

## Welcome to the Copilot+ PC Generation

Powered by Qualcomm Snapdragon X Series Processors

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## Introduction

## Copilot+ PCs are the fastest, most intelligent Windows PCs ever.



With the introduction of the Copilot+ PC category this year, Microsoft has kicked off the next generation of Windows devices, partnering with a vast ecosystem of system partners, silicon and technology providers, and software vendors to enable a new paradigm of personal computing. Copilot+ PCs are a class of computers that provide new Al experiences and capabilities not seen previously on a PC. With Windows 10 support ending on October 14th, 2025, now is the perfect time to consider upgrading. Copilot+ PCs provide cutting-edge AI capabilities, delivering unmatched power and performance that push the boundaries of what users can expect from their devices, making them an excellent choice for forward-thinking consumers and businesses.

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These breakthroughs enable you to perform tasks previously impossible on the PC. Use Recall (Preview) to effortlessly find and remember content you've viewed; generate and refine Al images almost instantly on your device with Cocreator; and overcome language barriers using Live Captions, which translates audio from over 40 languages into English.

This category also pushes the boundaries
of what is possible in terms of standard
compute performance and battery
life working with silicon partners like
Qualcomm to provide processors with
amazing power efficiency. This means
consumers with Copilot+ PCs can
generally expect longer battery life than
on any previous Windows laptops and

even competing MacBook Air laptops. On top of amazing battery life, performance across traditional and new Al-enabled applications will set a new bar for how laptops on both Windows and Mac are measured going forward.

Copilot+ PCs are now available from every major system OEM and come in a wide range of form-factors, price points, and screen sizes. This report will look at the latest offerings powered by the new Qualcomm Snapdragon X Elite and X Plus family of processors.

## The New Qualcomm Snapdragon X Series

The latest generation of Qualcomm<sup>®</sup> Snapdragon<sup>®</sup> processors for Windows laptops is a massive leap over previous generation products, offering classleading power efficiency, incredibly highperformance CPU cores, and the first Copilot+ ready NPU with 45 TOPS of computing power. The new X Series family of products has three different product lines that help span the entire Copilot+ PC segment while offering uniform NPU performance on the entire line to ensure optimal AI application performance.

The Snapdragon X Elite is the highest performing part in Qualcomm's lineup and offers 12 CPU cores, all utilizing the same architecture and design, ensuring optimal performance and compatibility in multithreaded applications. The Adreno GPU provides more than enough power for mainstream gaming on the go for more than 4.6 TFLOPS of rated performance. At 45 TOPS, the Hexagon Neural Processing Unit (NPU) was the first to meet the performance requirements of Microsoft a the Copilot+ PC feature set.

Qualcomm's heritage in the smartphone market brings a unique focus on power efficiency in addition to performance. Use in the smartphone market expect all-day battery life under continuous usage and that's the promise the Snapdragon X Series brings to the Windows laptop segment as well. All the Copilot+ PCs powered by the

	new Snapdragon chips offer incredible	S
	battery life, and as we'll show in our testing,	
	puts Windows in a new position against	
	competitors like the MacBook Air.	
t		E
	Systems powered by the X Series of	
	processors from Qualcomm span price	
nd	points starting at \$700 but scale up to the	G
	most premium tiers of laptops. This breadth	
	of offerings from the Snapdragon product	
	line empowers laptop buyers in basically	
	any price range to benefit from and	P
ers	experience the AI PC ecosystem to utilize	
	the Copilot+ features and capabilities that	
	Microsoft has brought to market.	







## Testing Comparison

For our system testing comparison today we are going to look at a couple of different laptops based on the Qualcomm Snapdragon X Series, both X Elite and X Plus 8-core. To show the generational performance advancements that come with this new Copilot+ PC line we have included a system based on the previous Snapdragon platform for Windows. To highlight how this segment of PCs compares to the Apple MacBook line we have performance from both the Apple M3-based MacBook Air and the M2-based model, showing a span of pricing options on the Mac that are currently available today, both running the latest MacOS Sequoia.

	Snapdragon Vendor A	Snapdragon Vendor B	Snapdragon Vendor C	8cx Gen 3 / SQ3	MacBook Air M3	MacBook Air M2
CPU	X1E-80-100	X1P-42-100	X1P-42-100	Microsoft SQ3	M3	M2
CPU Cores	12-cores	8-cores	8-cores	8-cores	4 P-cores 4 E-cores	4 P-cores 4 E-cores
CPU Clock	3.8 GHz base 4.0 GHz boost	3.4 GHz base	3.4 GHz base	2.4 GHz base 3.0 GHz boost	Up to 4.0 GHz	Up to 3.5 GHz
GPU	4.6 TFLOPS	1.7 TFLOPS	1.7 TFLOPS	3.0 TFLOPS	10-core	10-cores
NPU	45 TOPS	45 TOPS	45 TOPS	15 TOPS	18 TOPS	15.8 TOPS
Memory	16GB	16GB	16GB	16GB	16GB	16GB
Screen Size	15"	14"	14"	13"	15"	13"

8 USS 19 USS	RB1 23 RB2 24 RB3 25 RB4 25 RB5 26	P1 204R
14 RC3/5CL - 15 RC4/SDA 27 RB6/PGC 28 RB7/PGD 1 MCLR	RAD 2 RA1 3 RA2 4 RA2 5 RA3 5 RA4 6 RA5 7	



# Power Efficiency and Battery Life

One of the most important characteristics of picking a new PC is the real-world battery life you can expect from using the device day-in and day-out. All aspects of battery life are important: during active use in both high and lowperformance workloads, while watching video or other passive activities, and the ability for the system to handle standby power so it's always ready when you pull it out of your bag, even if it has been a few days.

We've already discussed how the Snapdragon X Elite and X Plus processors offer amazing power efficiency thanks in part to Qualcomm's background and heritage in the smartphone world, where battery life is THE critical determinant. There are many considerations when looking at battery life of a laptop including battery capacity itself, but also screen size, screen technology, screen brightness, and of course the platform itself. Signal65 testing considers all of this in our analysis and testing, providing real-world results.



There are three different tests above. The first is the Procyon Office Productivity test that measures battery life while looping through some easy-to-moderate workloads using the Microsoft Office suite of applications. The three Snapdragon X Series platforms provide more than 14.5 hours of battery life in this situation, more than enough for a full day's work, and then some. The Vendor B X Plus 8-core system, with its low power screen implementation, offers a stunning 23.5 hours of working time, giving users the ability to go multiple days to a week without needing to charge their device. The Apple MacBook Air systems do not support this benchmark, so results for it are not included.

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## **Battery Testing**

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### Power Efficiency and Battery Life

The second test looks at our custom Signal65 web browsing battery testing scenario, which uses Google Chrome and loops through different websites, scrolling, watching streaming video, all with multiple tabs open. At nearly 15 hours, all the Snapdragon platforms offer enough browsing time to get any user through a couple of days. That Vendor B X Plus 8-core system result again stands out, coming in at almost 21 hours of browsing battery life! The previous generation of Snapdragon processors only provided 8 hours of battery life in this scenario, nearly half of the lowest of the new platforms. The MacBook Air powered by the M3 manages 13.5 hours of battery life in this result, 90 minutes less than the lowest result we have for Snapdragon and Copilot+ PCs. Finally, is the video playback test, where battery life is measured using an offline video, which is repeated for the duration of the test. The Snapdragon-based Copilot+ PCs all resulted in at least 17.1 hours of usage, with the longest result again coming from the Vendor B system with the Snapdragon X Plus at 27 hours – a really astounding result! The MacBook Air M3 was just around 17.5 hours of usage in this scenario, putting it in line with the lower of our Copilot+ PC time.

#### Summary

The battery and power efficiency results on the Snapdragon X Elite and X Plus Copilot+ PCs clearly show that the advantage of Qualcomm's new SoC architecture, the efficiency of the Oryon cores used in it, and how the company started with a goal of optimizing for this vector of performance and succeeded. One of Microsoft's key drivers for the Copilot+ PC segment is to advance and improve the entire ecosystem of Windows PCs relative to previous generation products and the competitive landscape that Apple has changed. And in our battery testing results, this goal is clearly achieved.





# High Performance CPU Cores

Building a platform that is power efficient doesn't mean that you have to sacrifice performance. In fact, when it launched, the Snapdragon X Elite processor was the fastest Windows laptop CPU and brought a new level of competition to the MacBook line thanks to its unique architecture and 12-core design. Both the X Elite and the X Plus, in both 10-core and 8-core configurations, offer outstanding computing capability in both single threaded and multi-threaded workloads.



In this chart we compare performance on all platforms across the Geekbench and Cinebench family of tests. These help us understand the peak and sustained performance of the platforms, though of course more real-world application tests add to the clarity and focus of any comparisons. Scores are shown relative to the performance of the previousgeneration Snapdragon 8cx Gen 3 / SQ3 system.

#### CPU Benchmarks

The range of performance on the X Elite and X Plus laptops comes from the difference in core count (X Plus here is 8-core and the X Elite is 12-core) and CPU frequency. The X Elite model tested has a boost clock capability of over 4.0 GHz while the X Plus platforms tested don't utilize boost and maintain a peak clock of 3.4 GHz on all cores. The difference in peak performance is more on the multi-threaded results (up to 28% in Cinebench 2024) than the single threaded results (roughly 12% on both).



## High Performance CPU Cores

Looking at the generational compare, the new X Elite and X Plus platforms offer a significant upgrade in capability. Single threaded performance is up to 70% faster and multi-threaded performance jumps by as much as 2.1x thanks to both the new core design and an increase in core count. Users of previous Windows-on-Snapdragon system will immediately notice an impact of upgrading to an X Elite Copilot+ PC. The M3-based MacBook Air has strong performance on the single threaded results in both tests but falls behind both the X Elite and the X Plus platforms in the multithreaded Cinebench 2024 score. Multi-threaded results are more indicative of heavy multi-tasking, using content creation tools, and just generally working on more items and applications at the same time and its impressive to see that even the Snapdragon X Plus 8-core, with a target price for systems in the \$700-900 range, can outperform a much more expensive M3 MacBook Air 15" (priced at about \$1700). When we add in the M2 MacBook Air 13" that sells for a bit less, that gap increases further. Snapdragon X Series processors offer up to 43% faster multi-threaded performance than Apple MacBook Air



### High Performance CPU Cores



#### **Procyon Office Productivity**

The Procyon Office Productivity performance data is based on the same kind of testing as our battery life analysis, but this time we are focused on the time to complete the functions and observed performance of each system.

The first observation here is that the generation-on-generation comparison between the X Series of processors and the previous Snapdragon laptop shows significant gains even in office workloads. The X Elite is more than 70% faster overall and up to 75% faster in

the PowerPoint results, and even the lower priced and lower core-count X Plus product is up to 58% faster overall and 67% faster in that same subtest. Consumers and enterprise users should have no reservations about the Snapdragon processors being deployed in commercial environments.

The comparisons to the MacBook Air show us that the X Elite is outperforming the M3-based system, while the X Plus outperforms the M2based laptop. In fact, the X Plus makes a great attempt at overtaking the M3based system but falls just a few points short in each subtest.

#### Summary

The general performance of the new Copilot+ PCs based on Snapdragon X Elite and X Plus processor is a significant improvement over the previous generation of Windowson-Arm designs while providing leadership performance in key tests against the fastest MacBook Air available today. Additionally, with the broad price spectrum provided by the entire family of Copilot+ PC enabled Snapdragon parts, consumers get not just amazing performance but also better performance per dollar too.



## NPU Al Performance

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The 45 TOPS NPU on the Qualcomm Snapdragon X Series of	
processors is one of the most critical new features that it offers and	1.0
provides the capabilities not just for the wide array of Copilot+ PC	
features but also enabled a new generation of AI application developer	0.8
to take advantage of the performance and efficiency it provides.	0.6
Microsoft has been incredibly bullish on the NPU as an accelerator for	0.0
the PC space and its value for AI PCs that want to both operate in a	0.4
high-performance manner, but also do so with extreme efficiency to	
not impact battery life and user experience.	0.2
Measuring performance of the NPU can be a complicated process as	
there are benchmarks and still a small (but growing) number of real-	0.0
world applications.	

The Procyon AI tests aim to look at performance of the NPU through different AI models that might apply to the consumer space. We are looking at performance of an INT8/quantized format, the AI processing format that is most likely to be used for consumer applications and accelerators. (Note that we changed the relative comparison so that the Vendor A system with the X Elite is 1.0x because the SQ3 performed so differently in this test as to make the charts unreadable.)



Al Benchmarks



### NPU AI Performance

All three of the results based on the Snapdragon X Elite or X Plus processors are performing essentially identical thanks to matching 45 TOPS Hexagon NPUs. This demonstrates the advantages of Qualcomm's decision to not tier or change performance of its NPU based on the placement of the processor in the family, ensure that all users get optimal performance, rather than skewing performance for Al tools and background activities to higher end, higher priced systems. The neural processor on the Apple M3 based MacBook Air performs slower than the Snapdragon based Copilot+ PCs in our AI testing, where even the lower cost X Plus solutions are around 45% faster. The Apple M2 fares worse at only half the performance of the Snapdragon processors.



#### Summary

The NPU on the Copilot+ PCs powered by the Qualcomm Snapdragon X Elite and X Plus are nearly twice as performance as the competing Apple MacBook Air M2 laptop and this kind of performance and efficiency is what allows Microsoft to integrate the features and capabilities promised by the Copilot+ program. The decision by Qualcomm to keep the performance of the NPU the same across the entire family of processors means that no user is left out of the AI PC transition, regardless of the price point of the system they purchase.



## Real World Al Performance

We are in the early stages of defining what an Alenabled PC will be, and what a Copilot+ PC will be to consumers that buy in. But because we are in this ecosystem shift, and the application landscape continues to change day after day, it's worth exploring some use cases and workloads that we have been testing on the Snapdragon X Series based laptops.

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increasing the neural networks size, it enables more accurate and higher quality music separation, required more processing power and thus is only enabled on Copilot+ PCs with the higher performance integrated NPUs.

work faster.

Djay Pro

#### Djay Pro (https://www.algoriddim.com/djay-

pro-windows) allows users to mix music from their laptop with professional-grade tools. The Neural Mix tech enables users to remix individual elements from multiple tracks by separating the music into its components in real-time. You can isolate drums, instruments, and vocals of any song based on cuttingedge AI; that of course runs on the NPU in Snapdragon X Series chips.

This is one of those tools that even if you aren't a professional or aspiring DJ, is just fun to use and play with! Even if you do not accel in the musical arts, it is clear just in engaging with the capabilities that this kind of tool can be an incredibly powerful enabler for those learning the craft or experts that just want to move and

The developer, Algoriddim, has said that by



### Real World Al Performance

#### **GIMP with Stable Diffusion Plugin**

GIMP is an open-source image and photo editing software tool that offers powerful functionality and features. It is known for its extensibility as well through plugins, and it's that feature that has allowed silicon vendors to custom make stable diffusion generative AI capabilities for it.

As part of its Snapdragon X Series rollout, Qualcomm engineering created a plugin specifically for GIMP (https://github.com/quic/ wos-ai-plugins/tree/main/plugins/gimp/stablediffusion) that integrates text-based image generation, currently integrating SD v1.5. It's available on GitHub freely for anyone with a Snapdragon-based Copilot+ PC to install and experiment with.

The process is simple, and the results are impressive. In the screenshot above you can see that the plugin is utilizing the 45 TOPS

Hexagon NPU for the image generation, and our prompt of a "beautiful mountain vista" results in exactly that. There are a handful of options for the number of inference steps (affecting quality), setting the seed value (that randomizes the AI output), or adjusting the guidance scale (how much the model sticks to your prompt vs being creative).

Performance is excellent and the experience will feel like magic to those that haven't utilized generative AI capabilities previously. Its value for real work is clear, if you are comfortable with the quality of results that come from the SD v1.5 model.



## Windows Copilot+ Features and Capabilities

In addition to the emphasis on performance and battery life that Microsoft has put on this new laptop category, a brand-new set of features on Windows 11 will only work when you have a Copilot+ PC with a dedicated NPU. Recall (Preview)

Recall (Preview) is a feature that allows you to find things on your computer that you have seen, viewed, or read previously. It works by monitoring activity on the PC, using Al language models to analyze the images and words to really understand them, then creates a highly secure on-device vector database of that content for easy searching later. It can be quite difficult to just describe the power of this kind of feature, so it's better to look at a video of Recall (Preview) in action. Recall (Preview) is shifting from a preview broadly available for Copilot+ PCs on June 18, 2024, to a preview available first to members of Microsoft's Windows Insider Program starting in October. After Microsoft gets feedback on Recall (Preview) from the Windows Insider community, they plan to make Recall (Preview) available more widely to customers with Copilot+ PCs through a post-launch Windows Update.

Did you happen to look at a pair of shoes on your social media browsing last week but can't remember the brand or the style?



Using Recall (Preview) to search for "red shoes Instagram" utilizes the on-device AI engines to search that database and find what you were looking at, bringing it back on the screen so you can read the page and find all the information you need. Remember a video conference you had with a potential client that was wearing a black hat but not their name? Searching for "teams call man wearing black hat" can save you once again!

Recall (Preview) is a feature that has the power to fundamentally change how we interact with the data, ideas, and content that we use on our PC every day and it requires high performance, highly efficient Al processing on the NPU in the background to make this possible.

Windows Copilot+ Features and Capabilities

#### Cocreator

With an update to the Paint app on your Windows Copilot+ PC, Cocreator is multimodal with support for both text-to-image and image-to-image generation, and allows you to combine both an input field and a drawing pad input where you use your finger, mouse or cursor to roughly outline an idea, to create an Al-generated image. There is a slider that allows you adjust the level of 'creativity' – basically how much you want it to adhere to your original sketch or not – and some additional style options like 8-bit or watercolor, to add a specific tone.



This function utilizes the NPU on the Copilot+ PC and you can see in the image above the activity running on that NPU when you move the slider position, change the text prompt, or change the drawing pad.



### Windows Copilot+ Features and Capabilities



### Photos Restyle Image and Image Creator

Restyle Image and Image Creator are features in the Microsoft Photos app, exclusive to Copilot+ PCs, that let you reimagine your photos or create new imagery with the help of Al. With Restyle Image you can add contextual Al-generated styles to your pictures, by choosing one of the curated, pre-built options and adjusting the creativity slider, or by creating your own custom style with a text prompt.

With Image Creator, you can create new images by entering a text description of what you'd like to see. Both features use proprietary and open-source AI models that are finetuned by Microsoft. The models come with your Copilot+ PC





### Windows Copilot+ Features and Capabilities



Borderlands 3, 2K Games

### **Automatic Super Resolution**

Auto SR is a Microsoft specific gaming feature that is part of the Copilot+ PC lineup. It uses the dedicated NPU to implement super resolution technology directly at the OS level. This means the game itself can render an image at a lower resolution (and do so faster) and Auto SR will upscale it to improve image quality while providing a higher frame rate.





### **Windows Studio Effects**

Windows Studio Effects is the name for the AI-powered video and audio effects that are available on Copilot+ PCs with compatible NPUs. They include creative filters, portrait light & blur, eye contact adjustment, and voice focus. This works by modifying the outbound and inbound audio and video feed to enhance the conference call experience for users on both sides. Some Windows Studio Effects features, like creative filters, portrait light, and eye contact: teleprompter, are unique to Copilot+ PCs.

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### Windows Copilot+ Features and Capabilities



## Live Captions

Live Captions can detect up to 44 different languages and handle real-time translations of that audio into English, making more content across the globe more accessible to users anywhere. And it works across any audio stream on your laptop without requiring any developer intervention.





## Conclusion

The era of the Copilot+ PC is here now, and Microsoft has partnered with Qualcomm to develop an amazing family of processors to power them. While the emphasis on the Copilot+ PC program is clearly around the adoption of AI-enabled Windows features and applications courtesy of the new NPU dedicated AI acceleration engine that is built into the Snapdragon X Elite and X Plus processors, that's not all the brand represents. Consumers buying a Copilot+ PC can be sure they are getting one of the fastest and most efficient laptops with some of the best battery life on the market; and we aren't only referring to the Windows laptop market.

Our time with the new Snapdragon X Elite

and X Plus powered laptops used in this report has been eye opening, resulting in several key findings.

First, the Snapdragon X Elite and X Plus laptops have class-leading battery life and power efficiency, providing consumers with multi-day usage without needing to charge. And this is across a range of tests including office productivity work, video playback, and web browsing. This kind of battery confidence was mostly missing silicon partners is bearing fruit.

And finally, the AI performance and features that Snapdragon-based Copilot+ PCs bring to the table open the door for a new era of the PC, with a dedicated 45 from the Windows ecosystem before, but TOPS NPU across all versions of the X the partnership between Microsoft and its Series product line. This means users that buy a \$700 Copilot+ PC, or a \$1700 one, Second, the performance of both the X can be sure that they aren't getting left out Elite and X Plus processors is phenomenal, of the AI PC revolution. And by offering up



offering leadership multi-threaded results compared to the Apple M3- and M2-based MacBook Air laptops. And the single threaded performance is very competitive, especially when considering the performance per dollar you can get with the broad range of laptop options based on this family of processors.

to 75% more AI performance than the latest M3-based MacBook Air, Copilot+ PCs with Snapdragon in them will be at the forefront of that revolution for some time to come.







Important Information About this Report

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## Inquiries

Contact us if you would like to discuss this report and Signal65 will respond promptly.

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Signal65 provides research, analysis, advising, and lab services to many high-tech companies, including those mentioned in this paper. Research of this document was commissioned by Microsoft.

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## **About Signal65**

Signal65 exists to be a source of data in a world where technology markets and product landscapes create complex and distorted views of product truth. We strive to provide honest and comprehensive feedback and analysis for our clients in order for them to better understand their own competitive positioning and create optimal opportunities to market and message their devices and services.



## System Configurations

	Snapdragon X Plus 42-100 (Vendor C)	Snapdragon X Plus 42-100 (Vendor B)
CPU	Snapdragon X Plus 42-100	Snapdragon X Plus 42-100
Graphics	Qualcomm Adreno X1-45	Qualcomm Adreno X1-45
NPU	Qualcomm Hexagon NPU	Qualcomm Hexagon NPU
RAM	16GB LPDDR5X-8448	16GB LPDDR5X-8448
Storage	512GB NVMe	256GB NVMe
OS Build	Windows 11 26100.1457	Windows 11 26100.1457
Windows Power Mode (Performance)	Best Performance	Best Performance
Windows Power Mode (Battery Tests)	Best Power Efficiency	Best Power Efficiency
<b>OEM Power Settings (Performance)</b>	Performance	N/A
OEM Power Settings (Battery Tests)	Silent	N/A
Virtualization Based Security	Enabled	Enabled

### **Applications Used**

Geekbench 6.3.0 Cinebench 2024.0.1 3DMark 2.29.8294 UL Procyon 2.8.1352 Microsoft Office 365 2409 Adobe Photoshop 25.12 Adobe Lightroom Classic 13.5.1



Snapdragon X Elite 80-100 (Vendor A)	Microsoft SQ3 (Vendor D)	MacBook Air 15" - M3	MacBook Air 13" - M2
Snapdragon X Elite 80-100	Microsoft SQ3	Apple M3	Apple M3
Qualcomm Adreno X1-85	Qualcomm Adreno	Integrated	Integrated
Qualcomm Hexagon NPU	Qualcomm Hexagon NPU	Apple Neural Engine	Apple Neural Engine
16GB LPDDR5X-8448	16GB LPDDR4X-2092	16GB LPDDR5X-6400	16GB LPDDR5X-6400
512GB NVMe	512GB NVMe	256GB NVMe	512GB NVMe
Windows 11 26100.1457	Windows 11 26100.1457	MacOS Sequoia 15.0	MacOS Sequoia 15.0
Best Performance	Best Performance	N/A	N/A
Recommended	Recommended	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
Enabled	Enabled	N/A	N/A

