Student Project Proposal

Project title: : Metasurface for micro-tags detection

Project type: Master Semester Project (10 credits) or

Master Thesis Project (30 credits)

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

Contact: Anja Skrivervik – anja.skrivervik@epfl.ch

Adrián Fernández Carnicero – adrian.fernandezcarnicero@epfl.ch

Behnaz Bakhtiari – behnaz.bakhtiari@epfl.ch

Project description:

Implantable devices for medical applications such as detection and treatment of diseases have experimented a huge interest among the scientific community in the last decade. The desire to improve disease detection as well as their treatments and therapies requires a deeper understanding of cellular behaviours, which implies the use of extremely small antennas that are implanted inside living cells.

In the frame of this project, extremely small antennas (tags) need to be detected as far as possible from the transmitting unit, also known as the reader. For achieving this objective, **the student will design a metasurface (Artificial Magnetic Conductor - AMC) working in the band 2.4 - 2.5 GHz.** The designed metasurface will be used in combination with a tuneable segmented loop antenna. The final system will work as follows: the segmented loop antenna generates a uniform magnetic field that allows to feed the tag and detect it, whereas the AMC will increase the intensity of this magnetic field providing a larger detection distance of the tag.

Type of work:

- Theory and simulation: 50%
- Fabrication and measurements: 30%
- Documentation and reporting: 20%.

Student tasks:

- Design of an artificial magnetic conductor (AMC) metasurface.
- Fabrication of the designed metasurface.
- Testing the reader (antenna + metasurface) with tags of different dimensions.

Fig.1. Example of segmented loop antenna.

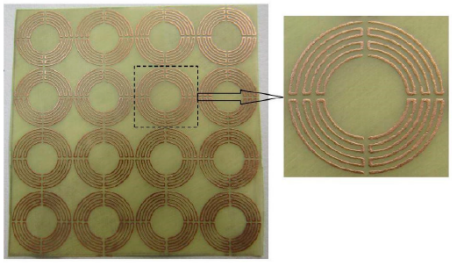

Fig.2. Examples of metasurfaces [2].

Fig.3. Fabricated tags available in the lab for performing measurements

References:

[1] Shaw, T., & Mitra, D. (2019). Metasurface-based radiative near-field wireless power transfer system for implantable medical devices. *IET Microwaves, Antennas & Propagation*, *13*(12), 1974-1982.