click Start.
13. At the Assessment Beginning screen, click Next.
14. Unplug the system when prompted.
15. When the training command is complete, plug the system back in, and make sure it charges to 100%.
16. Open an elevated command prompt.
17. Navigate to C:\data\asmt\
18. Run RunJobABLTrained.cmd
19. When the test is complete, record the results and copy the results folder to Documents.
20. Plug the system in, and charge it back to 100%.
21. Open Explorer, and delete the entire C:\data folder.
22. Repeat steps 1 through 21 twice more, and report the averages of the results.

PT custom test: Local video playback battery rundown

Setting up the test

1. Turn on the systems.
2. Copy the test video file and battery life logger to each system.
3. In Explorer, right-click the script, and click Properties.
4. Check Unblock file, and click OK.
5. Verify that the displays will remain on during the test:
 - Right-click the desktop, and select Display settings.
 - Uncheck the box next to Change brightness automatically when lighting changes, if available.
 - Uncheck the box next to Change brightness based on content, if available.
 - Select System from the left column.
 - Click Power & Battery.
 - For all power options listed under Screen and Sleep, select Never.
 - Set Turn energy saver on automatically at 20%.
 - Check the box next to Lower screen brightness when using energy saver.
6. Set the system volume to 60 dbA with a decibel meter.
7. To bring up a white screen, open a web browser and type `about:blank` into the address bar.
8. Unplug the system.
9. Using a nit meter, adjust the screen brightness to as close to 150 nits as possible.
10. Plug in the system.
11. Open PowerShell as administrator and run `Set-ExecutionPolicy Unrestricted`
12. Type `A` to choose yes to all, and press enter.
13. Open Control Panel, and click Hardware and Sound.
14. Click Power Options, and click Change plan settings on the currently selected power plan.
15. Click Change advanced power settings.
16. Set the Low battery notification on Battery to Off.
17. Open Microsoft Store, click the profile button at the top, and click Settings.
18. Turn off App updates.

Running the test

1. Verify that the system's battery is fully charged.
2. Open an elevated PowerShell and type `start-process "C:\Program Files\Windows Defender\MpCmdRun.exe" ("BuildSFC -Timeout 7200000") -Wait.`
3. After the command completes, type `start "rundll32.exe" ("advapi32.dll,ProcessIdleTasks") -Wait.`
Do not interact with the system until the command completes.
4. After the command completes, reboot the system.
5. Wait 5 minutes before proceeding.
6. Launch the test video file in full screen mode with Repeat enabled.
7. Open an elevated PowerShell and navigate to the directory containing the battery life logger script.
8. Type `.\<battery_script_name>.ps1` and press Enter to run the script.
9. Unplug the system when prompted and switch back to the full screen video.
10. When the test is complete, plug in the system and start it.
11. In Explorer, navigate to C:\ptbat\.
12. Open the folder corresponding with the date and time of the test and record the results from `batresults_minutes.txt`.
13. Repeat steps 1 through 12 twice more, and report the averages of the results.

PT custom test: Web browsing battery rundown

Setting up the test

1. Turn on the systems.
2. Copy the battery life logger and website iterator to each system.
3. In Explorer, right-click each script, and click Properties.
4. Check Unblock file, and click OK.
5. Verify that the displays will remain constant during the test:
 - Right-click the desktop, and select Display settings.
 - Uncheck the box next to Change brightness automatically when lighting changes, if available.
 - Uncheck the box next to Change brightness based on content, if available.
 - Select System from the left column.
 - Click Power & Battery.
 - For all power options listed under Screen and Sleep, select Never.
 - Set Turn energy saver on automatically at 20%.
 - Check the box next to Lower screen brightness when using energy saver.
6. Set the system volume to 60 dbA with a decibel meter.
7. To bring up a white screen, open a web browser and type `about:blank` into the address bar.
8. Unplug the system.
9. Using a nit meter, adjust the screen brightness to as close to 150 nits as possible.
10. Plug in the system.
11. Open PowerShell as administrator and run `Set-ExecutionPolicy Unrestricted`
12. Type `A` to choose yes to all and press enter.
13. Open Control Panel, and click Hardware and Sound.

14. Click Power Options, and click Change plan settings on the currently selected power plan.
15. Click Change advanced power settings.
16. Set the Low battery notification on Battery to Off.
17. Click the Windows start icon, and in the search field, type `regedit`. To open the Registry Editor, press Enter.
18. Navigate to `HKEY_LOCAL_MACHINE→SOFTWARE→Policies→Microsoft→Edge`.
19. If necessary, create the Edge folder by right-clicking in the right-hand pane, clicking New Key, and typing Edge.
20. Right-click in the right pane, click New DWORD (32-bit) Value, type `HideRestoreDialogEnabled`, and press enter.
21. Double-click `HideRestoreDialogEnabled`, and in the value data field, type `1`. Click OK.
22. Open Microsoft Store, click the profile button at the top, and click Settings.
23. Turn off App updates.

Running the test

1. Verify that the system's battery is fully charged.
2. Open an elevated PowerShell and type `start-process "C:\Program Files\Windows Defender\MpCmdRun.exe" ("BuildSFC -Timeout 7200000") -Wait`.
3. After the command completes, type `start "rundll32.exe" ("advapi32.dll,ProcessIdleTasks") -Wait`. Do not interact with the system until the command completes.
4. After the command completes, reboot the system.
5. Wait 5 minutes before proceeding.
6. Open an elevated PowerShell and navigate to the directory containing the battery life logger script.
7. Type `.\<battery_script_name>.ps1`
8. Open a second elevated PowerShell and navigate to the directory containing the website iterator script.
9. Type `.\<website_script_name>.ps1 -t`
10. Click Enter in each PowerShell window to run both scripts.
11. Unplug the system when prompted.
12. When the test is complete, plug in the system and start it.
13. In Explorer, navigate to `C:\ptbat\`.
14. Open the folder corresponding with the date and time of the test and record the results from `batresults_minutes.txt`.
15. Repeat steps 1 through 14 twice more, and report the averages of the results.

Setting up the system (macOS)

Setting up and updating the OEM image

1. Boot the system.
2. Follow the on-screen instructions to complete installation, using the default selections when appropriate.
3. Set Screen and Sleep options to Never.
 - Select System Settings.
 - Select Lock Screen.
 - Change the following options to Never:
 - Start Screen Saver when inactive.
 - Turn display off on battery when inactive.
 - Turn display off on power adapter when inactive.
 - Require password after screen saver begins or display is turned off.
 - Return to System Settings and select Battery.
 - Set On power adapter setting to High Power (Note: this is not an option available on all Macs).
 - Click Options.
 - Disable the Slightly dim the display on battery option.
4. Disable automatically adjust brightness.
 - Select System Settings.
 - Select Display.
 - Disable Automatically adjust brightness.
5. Run Software Update, and install all updates available.
6. Verify the date and time are correct.
7. Enable Automatic log in.
 - Select System Settings.
 - Click Users & Groups.
 - Select the drop down menu next to the Automatically log in as setting, and select the User account.
8. Disable Automatic Mac Updates.
 - Select System Settings.
 - Click General.
 - Click on Software Update.
 - Click the information icon next to Automatic updates.
 - Disable Check for updates.

Measuring performance (macOS)

Cinebench 2024 benchmark

Setting up the test

1. Download and install Cinebench from <https://www.maxon.net/en/downloads/cinebench-2024-downloads>.

Running the benchmark

1. Launch Cinebench.
2. Select File→Advanced benchmark.
3. Set the Minimum Test Duration to Off.
4. Select either CPU (Multi Core), CPU (Single Core), or GPU, and click Start.
5. Record the result.
6. Wait 15 minutes before re-running.
7. Repeat steps 1 through 6 twice more, and report the averages of the results.

Geekbench 6 Pro

Setting up the test

1. Purchase a Pro license and download and install Geekbench 6 Pro from <https://www.geekbench.com/download/>.

Running the test

1. Launch Geekbench.
2. Click Run CPU Benchmark.
3. Record the result.
4. Wait 5 minutes before re-running.
5. Repeat steps 1 through 4 twice more, and report the averages of the results.
6. After the first-time setup has successfully finished, the system is ready to run the benchmark.

3DMark

Setting up the test

1. Download 3DMark from the App Store.

Running the test

1. Launch 3Dmark.
2. Scroll through the benchmarks until you reach Wild Life Extreme Benchmark, and click Run.
3. When the benchmark run completes, record the results.
4. Perform steps 2 and 3 twice more, and report the averages of the results.

Speedometer 2.1

Running the test

1. In a browser, navigate to <https://browserbench.org/Speedometer2.1/>.
2. Click Start Test.
3. When the benchmark run completes, record the results.
4. Perform steps 2 and 3 twice more, and report the averages of the results.

Measuring battery life (macOS)

PT custom test: Local video playback battery rundown

Setting up the test

1. Turn on the systems.
2. Copy the test video file and battery life logger to each system.
3. Open Terminal, and navigate to the directory containing the script.
4. Run `chmod +x .\<script_name>.sh` to make the script executable.
5. Set the system volume to 60 dbA with a decibel meter.
6. Verify that the displays will remain on during the test:
 - Select System Settings.
 - Select Lock Screen.
 - Change the following options to Never:
 - Start Screen Saver when inactive.
 - Turn display off on battery when inactive.
 - Turn display off on power adapter when inactive.
 - Require password after screen saver begins or display is turned off.
 - Return to System Settings and select Battery.
 - Set On power adapter setting to High Power (Note: this is not an option available on all Macs).
 - Click Options.
 - Disable the Slightly dim the display on battery option.
 - Return to System Settings and select Display.
 - Disable Automatically adjust brightness.
7. To bring up a white screen, open a web browser and type `about:blank` into the address bar.
8. Unplug the system.
9. Using a nit meter, adjust the screen brightness to as close to 150 nits as possible.
10. Plug in the system.

Running the test

1. Verify that the system's battery is fully charged.
2. Launch the test video file in full screen mode with Loop enabled.
3. Open Terminal and navigate to the directory containing the battery life logger script.
4. Type `.\<battery_script_name>.sh` and press Enter to run the script.

5. Unplug the system when prompted, and switch back to the full screen video.
6. When the system has shut down, plug in the system, and start it.
7. In Finder, navigate to `/var/pt_results/batterylife`.
8. Open the folder corresponding with the date and time of the test and records the results from `batresults_minutes.txt`.
9. Repeat steps 1 through 8 twice more, and report the averages of the results

PT custom test: Web browsing battery rundown

Setting up the test

1. Turn on the systems.
2. Copy the web iterator script and battery life logger to each system.
3. Open Terminal, and navigate to the directory containing the scripts.
4. Run `chmod +x .\ for each script to make the scripts executable.`
5. Set the system volume to 60 dbA with a decibel meter.
6. Verify that the displays will remain on during the test:
 - Select System Settings.
 - Select Lock Screen.
 - Change the following options to Never:
 - Start Screen Saver when inactive.
 - Turn display off on battery when inactive.
 - Turn display off on power adapter when inactive.
 - Require password after screen saver begins or display is turned off.
 - Return to System Settings and select Battery.
 - Set On power adapter setting to High Power (Note: this is not an option available on all Macs).

- Click Options.
 - Disable the Slightly dim the display on battery option.
 - Return to System Settings and select Display.
 - Disable Automatically adjust brightness.
7. To bring up a white screen, open a web browser and type `about:blank` into the address bar.
 8. Unplug the system.
 9. Using a nit meter, adjust the screen brightness to as close to 150 nits as possible.
 10. Plug in the system.

Running the test

1. Verify that the system's battery is fully charged.
2. Open Terminal and navigate to the directory containing the battery life logger script.
3. Type `.\<battery_script_name>.sh`.
4. Open a second Terminal, and navigate to the directory containing the website iterator scripts.
5. Type `.\<website_script_name>.sh -t`.
6. Press Enter in each Terminal window to run both scripts.
7. Unplug the system when prompted.
8. When the system has shut down, plug in the system, and start it.
9. In Finder, navigate to `/var/pt_results/batterylife`.
10. Open the folder corresponding with the date and time of the test and records the results from `batresults_minutes.txt`.
11. Repeat steps 1 through 10 twice more, and report the averages of the results.

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