Université Gustave Eiffel

Laboratoire ESYCOM

Internship: Contactless Characterization of Miniature and Buried Antennas Within Reverberation Chambers

Starting Date and Duration
This offer is for a 4 to 6-month internship that could start anytime between February and April 2021. It may be extended to a **3-year PhD**.

Context
Smart cities rely on the use on wireless sensor networks in order to ensure monitoring activities for a large panel of applications: structural health, soil composition, air and water quality… Sensors are therefore either in contact or embedded within a lossy medium such as concrete, soil or water. Such complex environment in the sensor's vicinity implies a degradation of the radio performances and in particular a decrease in the antenna radiation efficiency. The estimation of such efficiency, critical parameter to limit power consumption, is barely possible with conventional measurement methods in the case of buried and miniature antennas. Indeed, conventional measurement approaches necessitate to connect the antenna under test to an analyzer whereas the presence of the cables in the antenna reactive near-field zone disturbs the radiation and impedance properties [1]. This perturbation can be considered as negligeable for large antennas but not for small ones. In that context, innovative efficiency measurement methods are required to overcome current limitations of conventional methods.

Internship Topic
Reverberation chambers (RCs) have become a reliable alternative to anechoic chambers to perform antenna radiation pattern [2] and efficiency measurement [3]. In particular, preliminary results established at the ESYCOM laboratory in 2021 [4], showed the proof-of-concept of a contactless measurement setup dedicated to antenna radiation efficiency estimation. During this internship, the particular case of low efficiency antenna will be analyzed, with a special focus on the sensitivity enhancement of the measurement setup while keeping the measurement time reasonable. The influence of the RC properties on the radiation efficiency estimation will also be evaluated, especially regarding its stirring capabilities. The specific tasks will include 1) State-of-the-art review, 2) RF measurement within RCs and 3) Data post-processing using Matlab.

Applicant Profile
The targeted student profile is the following:

- Enroll in last year of Master degree (or equivalent) in electrical engineering or physics;
- Strong background in electromagnetics and antennas (ideally in statistics as well);
- Interest for high frequency measurement, autonomous and highly motivated;
- Speak French and/or English;
- **Willing to pursue with a PhD**.

Contacts
Elodie Richalot, Full Prof., UGE: elodie.richalot-taisne@univ-eiffel.fr
François Sarrazin, Ass. Prof., UGE: francois.sarrazin@univ-eiffel.fr

The application file should include CV, statement of purpose, recommendation letters and all academic transcripts and may be addressed by email to both contacts. **Application deadline: March 15th 2021.**

References
[1] T. Fukasawa, N. Yoneda and H. Miyashita, *Investigation on Current Reduction Effects of Baluns for Measurement of a Small Antenna*, **IEEE Trans. Antennas Propag.**, vol. 67, no. 7, pp. 4323-4329, July 2019, doi: 10.1109/TAP.2019.2911360.
[2] A. Reis, F. Sarrazin, P. Besnier, P. Pouliguen and E. Richalot, *Contactless Antenna Gain Pattern Estimation From Backscattering Coefficient Measurement Performed Within Reverberation Chambers*, **IEEE Trans. Antennas Propag.**, doi: 10.1109/TAP.2021.3111184. open access
[3] A. Hubrechsen et al., *The Effect of Noise on Reverberation-Chamber Measurements of Antenna Efficiency*, **IEEE Trans. Antennas Propag.**, vol. 69, no. 12, pp. 8744-8752, Dec. 2021, doi: 10.1109/TAP.2021.3083822.
[4] W. Krouka, F. Sarrazin, J. de Rosny, A. Labdouni and E. Richalot, *Antenna Radiation Efficiency Estimation From Backscattering Measurement Performed Within Reverberation Chambers*, **IEEE Trans. Electromagn. Compat.**, doi:

10.1109/TEMC.2021.3129912. open access