

ASX RELEASE

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ASX: NVU

EMASS Achieves Breakthrough Performance in Image Recognition and Voice Command Benchmarks for System-on-a-Chip (SoC)

Results Demonstrate Energy Efficiency Up to 287x Greater Than Leading Peers

Highlights:

- **ECS-DOT Chipset** by Embedded A.I. Systems Pte. Ltd (EMASS) has demonstrated **peer leading energy efficiency**, outperforming industry leaders and peers (in anomaly detection and keyword spotting benchmarks).
- **Benchmark results validate** the SoC's potential to handle computationally intensive, yet energy-efficient tasks, such as **2D to 3D data conversion** based on **eye tracking**, crucial for real-time, adaptive user interactions.
- In the **Anomaly Detection Benchmark**, the ECS-DOT Chipsets achieved **1.22 ms** execution time with **0.8 microjoules** of energy per inference, representing up to **~287x improvement** in energy efficiency over the best public results reported by **STMicroelectronics (US ~\$24B Market Cap¹)**.
- For the **Keyword Spotting Benchmark**, the ECS-DOT Chipsets achieved **3.9ms** execution time and **3.07 microjoules** of energy per inference, delivering a **10x energy efficiency** improvement compared to **Syntiant's Core (~US\$500m valuation²)**.
- **ECS-DOT Chipsets** deliver high performance in ultra-low-power settings, making them ideal for **real-time, energy-sensitive applications** such as **IoT devices, wearables, and smart technology**, where power efficiency is paramount.
- Embedded AI Systems has successfully tested all **MLPerf Tiny benchmarks** and is exploring additional publicly available benchmarks to showcase the superior performance of the ECS-Dot Chipsets in 2D to 3D visual transformation and other various AI applications.

Nanoveu Limited ("Nanoveu" or the "Company") (ASX: NVU) is pleased to announce that it has completed comprehensive, industry-standard, benchmark testing for EMASS's ECS-DOT SoC (System on Chip) chipset in the categories of Anomaly Detection and Keyword Spotting.

EMASS' ECS-Dot chipset has demonstrated exceptional results in the latest benchmarking evaluations covering Anomaly Detection and Keyword Spotting. The ECS-Dot chipset has outperformed leading competitors and peers, including Qualcomm and Himax showcasing significantly superior energy efficiency. These results position the company as an industry front runner in ultra-low-power embedded AI applications.

¹ [STMicroelectronics N.V. Common Stock \(STM\) Stock Price, Quote, News & History | Nasdaq](#)

² [Syntiant - Funding, Financials, Valuation & Investors](#)

Benchmarking Results and Significance:

Anomaly Detection is a technique used in artificial intelligence and data analysis to identify data points, patterns, or behaviors that deviate significantly from what is considered "normal" or expected. It is particularly valuable in fields where detecting rare or unexpected events is essential for system reliability, security, or personalisation. Anomaly Detection is crucial for applications involving 2D to 3D data conversion based on eye tracking. By detecting abnormalities in user engagement, Anomaly Detection enables systems to adapt dynamically to unexpected behaviors, enhancing accuracy and responsiveness. This technology helps maintain seamless, intuitive, real-time interactions, allowing for a more personalised and immersive user experience.

Keyword Spotting is a fundamental component for **interactive language models**. This capability enables devices to "wake up" in response to specific speech triggers, activating more complex applications only when needed. This approach allows sophisticated systems to remain idle when not in use, conserving significant amounts of energy. Instead of continuously running background processes, Keyword Spotting allows for an efficient, speech-based AI interface that triggers larger systems on demand. This innovation is especially impactful for devices requiring low-power, "always-on" capabilities, as it ensures energy-efficient performance without sacrificing functionality

In the **Anomaly Detection** benchmark, Embedded AI Systems achieved the same level of accuracy as the best publicly available results, with an execution time of **1.22 ms** but with an energy consumption of only **0.8 microjoules**. This represents an **over 200x improvement** in energy efficiency compared to the best previously reported results by STMicroelectronics.

For **Keyword Spotting**, the ECS-Dot Chipsets achieved an execution time of **3.9 ms** and consumed just **3.07 microjoules** of energy per inference, translating to **over 10x energy efficiency gains** compared to the best results reported by Syntiant.

These significant results underscore the ECS-Dot Chipset's ability to deliver high performance computation in ultra-low-power settings, making it an ideal choice for real-time, energy-sensitive applications.







Anomaly Detection Benchmark			
Metric	STMicroelectronics NUCLEO-U575ZI-Q (NUCLEO-L4R5ZI)	EMASS ECS-DOT	Remarks
			
 Execution time (ms)	3.43 (5.26)	1.22	
 Energy Consumption (µJ)	81.88 (203.37)	0.8	102.3x (254.2x) Lower energy
 Energy-delay product (n J.s)	280.85 (1069.73)	0.976	287.7x (1096.03x) improved energy efficiency
 Clock Frequency (MHz)	160 (120)	50	Low operating frequency is typical for edge devices for better efficiency and lower thermal dissipation

Table 1: Anomaly Detection Benchmark compared to STMicroelectronics NUCLEO-U575ZI-Q

Anomaly Detection Benchmark







Metric	<div> <div>STMicroelectronics NUCLEO-H7A3ZI-Q</div> <div>EMASS ECS-DOT</div> </div>		Remarks
			
 Execution time (ms)	1.23	1.22	
 Energy Consumption (μJ)	165.73	0.8	207.16x lower energy
 Energy-delay product (n J.s)	203.85	0.976	208.9x improved energy efficiency
 Clock Frequency (MHz)	280	50	Low operating frequency is typical for edge devices for better efficiency and lower thermal dissipation

Table 2: Anomaly Detection Benchmark compared to STMicroelectronics NUCLEO-H7A3ZI-Q

Keyword Spotting Benchmark







Metric	<div> <div>Syntiant Core³ (Market Leader)</div> <div>EMASS ECS-DOT</div> </div>		Remarks
			
 Execution time (ms)	1.48 (4.37)	3.9	
 Energy Consumption (μJ)	43.8 (31.54)	3.07	14.3x (10.3x) Lower energy
 Energy-delay product (n J.s)	64.82 (137.83)	11.973	5.4x (11.51x) improved energy efficiency
 Clock Frequency (MHz)	98.7 (30.7)	50	Low operating frequency is typical for edge devices for better efficiency and lower thermal dissipation

Table 3: Keyword Spotting Benchmark compared to Syntiant

Embedded AI Systems has successfully examined all MLPerf Tiny benchmarks and is actively exploring other publicly available benchmarks to showcase the superior efficacy of its ECS-Dot Chipsets across various AI applications. This commitment highlights the company's dedication to incessant improvement and industry leadership in energy-efficient AI solutions and continuous improvement of the EyeFly3D™ platform for delivering glasses-free 3D experiences.

In the first benchmarking results announced³ in October 2024, EMASS demonstrated **20x lower energy consumption compared to peers** validating the potential for image conversion in an energy efficient manner which is important for EyeFly3D™ applications.

- In the category of **Person Detection** EMASS had set a new benchmark for AI processing, achieving a remarkable latency of 5.2 ms per inference while consuming a mere 3.7 microjoules of energy.
- For **Image Classification**, the company's solution demonstrated 6.3ms latency per inference while consuming only 5.5 microjoules of energy. This performance is 20x lower in energy consumption compared to previous results reported by other edge AI chipset companies including Syntiant, Ambiq, Himax and Maxim integrated.

³ ASX announcement 22 October 2024





Metric (single image inference)		Syntiant Core ³ (Market Leader)	EMASS ECS-DOT	Remarks
	Execution time (ms)	5.1 (16)	6.3	Similar latency, equivalent accuracy
	Energy Consumption (μJ)	139.4 (101.8)	5.5	27.88x (18.5x) lower energy
	Energy-delay product (n J.s)	710.94 (1628.8)	34.65	20.5x (47x) improved energy efficiency
	Clock Frequency (MHz)	98.7 (30.7)	50	Low operating frequency is typical for edge devices for better efficiency and lower thermal dissipation

Table 4: Execution time and Energy consumption of ECS-Dot chipset against the best performing edge AI SoC with public available data in the Image Classification Benchmark

Embedded AI Systems continues to lead the charge in developing energy-efficient, high-performance AI solutions for IoT, wearable devices, and other real-time applications. The company is actively expanding its portfolio by exploring new benchmarks to further demonstrate the capabilities of the ECS-Dot Chipsets in a wide range of AI driven technologies in areas such as:

- **2D to 3D Conversion:** In digital twin technology, it creates real-time 3D models for virtual testing and optimization of industrial systems.
- **Self-Navigation of Drones:** In Agriculture IoT, drones autonomously monitor crops and manage farm operations.
- **Autonomous Driving Systems:** In transport and logistics, AI-powered systems allow vehicles to navigate and make decisions independently, optimize transportation and reduce delivery times in urban areas.
- **Robotics:** In manufacturing, robotics automate assembly lines, enhancing precision and efficiency. In healthcare, robots assist in surgeries and patient care, improving outcomes with minimal human intervention.
- **Smart Home Systems:** In retail, they enable seamless in-store experiences like voice-activated shopping and personalized services.
- **Security and Surveillance:** In urban infrastructure, AI-powered surveillance systems monitor public spaces for safety and emergency response.

Commenting on the benchmarking results, Mohamed M. Sabry Aly, Founder of EMASS technology, said, “We are extremely proud of the performance shown by our ECS-Dot Chipsets in these benchmarks. These results highlight our continuous drive for innovation in ultra-low-power AI solutions. By achieving such energy-efficient performance without compromising on accuracy, we are opening new possibilities for embedded AI applications across various industries.”

This announcement has been authorised by the Board of Directors of Nanoveu Limited.

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About Nanoveu Limited

Nanoveu is a company specialising in advanced films and coatings. <https://www.nanoveu.com/>.

Further details on the Company can be found at <https://wcsecure.weblink.com.au/pdf/NVU/02656570.pdf>.

EyeFly3D™

The EyeFly3D™ platform is a comprehensive solution for delivering glasses-free 3D experiences across a range of devices and industries. At its core, EyeFly3D™ combines advanced screen technology, sophisticated software for content processing, and now, with the integration of EMASS's ultra-low-power SoC, powerful hardware.

Nanoshield™ - is a self-disinfecting film that uses a patented polymer of embedded Cuprous nanoparticles to provide antiviral and antimicrobial protection for a range of applications, from mobile covers to industrial surfaces. Applications include:

Nanoshield™ Marine, which prevents the growth of aquatic organisms on submerged surfaces like ship hulls, and

Nanoshield™ Solar, designed to prevent surface debris on solar panels, thereby maintaining optimal power output.

EMASS (to be acquired by Nanoveu, subject to shareholder approval⁴)

EMASS is a pioneering technology company specialising in the design and development of advanced systems-on-chip (SoC) solutions. These SoCs enable ultra-low-power, AI-driven processing for smart devices, IoT applications, and 3D content transformation. With its industry-leading technology, EMASS will enhance Nanoveu's portfolio, empowering a wide range of industries with efficient, scalable AI capabilities, further positioning Nanoveu as a key player in the rapidly growing 3D content, AI and edge computing markets.

Forward Looking Statements

This announcement contains 'forward-looking information' that is based on the Company's expectations, estimates and projections as of the date on which the statements were made. This forward-looking information includes, among other things, statements with respect to the Company's business strategy, plans, development, objectives, performance, outlook, growth, cash flow, projections, targets and expectations and related expenses. Generally, this forward-looking information can be identified by the use of forward-looking terminology such as 'outlook', 'anticipate', 'project', 'target', 'potential', 'likely', 'believe', 'estimate', 'expect', 'intend', 'may', 'would', 'could', 'should', 'scheduled', 'will', 'plan', 'forecast', 'evolve' and similar expressions. Persons reading this announcement are cautioned that such statements are only predictions, and that the Company's actual future results or performance may be materially different. Forward-looking information is subject to known and unknown risks, uncertainties and other factors that may cause the Company's actual results, level of activity, performance, or achievements to be materially different from those expressed or implied by such forward looking information.

⁴ ASX Announcement 15 October 2024