Nanoveu Limited
Level 5, 191 St Georges Terrace
Perth WA, 6000 Australia
+61 8 6244 9095
www.nanoveu.com

ASX RELEASE **22 October 2024**

ASX: NVU

EMASS Achieves Breakthrough Results in Benchmark Testing for System-on-a-Chip (SoC) Semiconductor Company

AI Performance Analysis Reveals 20x Energy Efficiency Compared to Peer Chips

Highlights:

- ECS-DOT chipset by Embedded A.I. Systems Pte. Ltd (EMASS) has demonstrated 20x lower energy consumption compared to peers, setting a new benchmark for ultra-low power performance in edge AI applications.
- Results validate the SoCs potential to handle computationally intensive tasks, like real-time 2D to 3D image conversion, but in an energy efficient manner which is important for EyeFly3D™ applications.
- ECS-DOT achieved industry-leading inference latency, with 5.2 ms (milliseconds) for Person Detection and 6.3 ms for Image Classification.
- EMASS's solution operates with energy consumption as low as 3.7 microjoules per inference, making it ideally suited for power-sensitive applications such as IoT devices, wearables, and smart technology, where efficiency is paramount.
- The comprehensive benchmarking process, from setup to evaluation, was completed in under 2 hours per benchmark, showcasing the system's efficiency in both performance and testing methodologies and allowing additional time for further testing and result validation which continued to Friday 18 Oct 2024.

Nanoveu Limited ("Nanoveu" or the "Company") (ASX: NVU) is pleased to announce that EMASS has completed comprehensive, industry-standard, benchmark testing for EMASS's ECS-DOT SoC (System on Chip) chipset, following the Company's recent announcement to acquire 100% of EMASS, subject to shareholder approval. [1]

The testing demonstrated that EMASS's AI technology significantly outperformed other edge AI chipset companies in critical performance metrics. The system demonstrated unmatched energy efficiency, achieving performance levels that are 20x lower in energy consumption compared to the closest other leading edge AI chipset company of which EMASS is aware, Syntiant, while maintaining high levels of computational accuracy and speed.

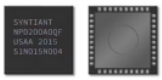
EMASS achieved outstanding results in the MLPerf Tiny v1.2 benchmark protocol, excelling in both the Person Detection and Image Classification categories. These results underscore the system's industry-leading potential to deliver ultra-low power AI solutions for a diverse array of image-focussed, "edge" applications.

In the **Person Detection** category, EMASS set a new benchmark for energy-efficient AI processing, achieving an impressive latency of just 5.2 ms per inference while consuming a mere 3.7 microjoules of energy. This remarkable performance sets a new standard for what's possible in ultra-low-power AI processing technology.

For **Image Classification**, the company's solution demonstrated 6.3 ms latency per inference while consuming only 5.5 microjoules of energy. This performance is 20x lower in energy consumption compared to any previous results reported by other edge AI chipset companies including Syntiant, Ambiq, Himax and Maxim Integrated.

[1] ASX announcement 15 Oct 2024

Table 1: Execution time and and Energy Consumption Comparison of Our ECS-Dot Chipset against the best performing edge AI SoC with publicly available data[2]. The numbers are reported for the image classification benchmark and our metrics are extracted during the execution of this benchmark from start to completion. Energy-delay product is a well-known common metric for energy efficiency. The results include the energy consumption of the computing core, memory and the AI accelerator. It does not include the energy consumed by peripherals and I/O interfaces.

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

The ECS-DOT system, comprising the entire evaluation board, all connections and peripherals, operates on just a few milliwatts of power. This includes input/output (I/O) connections, which allow the system to communicate with other devices and sensors. This low power consumption makes it an ideal choice for low-power applications where energy efficiency is crucial, such as rapid 2D to 3D image conversion. The SoC's capabilities are anticipated to enhance the feature-set of NVU's EyeFly3D™ platform, specifically enabling real-time 2D to 3D processing which is required to support such applications as "glasses-free 3D" video calls and other applications that require sophisticated 3D imaging and visualization such as:

- 2D to 3D Conversion
- Self-Navigation of Drones
- Autonomous Driving Systems
- Robotics
- Smart Home Systems
- Security and Surveillance

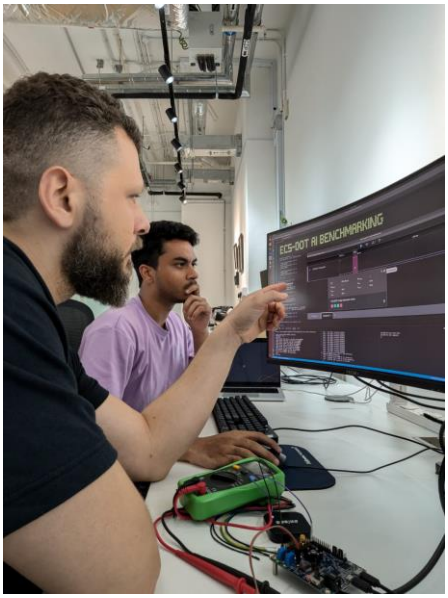


Figure 1: EMASS team conducting the benchmarking on ECT-DOT SoC

2 https://www.globenewswire.com/news-release/2023/07/05/2699482/0/en/Syntiant-Core-2-Achieves-Outstanding-Results-in-Latest-MLPerf-Tiny-v1-1-Benchmark-Suite.html

The total duration for completing the benchmarking process, encompassing the downloading of source workloads and the measurement of time and energy consumption using logical analyzers and on-chip timers, was just 2 hours for both workloads. This rapid turnaround highlights the efficiency of the system setup and testing methodology and allows the testing team to conduct further result testing and validation.

Commenting on the benchmarking results, Mohamed M. Sabry Aly, Founder of EMASS technology, said, "*We are proud to set a new benchmark in energy efficiency with these results. Achieving such low energy consumption without compromising on latency is a critical step forward for the future of AI at the edge. These results validate our dedication to pushing the boundaries of AI performance, making our solutions ideal for applications that require real-time processing and ultra-low power consumption, such as smart home devices like security cameras and smart doorbells."*

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

Further information:

Alfred Chong
Managing Director and CEO
t: +65 6557 0155
e: info@nanoveu.com

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

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 enhances 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