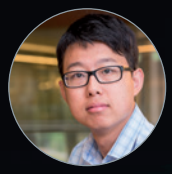
CASE STUDY

UTS Plots R&D Antenna Path to Future Wireless Comms with MVG's CR-M

UTS

LEARN HOW…

University of Technology Sydney is using a compact MVG anechoic test chamber to become one of Australia's leaders in advanced antenna research.



Dr Peiyuan Qin
Associate Professor, Co-director of Electromagnetic Informatics Lab, Global Big Data Technologies Centre (GBDTC), Faculty of Engineering and Information Technology, UTS

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mvg Microwave Vision Group

Dr Peiyuan Qin, Associate Professor at University of Technology Sydney (UTS), leads the university's R&D on highly advanced antennas for future wireless communications together with Distinguished Professor Y. Jay Guo, Director of Global Big Data Technologies Centre (GBDTC).

His team, which sits within UTS' GBDTC, Faculty of Engineering and IT (FEIT), continues to grow through funding grants from Australia Research Council (ARC), New South Wales (NSW) government, and Australian industry.

Yet R&D expansion of this sort would not have been possible, concedes Dr Qin, without MVG's Mini-Compact Range (CR-M), an optimally small compact antenna test range for antenna characterizations.

"When I arrived at UTS in 2015 there was no anechoic testing chamber at UTS", he recalls. "It meant, of course, we couldn't pitch for funding as we didn't have any way of confirming our measurements. Another challenge was that we had very specific testing requirements."

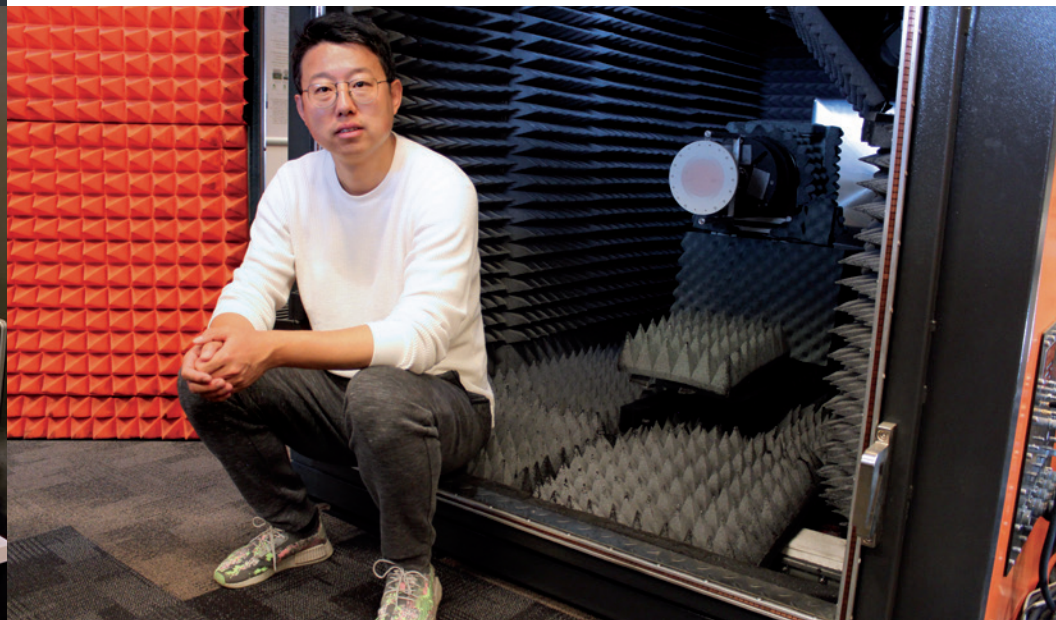
Antenna R&D, in which Dr Qin and his team are engaged, requires measuring performance at very different parts of the electromagnetic spectrum: 8 GHz–26.5 GHz and 60 GHz–90 GHz. The former is used to develop advanced millimetre wave (mmWave) antennas for 4G/5G, while the latter accommodates testing of E band antennas.

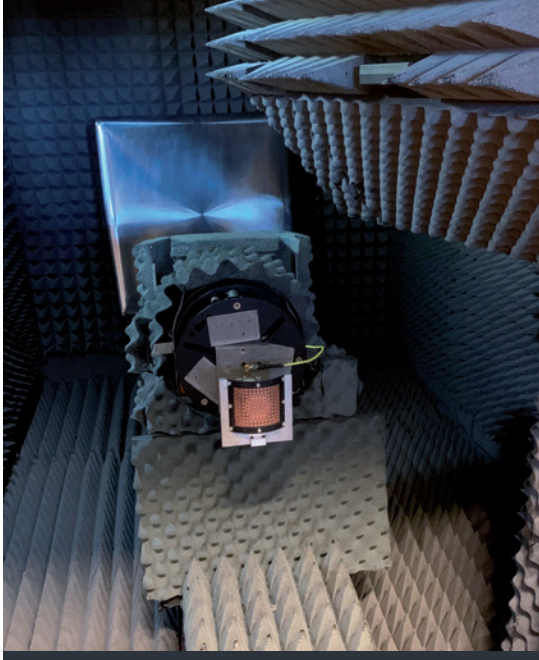
"It's extremely difficult to find one chamber that can accommodate such a large frequency range," Dr Qin says. "We also needed a compact solution since we had no space to install a large chamber at the UTS building in Ultimo, NSW."

After scanning the market for a suitable antenna testing solution, Dr Qin concluded that MVG's Mini-Compact Range ticked all the necessary boxes. Built by MVG compact range specialists in Israel according to UTS' specifications, it was up and running at FEIT in 2017.

"It was, and still is, a unique chamber among all Australian universities, enabling us to test antenna far-field performance in both the 8 GHz–26.5 GHz and 60 GHz–90 GHz frequency bands," enthuses Dr Qin. "It's also a turnkey solution, allowing us to collect and analyse measurement data with easy-to-use software."

Dr Qin's notes approvingly too that the extra compact chamber size of the CR-M allows it to be conveniently installed in a room near his office. No need for a large, separate building.





ANTENNA PROBLEM SOLVING TO HELP AUSTRALIA

The MVG Mini-Compact Range which can measure far-field radiation patterns, antenna gain, and levels of polarization and cross-polarization, is being put to work by UTS to solve practical problems in Australia.

It helps explain why Dr Qin and his team have won numerous ARC funding awards and NSW government grants to expand their R&D scope.

“We’re now moving into imaging and sensing, assisted by ARC Discovery Project (DP) funding, to develop a system that can predict and monitor floods and bushfires and give advanced warning to emergency services,” says Dr Qin. “Floods cost New South Wales millions of dollars in lost revenue every year.”

This ARC DP project, adds Dr Qin, will focus on development of theory and enabling techniques “to realise a low-complexity and high-resolution imaging and sensing system”, which can provide accurate environmental and climate change observations. The MVG chamber plays a key role in project delivery, measuring an advanced beam-scanning antenna.

“Because of our good reputation for antenna research, some industry players have also reached out to UTS to develop specific solutions,” adds Dr Qin. “We’re working with industry and the government of New South Wales, for example, to provide long-range Wi-Fi for people living in the State’s rural areas.”

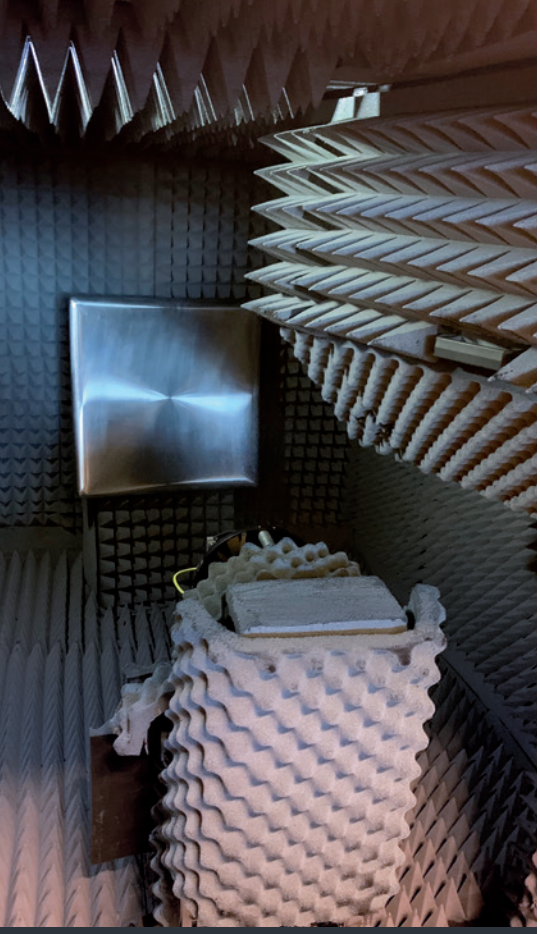
Developing antennas that can support both 4G and 5G, working independently without interference, is another industry challenge embraced by UTS. It saves valuable space on towers and rooftops, and is much more cost-efficient for operators.

Cracking the E-band code for 6G

Another ARC Discovery Project is to develop smart antenna arrays flexible enough to adapt to fast changing system requirements for emerging 6G networks, which may include satellite-terrestrial integration to provide remote area coverage. Improving antenna performance in the E-band, which occupies 60 GHz - 90 GHz, plays a vital role here. E-band can potentially provide high-speed Internet access via satellite downlinks, as well as offer terrestrial links, but much more R&D work is needed to deliver on the promise.

It is well understood that mmWave wireless communications require high-gain antenna arrays to compensate for high path loss, but this approach is not enough for meeting the demands of communications networks in the future. Dr Qin points out that due to the very narrow bandwidth of these arrays, they can only cover a small angular area. New multi-beam antennas are needed. “The transmission-line based feeding networks for traditional high-gain antenna arrays are very ‘lossy’ at E-band, which reduces their gain,” he says. “We must find low-loss high-efficiency alternatives to achieve multi-beam antenna with a wide angular coverage.”

“Several pattern reconfigurable antennas and multi-beam confor-mal antennas, says Dr Qin, have already been measured in the MVG chamber as part of the smart antenna array project.”



EASY-TO-USE AND EXCELLENT CUSTOMER SERVICE

Dr Qin is not only impressed by the large spectrum range the MVG chamber can handle, but also its ease of use.

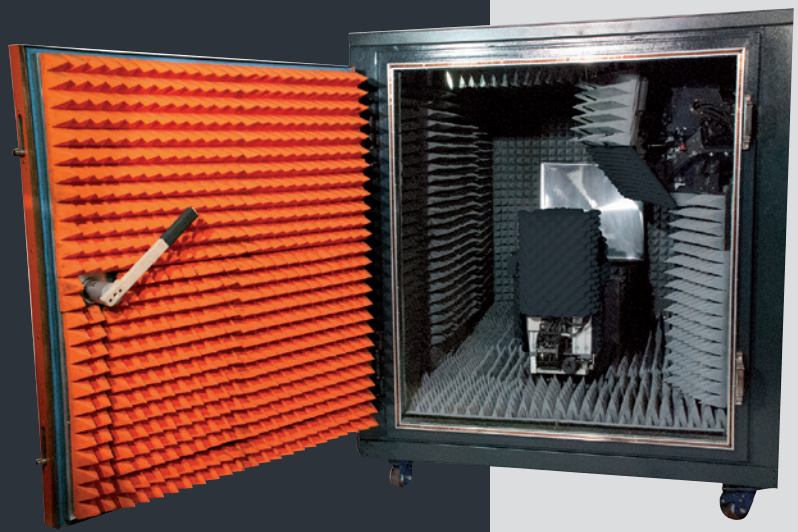
MVG's software package covers two areas: collection of measurement data and then data analysis. "We can plot antenna gain patterns quickly, and the software interface is user-friendly," says Dr Qin. "All my PhD students use it."

Although site visits from MVG engineers based in Israel are not practical, Dr Qin says this has in no way impaired what he calls an "excellent" customer support service. "MVG technicians are very knowledgeable and always respond quickly by email – no more than one business day and often sooner – to any problem we might encounter," says Dr Qin. "Their detailed guidance and analysis make problem solving much easier."

FROM 5G TO 6G

Prof Guo and Dr Qin see the MVG Mini-Compact Range as crucial for both boosting 5G performance and paving the way for deployment of 6G comms in Australia through the next decade. STIN, or Space-Terrestrial Integrated Network, is a key part of the 6G vision, enabling ubiquitous coverage.

"The testing chamber underpins our antenna R&D," says Dr Qin, before repeating again what he believes is a unique MVG attribute in the field of antenna measurement testing: "Its turnkey solution."



MVG Mini-Compact Range - Made to meet the high frequency testing challenge!

Little in size, BIG in performance

The CR-M mini compact range and chamber assembly have been designed to enable cost-effective testing of microwave and millimeter wave antennas, with a quiet zone diameter up to 0.5 m. The system provides a compact, accessible test tool for small antenna designs. It is particularly well suited for high frequency antenna measurements and testing.