



## Available PhD thesis position

Oct 2019-Oct 2022

**RF wireless interconnect design and characterization of boundary effects for high density multilayer circuits (CMOS, PCB or LTCC).**

### Context of the study :

In electronic domain, the miniaturization, the utility increase, a best reconfigurability or a consumption reduction have been mainly obtained with the help of the development of multilayer technologies as CMOS, PCB or LTCC approaches. The studies of these structures carry on, and as example, it is now possible to insert passive or active component inside the stack of multilayer circuits which improve the compacity and simplify the routing. In another hand, to satisfy the need of always bigger data rates, the working frequencies rise which combined with high compactness, this implies more negative effects on signals propagated on classical wired interconnects. As example of negative effects, we can cite crosstalk effects, impedance mismatching, important delays and desynchronization. Moreover, wire interconnects occupy large useless surfaces, limit the reconfigurability and need complex 3D routing tasks increasing the time of design and the "time to market".

So, in this context of multilayer electronic circuits, this thesis aims to overcome the limits of classical interconnects by replacing them by wireless links and to study the boundaries effects on signal propagation.

### Aims of works.

The proposed thesis is in the continuation of the previous BBC project (Broadcast Based parallel Computing) which was funded by the French labex Cominlabs. This project addressed the study of high frequency wireless interconnects for NoC (Network on Chips) with the objective to overcome the impact of classical interconnects and to facilitate data broadcast on chips.

The studies will mainly concern multiple-scale analysis of wireless communications, ranging from intra-chips communications to inter-card communications, with the aim of development of internal communication networks on these devices. The modeling of the different propagation channels at millimeter frequencies (close to 60 GHz) or at sub-terahertz (up to 150 GHz) is the first work to make. The analysis of boundary effects of the circuits (substrate-air for CMOS, PCB and LTCC devices and package for racks) will also be done with the aim to limit their influences on propagation. In fact, the boundaries have a great influence on propagation but also in context of data hacking security. After these analysis, new solutions for control boundaries with good electromagnetic properties, it means good for information transmission, and robust against hacking, will be proposed and developed. The next step will concern the development of appropriate access technic (RF modulation, coding ...). Finally, a comparison between other interconnect solutions as for example optical interconnects or RF guided interconnects will be realized with the aim to identify the best solution at each integration level.

### Key words :

Propagation, Electromagnetic, Antennas, Wireless interconnects, CMOS, PCB, LTCC technology, Network on Board and Network on Chips, modulation.

### Supervisor team and lab facilities

This thesis will be done in Lab-STICC laboratory located in BREST (<https://www.labsticc.fr/en/index/>) in the University of BREST (Université de Bretagne Occidentale (UBO)). The Thesis will be supervised by 3 researchers, Thierry le Gouguec and Pierre-Marie are specialized on propagation inside electronic circuits, interconnect characterization, and Rozenn Allanic is more specialized on CMOS technology and microwave devices.

The laboratory Lab-STICC has the necessary resources in software, computing capabilities and measurement to achieve all studies and works which are planned during the PhD.

### Candidate profile

The candidate has to present a good ranking in master degree or an equivalent title recognized by the doctoral school SICMA in the field of microwave electronics or microelectronics as well as an excellent CV. A good knowledge of commercial software like ADS, CST, HFSS and Ansoft Designer as well as a knowledge in CMOS technology will be a real asset.

No nationality requirement is needed.

**Application:**

The applicant should provide by email before June the 1<sup>st</sup> a ZIP archive containing :1) a detailed CV, 2) a motivation letter, and 3) marks obtained over the master degree.

After the selection: a short interview could be done.

**Additional details**

The thesis will be funded by the region of Bretagne and the University of Brest. The final selection of thesis subjects will be made by the doctoral school after the interview of different candidates.

The gross monthly salary is 1685 €.

**Contact:**

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