This project aims to develop the technology of gap waveguides (GW), a groundbreaking approach to the design of millimeter-wave transmission lines introduced by Professor P.-S. Kildal in 2009. Gap waveguides, which confine electromagnetic waves using spectral gaps created by periodically placed metal pins without the need for electrical contact between metal components, offer significant advantages compared to traditional waveguides. These advantages include reduced losses, lower weight and costs, and simplified manufacturing processes. Despite its potential, gap waveguide technology remains underexplored compared to traditional technologies such as hollow rectangular waveguides and microstrips, or newer ones like Substrate Integrated Waveguides (SIW).

The main goal of this project is to develop, design, manufacture, and measure new concepts of high-performance, cost-effective, and easily producible millimeter and submillimeter wave antennas, microwave components, and sensors utilizing gap waveguide technology. Some aspects of the research will be pioneering, especially in the uncharted area of gap-waveguide based sensors. The project will focus on four key areas:

1. New design concepts and low-cost production of components and subsystems for gap waveguides,
2. EBG waveguide sensors: As no gap - waveguide based sensors have been reported in the literature, these projects will be pioneering solutions,
3. Antennas, passive components for antenna feed networks, and front-ends for millimeter waves,
4. Broadband high-gain antennas with low sidelobe levels (SLL) for millimeter waves.