

MEDIA RELEASE

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A*STAR, ARQANA TECHNOLOGIES TO JOINTLY DEVELOP MMWAVE PHASED ARRAY SYSTEM FOR THE 5G CELLULAR MARKET

SINGAPORE – A*STAR and arQana Technologies are entering a Master Research Collaboration Agreement to jointly develop capabilities in mmWave Phased Array System for 5G cellular infrastructure, drone detection radar, and satellite communication on the move (SOTM).

The three-year collaboration will see an investment of S\$10M by arQana to develop differentiating performance factors that are currently missing in the industry such as greater cost effectiveness, smaller form factor, and higher power efficiency.

arQana, a fabless supplier of millimeter-wave IC (MMIC) components based in Singapore, will tap on A*STAR's research capabilities and expertise to jointly develop solutions through four work packages, namely Antenna Array and Calibration, Circuit Design, Antenna in Package and Test Methodology. These solutions can be applied in 5G cellular infrastructure, drone detection radar, Ka/Ku band SOTM.

Through this collaboration, arQana expects to integrate the MMIC and antenna within the package while still maintaining a high-performing system and increasing cost effectiveness— an optimal level of integration that is not currently available. These improvements would make 5G and satcom systems more power efficient and hence, more green. This would be achieved by tapping on the Fan-Out Wafer Level Packaging (FOWL) technology from the Institute of Microelectronics (IME) and in-situ built-in fast antenna array self-calibration technique from the Institute for Infocomm Research (I²R). Further details about the technologies and collaborations are available in **Annex A**.

Professor Dim-Lee Kwong, Executive Director of IME, said, "5G technologies form the backbone of Singapore's digital economy. A*STAR is keen to help local SMEs like

arQana leverage key technologies to boost their competitive advantage, and contribute to building Singapore's 5G tech ecosystem.”

Mr Glenn Vandevoorde, CEO of arQana Technologies, said, “The 5G revolution is at our doorstep and, while it promises a vast spectrum of new capabilities for commercial and industrial use, its advent requires an unprecedented level of challenges to develop systems that provide high-power efficiency and integration, while also being cost-effective. We welcome the collaboration with A*STAR to overcome these challenges and make significant impact to the global Radio Frequency (RF) components market, which is expected to be worth US\$45B by 2025¹.”

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¹ https://www.reportbuyer.com/product/5785339/radio-frequency-components-market-size-share-and-trends-analysis-report-by-product-by-application-and-segment-forecasts-2019-2025.html?utm_source=PRN

About A*STAR's Institute of Microelectronics (IME)

The Institute of Microelectronics (IME) is a research institute of the Science and Engineering Research Council of the Agency for Science, Technology and Research (A*STAR). Positioned to bridge the R&D between academia and industry, IME's mission is to add value to Singapore's semiconductor industry by developing strategic competencies, innovative technologies and intellectual property; enabling enterprises to be technologically competitive; and cultivating a technology talent pool to inject new knowledge to the industry. Its key research areas are in integrated circuits design, advanced packaging, bioelectronics and medical devices, MEMS, nanoelectronics, and photonics.

For more information on IME, please visit www.a-star.edu.sg/IME.

About A*STAR's Institute for Infocomms Research (I²R)

The Institute for Infocomm Research (I²R pronounced as i-squared-r) is a member of the Agency for Science, Technology and Research (A*STAR) family and is Singapore's largest ICT research institute. Established in 2002, our vision is to power a vibrant and strong infocomm ecosystem in Singapore. We seek to foster world-class infocomm and media research and develop a deep talent pool of infocomm professionals to power a vibrant knowledge-based Singapore. At I²R, our key research areas are in Artificial Intelligence, Audio; Language & Speech, Data Analytics, Communications & Networks, Cybersecurity, Heterogeneous Analytics, Healthcare, Robotics & AV, Satellite, Smart Energy & Environment and Video & Image Analytics.

For more information about I²R, visit www.a-star.edu.sg/I2R.

About the Agency for Science, Technology and Research (A*STAR)

The Agency for Science, Technology and Research (A*STAR) is Singapore's lead public sector agency that spearheads economic oriented research and development. As a Science and Technology Organisation, A*STAR bridges the gap between academia and industry. Our research creates economic growth and jobs for Singapore, and enhances lives by contributing to societal benefits such as improving outcomes in healthcare, urban living, and sustainability. Through open innovation, we collaborate with our partners in both the public and private sectors to benefit society. A*STAR's R&D activities span biomedical sciences and physical sciences and engineering, with research entities primarily located in Biopolis and Fusionopolis. A*STAR also plays a

pivotal role in nurturing scientific talent and leaders for the wider research community and industry. For ongoing news, visit www.a-star.edu.sg.

About arQana Technologies

arQana Technologies is a fabless semiconductor company headquartered in Singapore that develops RF solutions for mmWave radar, satellite communications and 5G infrastructure. Its facilities include a pilot packaging lab, an ESD compliant Class 10,000 cleanroom, and a PCB assembly lab. arQana's Taiwan office conducts R&D, production and manufacturing. arQana's Belgium office focuses on advanced R&D on MMIC & RFIC for microwave and mmWave phased array and active antenna system solutions for communication and sensing.

As a supplier of MMIC components providing a range of amplifiers, control components and transistors operating in the micrometer and millimeter wave bands, and by specializing in the design of phased array wireless systems that will offer highly integrated solutions for 5G, radar, and SatCom, arQana Technologies helps build a future that is more connected by delivering technology with speed, innovation, and quality.

arQana Technologies is part of Synesys Technologies Holding, a group of technology companies specializing in products and knowledge-based engineering services for electronic industries.

For more information about arQana Technologies, visit www.arQana-tech.com.

ANNEX A

Collaboration with A*STAR's Institute of Microelectronics (IME)

The 5G mmWave FOWLP Antenna-in-Package is a novel solution based on IME's Fan-Out Wafer Level Packaging (FOWLP) technology, and it has good electrical performance at millimeter wave frequency. This allows the MMIC and antenna to be integrated within the package. Using the 3D FOWLP integration, the antenna in package (AiP) can be designed on top of the MMIC, allowing a scalable sub-array of AiP to be formed. The sub-array AiP is then used to realise the compact antenna array with more elements, to meet the desired beam width, angular steps during beam steering, and radiated power. Such an optimal level of integration is not available in the market currently. This allows for the elimination of a high frequency board to increase cost effectiveness.

Larger antenna arrays assisted by an indigenously designed fine phase shifter enables the concentration of narrower beams of power on the required space, as well as simultaneous beams from base stations at the same frequency spectrum, thus improving spectral efficiency. By integrating the antenna with chips, the losses and the unintended radiation from inter-connects are reduced improving the overall power efficiency and sensitivity by 25 per cent. This improvement will make 5G and satcom systems more environmentally-friendly

Collaboration with A*STAR's Institute for Infocomm Research (I²R)

To maintain a high performance of the system, accurate antenna array calibration is key. The in-situ built-in array fast self-calibration technique from I²R reduces the down-time of communication links by up to ten times. This is achieved through deep learning techniques that process calibration data sets over various operation environments.

These solutions can be applied in 5G cellular infrastructure, drone detection radar, Ka/Ku band SOTM.