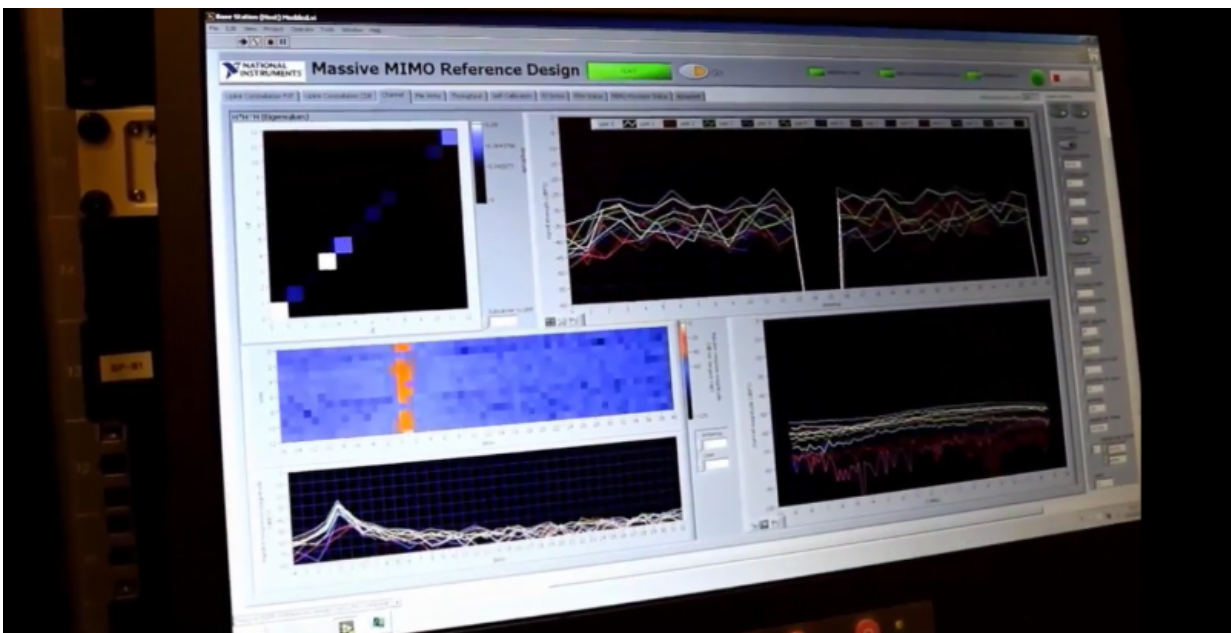


# Engineers set a new world record in 5G wireless spectrum efficiency

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New research by engineers from the Universities of Bristol and Lund, working alongside National Instruments (NI), has demonstrated how a massive antenna system can offer a 12-fold increase in spectrum efficiency compared with current 4G cellular technology.

Multiple antenna technology, referred to as MIMO, is already used in many Wi-Fi routers and 4G cellular phone systems. Normally this

involves up to four antennas at a base station. Using a flexible prototyping platform from NI based on LabVIEW system design software and PXI hardware, the Bristol configuration implements Massive MIMO, where 128 antennas are deployed at the [base station](#).

The hardware behind this demonstration was provided to Bristol University as part of the Bristol Is Open programmable city infrastructure. Lund University has a similar setup, the LuMaMi testbed, enabling researchers at both sites to work in parallel with their development.

Bristol's Massive MIMO system used for the demo operates at a carrier frequency of 3.5GHz and supports simultaneous wireless connectivity to up to 12 single antenna clients. Each client shares a common 20MHz radio channel. Complex digital signal processing algorithms unravel the individual data streams in the space domain seen by the antenna array.

The Massive MIMO demonstration was conducted in the atrium of Bristol's Merchant Venturers Building and achieved an unprecedented bandwidth efficiency of 79.4bit/s/Hz. This equates to a sum rate throughput of 1.59Gbit/s in a 20MHz channel.

Professor Andrew Nix, Head of the CSN Group and Dean of Engineering, said: "This activity reinforces our well established propagation and system modelling work by offering a new capability in model validation for Massive MIMO architectures. This is a truly exciting time for our PhD students and opens up further opportunities for collaborative research with our national and international partners."

Ove Edfors, Professor of Radio Systems at Lund University says: "We see massive MIMO as the most promising 5G technology and we have pushed it forward together with partners in Bristol and in our EU project MAMMOET. It is a pleasure seeing those efforts materialize."

Mark Beach, Professor of Radio Systems Engineering in the Department of Electrical & Electronic Engineering and Manager of the EPSRC Centre for Doctoral Training (CDT) in Communications, added: "Massive MIMO is one of four core activities in '5G and beyond' wireless research at Bristol. This demonstration was made possible by the cohort training offered within our CDT in Communications. The CDT gives Bristol a unique edge to conduct activities at scale."

Fredrik Tufvesson, Professor with the Faculty of Engineering at Lund University explained: "It has been an exciting journey, hosting Bristol researchers Paul Harris and Siming Zhang as the group in Lund developed and tested the reference design. Our state-of-the-art test-beds show the culmination of significant effort from many researchers and it is fantastic to see these results from the Bristol deployment."

The collaborative research project with Lund University and National Instruments included five Bristol based PhD students under the collective guidance of five academic supervisors. In Lund seven PhD students and six supervisors contributed, making it a huge interdisciplinary research effort.

Paul Harris, PhD student in Bristol, explained: "My PhD training at Bristol alongside a two-month secondment at NI (Austin) put me in a unique position to use this cutting-edge equipment and support my fellow postgraduates with their state-of-the-art research in next generation wireless." Steffen Malkowsky, PhD student in Lund, continued: "Our joint secondment at NI led to a very close and fruitful collaboration that we have now brought back to Europe."

James Kimery, Director of RF Research and SDR Marketing at NI, commented: "With much discussion around 5G, NI is excited to work with top research institutions such as Bristol and Lund universities, and organizations like Bristol is Open to drive the standard forward. This

Massive MIMO reference design system demonstrates the power and productivity researchers can achieve with NI tools and technologies."

Paul Wilson, Managing Director Bristol Is Open, remarked: "This is truly outstanding work putting Bristol at the forefront of 5G wireless connectivity. We are looking forward to moving this facility outdoors in late 2016 as part of the BIO Harbourside deployment."

Spectrum and power efficient wireless communications are core to Bristol University's Communication Systems & Networks (CSN) Group and the EPSRC Centre for Doctoral Training in Communications as well as to the department of Electrical and Information technology at Lund University.

Viktor Öwall, Dean of the Faculty of Engineering at Lund University, concluded: "Our openness, very similar goals, backgrounds and structures have enabled this remarkable achievement."

Provided by University of Bristol

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