

# Seminario

## Implantable Antennas : KPIs, Physical Limitations and Design

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**Sala Archimede** (locali Presidenza),  
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**Abstract** - The implanted antenna is a key component in the wireless link with sensors implanted in biological media, as their impact on the global efficiency of the system is very large. The design of such antennas presents two challenges, the miniaturization and the high dielectric losses of the media into which they are implanted. The latter point makes them different from usual electrically small antennas, or from usual antennas in general, which radiate into free space, which is lossless. This has a deep impact not only on the link performance, but also and more fundamentally on the way antenna radiation performance is described and on the fundamental limitations of these antennas. In this contribution, we will gain insight into the main fundamental difference between classic electrically small antennas and implantable antennas. We will then study some canonical cases to understand the loss mechanisms and propose some physical bound on the efficiency of implantable antennas. Based on these results we will propose design rules, illustrated on several realistic examples. Finally, we will discuss issues linked to the measurement of implantable antennas.



**Bio** – Anja K. Skrivervik received the master's and Ph.D. degrees in electrical engineering from the École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland, in 1986 and 1992, respectively. After a stay at the University of Rennes, Rennes, France, as an Invited Research Fellow and two years in the industry, she returned part time to EPFL as an Assistant Professor in 1996, where she was a Professeur Titulaire and the Head of the Microwave and Antenna Group. She was the Director of the EE Section from 1996 to 2000. She is currently the Director of the EE Doctoral School at EPFL. She is also a Visiting Professor at the University of Lund, Lund, Sweden. Her teaching activities include courses on microwaves and antennas, and she teaches at bachelor's, master's, and Ph.D. levels. She is author or co-author of more than 200 peer reviewed scientific publications. Her research interests include electrically small antennas, antennas in biological media, periodic structures, reflect- and transmit-arrays, and numerical techniques for electromagnetics.

Dr. Skrivervik is a Board Member of the European School on Antennas. She was a member of the Board of Directors of the European Association on Antennas and Propagation (EurAAP) from 2017 to 2022. She received the Latsis Award. She has been the General Chair of the Loughborough Antenna and Propagation Conference in 2015, the Vice-Chair and Technical Program Committee-Chair of the EuCAP 2016 Conference, and the Financial Chair of EuCAP 2017 to EuCAP 2022.