***XLIM is hiring a Post-doc Candidate on Very High Energy Efficiency Millimeter Power Amplifier Architectures for 5G MIMO Active Antennas***

***Contract duration : 14 months (start of contract: 1st September 2023)***
***Location : XLIM laboratory***
***Contacts : Ms. Audrey MARTIN audrey.martin@xlim.fr and M. Philippe BOUYSSE philippe.bouysse@xlim.fr***

***In the framework of a PEPR 5G project, the research focuses on the following themes:***

- Design and demonstrate RF transceivers circuits with high power efficiency and versatility;
- Promote transversality in the design of antenna, circuit functions and associated signal processing techniques;

This project addresses the design of HPA in the context of active antenna in the mmWave frequency bands.

Context :

The design of different architectures of HPAs can also be performed thanks to a simultaneous multicriteria optimization of Power Gain, Output Power, Global Efficiency, linearity. The design can be realized through quasi-static simulations to minimize the power consumption in the PA (high efficiency), while respecting the linearity constraints and addressing the mmWave bands of 5G.

**For this post-doctorate, the work will focus on two techniques for improving the performance of power amplifiers (ET : Envelope Tracking and APT : Average Power Tracking). These techniques will be explored through different designs, different types of analysis and experimental characterizations.**
The design can also be performed through dynamic simulations using actual and future modulation schemes dedicated to the application of the realized PA. Then, CW HB analysis is no more usable but new non-linear simulations should be introduced to deal with baseband frequencies and modulated frequencies located at the carrier frequency but also with the harmonics of the baseband frequencies and the harmonics of the carrier frequencies associated to the modulated frequencies. The simulation process should integrate the generation of the baseband signal, the generation of the mmWave carrier frequency, the generation of the mmWave modulated signal driving the HPA, the demodulation of the mmWave modulated signal at the output of the HPA. A solution with circuits based on GaN capable of operating in wide frequency bands will be investigated with the final objective of exploring the architectures and the integration possibilities of HPAs for 5G and beyond Base-stations.

The 5G mobile telecommunication systems are structured around an antenna architecture called "massive MIMO" (Multiple Input Multiple Output), which allows to connect several users simultaneously with a better connection quality and an optimization of the radiant energy. The MIMO system requires the deployment of antenna arrays (APAA: Active Phase Antenna Array) that allow the directional beam forming in order to concentrate the radiant energy mainly towards the connected object. The development of these APAA requires the design of medium power amplifiers (few watts are enough) but with high bandwidths (several hundred MHz) in the millimeter wave range (Ka band) with the best energy efficiency as possible. The research project we propose is therefore part of this context of amplification systems for massive MIMO 5G and aims more specifically to reduce the power consumption of solid-state millimeter power amplifiers in GaN technology for two architectural topologies: Envelop Tracking and Average Power Tracking using a full MMIC solution. This project represents a great opportunity to achieve a technological breakthrough that will allow industrial partners, including both foundries and equipment manufacturers, to acquire a competitive advantage, even decisive, in the field of design and fabrication of power amplifiers for 5G mobile telecommunication systems via the improvement of energy consumption and bandwidth at millimeter frequencies.