



ERASMUS MUNDUS



MASTER in PHOTONICS EUROPHOTONICS-POESII

MASTER THESIS PROPOSAL

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Laboratory: TSC, Universitat Politècnica de Catalunya, Campus Nord
City: Barcelona
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Title of the master thesis: Microwave photonic techniques for 5G mobile networks

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Summary of the subject (maximum 1 page):

As communications networks evolve to address the demands of a fully connected society, the limits between the wireless and the photonic domains of the network gradually dissolve into a blur. Massive connection of heterogeneous terminals for the Internet of Things (IoT), connected car, e-health, and some yet to appear and even be conceived, will require a fully reconfigurable and highly flexible network that may grow and be seamlessly and easily upgraded. This future network will need to rely on as yet two very differentiate technologies, which will have to cooperate and evolve towards the global concept of Fiber-Wireless (Fi-Wi) networks as a new paradigm embodying a common approach to network management and control which involves joint strategies to smartly combine the potentials of both fiber and wireless technologies in order to maximize efficiency and flexibility and reduce cost and power consumption.

The high capacity and low-loss of fiber optic links allows the provision and control of services from a common location to a very wide coverage area, resulting in efficient dynamic relocation of network resources to temporary heavy demand hot spots; while the move towards higher wireless frequency bands, well into the mm wave, increases the capacity offered to mobile users while reducing the coverage area down to the femtocell, thus increasing the number of points of service leading to higher spatial granularity and more complex management with more frequent hand-offs. In this scenario, it is only reasonable to think that a good understanding of the respective capabilities and strengths of each technology, should be paramount towards the networks of the future, in as much as it should allow to identify and exploit complementarities and synergies leading to optimized designs that could meet the expected performance figures. Under this interdisciplinary view, the

research into this master thesis will focus on the study of combined microwave-photonic approaches that may bring to a reality the promises of a next generation of communication networks that may address the needs of our connected society.

The high frequency bands envisioned in the framework of 5G mobile networks, well beyond the mm wave ranges, and the massive amount of point of services required point to photonic technologies as a necessary enabler. In this master Thesis we will review the state of the art of microwave photonic technologies and assess their potential to contribute to the future 5G roll-outs. An analysis of digital vs analog solutions for the fiber-wireless link will be carried out and a variety of modulation and user multiplexing formats will be studied. Advances into analog radio over fiber techniques are expected through research into linearization schemes allowing for efficient Subcarrier Multiplexing (SCM) and Orthogonal Frequency Division Multiplexing (OFDM) formats.

Keywords: 5G mobile networks, microwave photonics