'Open RAN and Small Cells – The Analogue Radio Reality Check'
A CW (Cambridge Wireless) event in partnership with UKTIN
Hosted by University of Bristol and Sponsored by VIAVI Solutions
Delivered by CW's Small Cell & Radio Technology SIG's.
10th November 2023

Venue: Wills Memorial Great Hall, University of Bristol, Queens Road, Bristol, BS8 1RL

Draft Agenda	
10:30	Registration and networking with refreshments
11:00	Welcome from **CW (Cambridge Wireless)**, **Professor Mark Beach, University of Bristol**
11:05	Welcome from our event host, **University of Bristol, Professor Robert Piechocki, Professor of Wireless Systems, School of Electrical, Electronic and Mechanical Engineering**
11:10	Introduction from our Chair for the event and CW SIG Champion, **Vicky Messer, Picocom**
11:15	**Introducing the current landscape** **Nick Johnson, Head of UKTIN**
11:40	**'Open RAN & Massive MIMO'** **Wael Boukley Hasan, Senior Standards Strategist, Vodafone**
12:05	**'UK GaN Technology for Energy Efficient RF Power Amplifiers'** **Professor Mark Beach, University of Bristol and Professor Khaled Elgaid, Cardiff University** Energy efficient PAs based on Doherty and similar architectures can improve the Power Added Efficiency (PAE), however RF designers have a limited range of devices (power rating) as components off the shelf (COTS), thus not well aligned to small-cell O-RAN deployment. Empowered through DSIT REASON funding, researchers at Bristol and Cardiff Universities, with support from CS Connected, are fabricating in the UK GaN devices for use in a proof of concept RF PA for O-RAN deployments. This talk will outline the rational for this work and progress to-date.
12:30	**'Developments in Digital Predistortion'** **Martin Lysejko, Chief Systems Architect, Picocom** Martin will review the development of Digital Predistortion for Radio Frequency Power Amplifier linearisation and show how developments in Machine Learning and Artificial Intelligence are driving the next generation of Digital Predistortion algorithms.
12:55	**A word from our event partner, UKTIN, from Nick Johnson, Head of UKTIN**
13:00	Lunch and networking over University Research Poster Boards
14:05	**A word from our Sponsor, Dr Paul Harris, VIAVI Solutions**
14:10	Chair for the event and CW SIG Champion **Vicky Messer, Picocom**
14:15	**'The RIC: What it can and can't do'** **Richard Mackenzie, Distinguished Engineer in Wireless Networks at BT's Applied Research, BT** The RIC is seen to be the enabler of lots of Open RAN's key benefits. There are expectations in terms of automation, optimisation, service differentiation, leveraging AI/ML, and more. This talk will give an overview of the current status of the RIC, to highlight how it could benefit networks today. We'll then look at how the RIC is maturing and where the industry is focussing its attention. For example, energy saving has lots of use cases in Open RAN; which of those require or benefit from a RIC?
14:40	**'Test & Integration – From Radio to RIC'** **Dr Paul Harris, Principal Wireless Architect, VIAVI Solutions** Open RAN brings with it a myriad of new interfaces, a demand for multi-vendor interoperability, and the disruptive playground for innovation that is the RIC. To ensure the industry can truly move forward successfully with RAN disaggregation, comprehensive testing and benchmarking is essential. This talk will provide an overview of VIAVI's approach to testing for the O-RU and RIC, considering the types of testing required, the importance of performance in addition to conformance, and how the RIC and x/r-Apps can be evaluated through RAN Scenario Emulation.

15:05	Panel Session: **'Power, Performance & Sustainability', Led by Prof Simon Saunders, Visiting Professor, King's College London & CW SIG Champion** With all speakers and additional panellist: • **Doug Fripp, Network Architect, Radio Access Networks, BT**
15:50	Closing remarks, **Vicky Messer, Picocom**
16:00	Further networking **event ends at 17.00**

With the permission of the speakers, presentations will be available upon request following the event

Profile of organisers

Cambridge Wireless (CW) www.cambridgewireless.co.uk
CW is the leading international community for companies involved in the research, development and application of wireless and mobile, internet, semiconductor and software technologies. With over 400 members from major network operators and device manufacturers to innovative start-ups and universities, CW stimulates debate and collaboration, harnesses and shares knowledge, and helps to build connections between academia and industry. CW's 19 Special Interest Groups (SIGs) provide its members with a dynamic forum where they can network with their peers, track the latest technology trends and business developments and position their organisations in key market sectors. CW also organises major conferences and start-up competitions along with other high-quality industry networking events and dinners. With headquarters at the heart of Cambridge, UK, CW partners with other international industry clusters and organisations to extend its reach and remain at the forefront of global developments and business opportunities.

The CW Small Cell Group -www.cambridgewireless.co.uk/groups/radio-technology/

The explosion in popularity of Mobile Broadband is causing congestion on the mobile networks resulting in a less than optimal customer experience. Bringing the mobile network capacity as close as possible to the user (using small-cell technology) while also off-loading from the overloaded macro layer, will be key to sustaining the demand for mobile broadband. The Small Cell SIG will cover the underlying technology supporting small cell deployments. It is championed by:

- Simon Fletcher, CEO, Real Wireless - **https://real-wireless.com**
- Caroline Gabriel, Research Director, Analysys Mason, Co-founder and Research Director, Rethink Technology Research - **https://rethinkresearch.biz**
- Vicky Messer, VP Product Management, Picocom - **https://picocom.com**
- Dr Neil Piercy, Independent
- Prof Simon Saunders, Visiting Professor, King's College London - **www.kcl.ac.uk**

The CW Radio Technology Group - www.cambridgewireless.co.uk/groups/radio-technology/
The whole wireless business depends on our ability to design, build and operate large-scale radio networks, and therefore on understanding the basic science, engineering and economic realities that govern them. The Radio Technology SIG aims to increase the awareness of the scientific and engineering limits on radio communications; and the opportunities that could be exploited to improve the state-of-the-art. It is championed by:

- Mark Beach, University of Bristol **www.bristol.ac.uk/engineering/research/csn/**
- Brian Collins, BSC Associates - **www.bscassociates.co.uk**
- Paul Harris, VIAVI Solutions – **www.viavisolutions.com**
- Dr Peter Kibutu, TTP Group - **www.ttp.com**
- Peter Topham, Qualcomm Technologies International - **www.qualcomm.com**

Profile of Event Partner

UKTIN - https://uktin.net
UKTIN is the innovation network for the UK telecoms sector, bringing together industry, academia, and government to catalyse telecoms R&D investment, cooperation, and commercialisation. Founded in 2022, it is delivered by a consortium of four partners - Digital Catapult, Cambridge Wireless, University of Bristol, and WM5G - who draw on their distinct strengths in a collaborative approach. UKTIN has been initially funded by the Department for Digital, Culture, Media & Sport (DCMS) to drive the 5G Supply Chain Diversification Strategy and it will provide support for

supply chain diversification in UK telecoms. It will work towards this goal by strengthening UK capabilities in open telecoms, attracting overseas companies and talent, facilitating indigenous supply chain development, catalysing public and private investment, and proactively promoting UK capability internationally.

Profile of Event Host

University of Bristol - **www.bristol.ac.uk**
The University of Bristol is at the cutting edge of global research. The University has had a reputation for innovation since its founding in 1876. Our research tackles some of the world's most pressing issues in areas as diverse as infection and immunity, human rights, climate change, and cryptography and information security.
The **Communication System and Network (CSN) Research Group** addresses topics such as the Internet of Things (IoT), Massive MIMO, Intelligent Transport Systems, dynamic mmWave networks, full duplex communications, wearable wireless technologies and wireless/optical network integration. Researchers of the CSN Research Group are members of the Smart Internet Lab. This recent initiative builds on Bristol's strategic research in communications and digital technologies to create a hub for Internet Research with long lasting benefits for society and the economy.

Profile of Event Sponsor

VIAVI Solutions - **www.viavisolutions.com**
VIAVI Solutions helps network operators address their toughest network, application, and service performance challenges and successfully deploy the networks of tomorrow. VIAVI Solutions is a global leader in both network & service enablement and optical security and performance products and solutions. Our technologies contribute to the success of a wide range of customers – from the world's largest mobile operators and governmental entities to enterprise network and application providers to contractors laying the fiber and building the towers that keep us connected.

Profile of Speakers

Professor Mark Beach, Professor of Radio Systems Engineering, University of Bristol -
www.bristol.ac.uk/engineering/research/csn/
Mark Beach received his PhD for research addressing the application of Smart Antenna techniques to GPS from the University of Bristol in 1989, where he subsequently joined as a member of academic staff. He was promoted to Senior Lecturer in 1996, Reader in 1998 and Professor in 2003. He was Head of the Department of Electrical & Electronic Engineering from 2006 to 2010, and then spearheaded Bristol's hosting of the EPSRC Centre for Doctoral Training (CDT) in Communications. He currently manages the delivery of the CDT in Communications, leads research in the field of enabling technologies for the delivery of 5G and beyond wireless connectivity, as well as his role as the School Research Impact Director. Mark's current research activities are delivered through the Communication Systems and Networks Group, forming a key component within Bristol's Smart Internet Lab. He has over 25 years of physical layer wireless research embracing the application of Spread Spectrum technology for cellular systems, adaptive or smart antenna for capacity and range extension in wireless networks, MIMO aided connectivity for through-put enhancement, Millimetre Wave technologies as well as flexible RF technologies for SDR modems underpins his current research portfolio.

Wael Boukley Hasan, Senior Standards Strategist, Vodafone - **www.vodafone.co.uk**
Wael received his PhD from the University of Bristol for evaluating the practicality of using massive MIMO in real-world scenarios and identifying solutions to operational deployments. He is currently a Senior Standards Strategist at Vodafone and an Honorary Industrial Fellow at the University of Bristol. He represents Vodafone within 3GPP RAN for developing the standards specifications on RF topics and physical layer aspects related to 4G, 5G and beyond. Prior joining Vodafone, he worked at Alcatel-lucent in the small cells and at the University of Bristol researching wide range of wireless topics such as massive MIMO, coordinated multi-point, software-defined networking agent for multi-RAT switching between different wireless technologies (NR, LTE and Wi-Fi), non-cellular IoT (LoRaWAN) and using AI/ML for massive MIMO. For his research, he designed, implemented and enhanced several wireless testbeds and simulators to achieve realistic performance evaluation.

Professor Khaled Elgaid, Cardiff University - www.cardiff.ac.uk

Professor K Elgaid FIET, SIEEE, is presently leading a high frequency devices and integrated circuits research team using GaN technology. He has >140 publications, presented 5 invited talks in international conferences/workshops in the past 2 years and co-authored a book chapter in "RFIC and MMIC design and technology"; widely regarded as a reference text, translated into Chinese in 2007. He has >20 years' experience in MMIC technology development operating up to 325GHz, i.e. world leading mHEMT performance (fT/fmax = 440/400 GHz), InP HEMT performance (fT 550GHz), highest reported 300nm T-gate RF GaN on LR Si HEMT (fT/fmax = 55/121 GHz), demonstrated UK only 200GHz MMIC LNA, Ka-Band diode based MMIC mixers/LNA and state of the art MMIC compatible integrated THz antennas technology. He has collaborated with world leading national/international industrial partners (e.g. QinetiQ, BAE Systems, DTC and Keysight). GaN technology, with its exceptional power output, power added efficiency and low noise performance has the potential to become the mm-wave integrated circuit technology of choice for many applications above 75GHz; providing a step change in performance in 5G telecommunications, sensing (e.g. automotive, security, satellite and medical), EW and radar applications, as well as Terahertz Sources (GaN Schottky diode based).

Dr Paul Harris, Principal Wireless Architect, VIAVI Solutions - https://www.viavisolutions.com

Paul received his PhD from the University of Bristol for evaluating the performance of massive MIMO technology in the lead-up to 5G and has since gained a range of industry experience in research, design, implementation and standardisation. He is currently a Principal Wireless Architect within the CTO Office at VIAVI Solutions providing thought leadership on new and emerging technologies for 5G, 6G and beyond, and represents VIAVI within a range of bodies and fora including 3GPP and the UKTIN. His industry experience prior to joining VIAVI includes representing Vodafone within 3GPP for radio performance aspects, contributing to the development of channel estimation solutions as a Senior Systems Engineer at Cohere Technologies, and working with customers as a domain expert at National Instruments to help establish effective research solutions using software-defined radio. He is also a Chartered Engineer, Senior Member of the IEEE, Fellow of the ITP, and an Honorary Industrial Fellow at the University of Bristol.

Nick Johnson, Head of UKTIN – https://uktin.net

Nick was founder and CTO of ip.access, the leading small cell infrastructure business based in Cambridge UK from its inception in 2000 to acquisition by Mavenir in 2020. As well as leading the ip.access product line from GSM to 5G, he chaired the Radio and Physical Layer Working Group in the Small Cell Forum and introduced the world to FAPI - the industry standard software/platform interface for small cells. Nick brings an unequalled commercial experience to the UKTIN and is looking forward to it helping those seeking to exploit and contribute to the unrivalled inventive spirit of the UK, as well as informing the UK Innovation ecosystem into the foreseeable future.

Martin Lysejko, Chief Systems Architect, Picocom - https://picocom.com

Martin Lysejko is Chief Systems Architect at Picocom where he has been responsible for defining multiple generations of Open RAN 4G/5G Wireless Baseband SoCs since 2019. On graduating in 1987 with an M.Eng in Electronic Engineering from Bangor University, Martin spent five years working on development of mixed signal ASICs which included the design of novel pipelined A/D converters. Martin joined Airspan Networks in 1992, initially specialising in signal processing, and has over a 25-year career architecting multiple generations of proprietary and standards-based wireless systems. Martin is an active contributor to Small Cell Forum (SCF) and O-RAN WG4 specifications, and has co-authored 40 US patents spanning encryption, CDMA air-interface, co-operative wireless and beamforming antennas.

Richard Mackenzie, Distinguished Engineer in Wireless Networks at BT's Applied Research, BT- www.bt.com/about/bt/research-and-development

Richard Mackenzie is a Distinguished Engineer in Wireless Networks at BT's Applied Research. Since joining BT in 2009 he has worked on a number of cutting-edge wireless innovations. His current focus is on creating an ecosystem for RAN virtualization, network automation, and the use of small cells. He is co-chair of the Telecom Infra Project (TIP) "RAN Intelligence & Automation" OpenRAN sub-project and is also involved in Next Generation Mobile Networks (NGMN), where he was Chair of the "RAN Functional Split and X-Haul" Group, O-RAN Alliance and Small Cell Forum (SCF). Richard was a Spectrum Manager for the London 2012 Olympic and Paralympic Games and was part of BT's bidding team for spectrum auctions, notably the U.K. 4G spectrum auction where BT got back into the mobile game. He has an MEng degree from University of York, and PhD from University of Leeds.

With additional Panellist; Doug Fripp, Network Architect, Radio Access Networks, BT
www.bt.com/about/bt/research-and-development
Doug Fripp is a RAN Architect at BT, focussed on small cells and new RAN architectures. He has been working in mobile RAN for 24 years and has led EE/BT Small cells development since 2016, with his time split between indoor and outdoor small cells, Neutral Host/multi-operator and OpenRAN, he is very excited about new technology development and is keen to see the small cells domain an opportunity to pioneer new ideas to enable lower cost, higher density network capacity without compromising on performance.