PhD offer

Contactless Characterization of Miniature and Buried Antennas Within Reverberation Chambers

Supervision François Sarrazin: Junior Professor Chair at Université de Rennes
Philippe Besnier: Research Director at CNRS

Keywords: Antenna characterization, Miniature antenna, Reverberation chamber

Context: Smart cities rely on the use on wireless sensor networks 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 particularly 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]. In that context, innovative efficiency measurement methods are required to overcome current limitations of conventional methods.

Objectives and Work Plan: Reverberation chambers (RCs) have become a reliable alternative to anechoic chambers to perform antenna radiation pattern [2] and efficiency measurement [3]. The objective of this PhD is to develop a contactless antenna measurement method suitable for low efficiency and buried antennas, based on our recent proof-of-concept [4]. The work plan is the following:

- Develop new analytical models of antenna scattering and absorbing properties within reverberation chambers.
- Develop the measurement protocol and test bench to retrieve antenna parameters from non-invasive scattering parameters measurements.
- Validate the approach first in a free-space scenario and then for antennas buried in a complex medium.
- Evaluate the measurement uncertainties regarding the antenna and RC properties.

PhD Working Environment: The PhD will take place at the IETR – UMR CNRS 6164 (www.ietr.fr) on the *Beaulieu* campus of the *Université de Rennes*, France. The PhD student will join the eWAVES team and will benefit from the group expertise as well as IETR's world-class technological platforms including M²ARS and Complex Systems Oriented Quantification.

Applicant Profile
Education level: Master or equivalent degree
Background: electrical engineering, physics
Language: English or French (French is not required)

Practical Details and Application

Starting date: Anytime in 2024 for 36 months

Salary: about €1800 net per month

How to apply: **send a resume, cover letter, and last academic transcripts to francois.sarrazin@univ-rennes.fr**

Bibliography

[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.

[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.