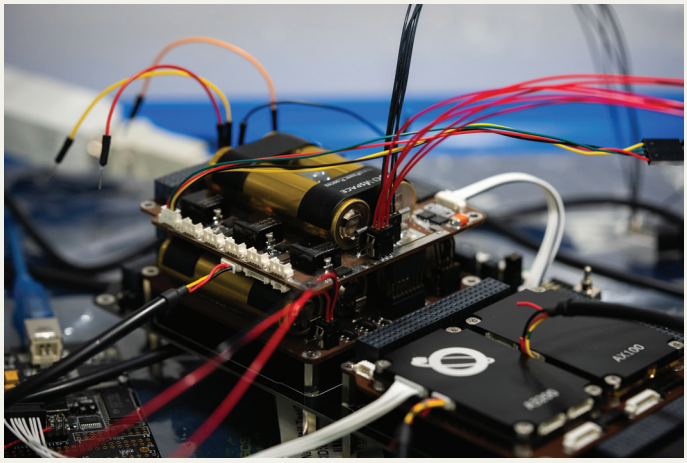
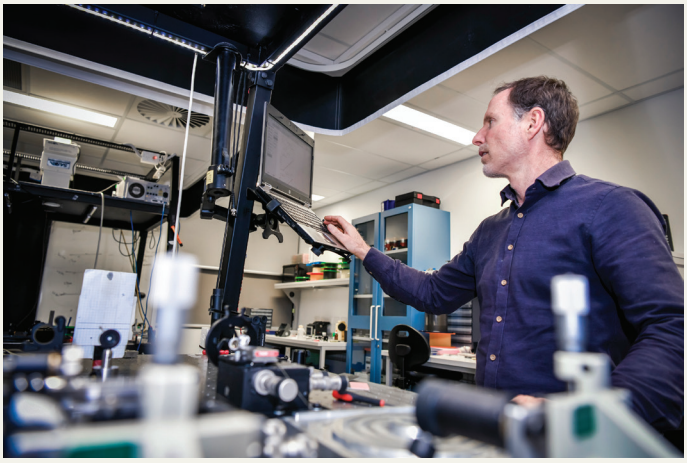
THEME 4: MICROELECTRONICS AND OPTICS

Microelectronics and optics are fundamental tools underpinning modern society's advancement, enabling a broad range of civil, industrial and defence applications. The School of Engineering leads research in these key areas, including high-frequency and IC design, photonics and lasers, and embedded systems. Highlights of successful outcomes and impact include demonstrating low-noise integrated circuits based on advanced semiconductors (GaN, GaAs and SiGe) operating at the limits of power and frequency, high-quality mid-infrared lasers at unconventional wavelengths for specialised medical and defence applications, ultra-sensitive photonic probes uncovering new biomarkers for clinic translation, and custom wireless devices powered by FPGAs for novel satellite systems and hearing aids. With increasing industrial engagement, these research pillars will form the foundation for critical developments in Industry 4.0, future communications beyond 5G, big data and AI, smart cities, space technologies, security and defence, biomedical engineering and more – benefiting Australia and humanity. Through our Macquarie Analog Devices Laboratory (MAD Lab), our team pushes the horizons of industry-driven wireless electronics for applications such as satellite systems, test instruments, phased array, high-capacity microwave radio applications, 5G/6G radio access and backhaul.





NEXT GENERATION OF SENSOR INSTRUMENT

Methane is a potent greenhouse gas under immense scrutiny. In collaboration with industry partners, we are developing the next generation of a sensor instrument, a laser heterodyne radiometer, to fingerprint and classify methane emission sources from space, thereby identifying their source type (eg natural gas or agriculture). The sensor's fingerprinting ability, when combined with a satellite's global coverage, provides a powerful platform to quantify, classify and subsequently address methane emissions.

HIGH-POWER FIBRES

We lead a well-funded national research program focused on developing high-power fibres that emit wavelengths between 580 nm and 3500 nm. We are creating advanced optical systems for materials processing (inorganic and biological), directed energy applications in defence and broadband sensors for security applications.