Project title: **Multibeam Dielectric Resonator Antenna (DRA) System for IoT and 5G Applications**

Project type: **Master Thesis Project (30 credits)**

Faculty and Laboratory: STI, Microwaves and Antennas Group (MAG)

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Project Description

Achievement in the field of wireless communication in the last decade resulted in a successful passage from the fourth generation (4G) to the fifth generation (5G) communication services. Nevertheless, one of the important considerations in the mm-wave regime is the possible strategy to cope with the higher loss level attributed to this band, which is theoretically followed by the Friis transmission equation.
Microstrip antennas and dielectric resonator antennas (DRA) seem to be good candidates for the aforementioned applications. Moreover, DRA has the advantage of having negligible metallic loss and a low profile, which makes it possible to have a high efficient antenna system once operated at mm-wave frequency range. Even though various low loss material is available for this application, generally these ceramic-based materials are difficult to be shaped into a suitable form for DRA design as these materials are fragile by nature, hence the degree of freedom in shaping such material is lower as well. These challenges, however, can be solved using the novel method proposed in [1]. In this project, students will have the freedom to facilitate the proposed manufacturing technique which gives the possibility of increasing the degree of freedom in the geometrical shape. Additionally, direct microstrip feedline or aperture coupling with a microstrip feedline can be used for feeding the structure.
The goal of this project is to have a pattern reconfigurable efficient antenna system operating at 24 GHz ISM band.

[1] Polymer Bridging Induced by a Single Additive Imparts Easy-To-Implement Green Machinability to
Yttria-Stabilized Zirconia https://pubs.acs.org/doi/10.1021/acsapm.1c00605

Student Tasks

- Electrical characterization of the ceramic based material (Various Techniques)
- Analysis of DRA structures
- Analysis of DRA feeding
- Design and simulation of DRA
- Fabrication of a prototype
- Measurement of the final fabricated antennas
- Writing a report with results

Outcomes

- Student will learn the theory behind the pattern reconfigurable antenna design.
- Students will learn different electrical characterization techniques at mm-wave regime
- EM Simulation and measurement techniques will be learned.

Type of Work

- Theory 20%
- Simulation 20%
- Measurement 40%
- Documentation & Reporting 20%