Job Title	***Postdoc**: Integrated optical-and-digital UWB signal processing for robust, high performance, and versatile wireless networks*
Main Research Field	*Information Science and Engineering (ENG)*
Sub Research Field	*Impulse radio ultra-wideband (IR-UWB) communications*
Key words	*UWB over fiber transmission, IR-UWB signal processing, sub-Nyquist sampling, finite rate of innovation, compressive sensing*
Job Description	*Short-range wireless communications have known considerable growth over the last few years, especially due to the increasing and widespread deployment of Wireless Local/Personal/Body Area Networks (WLAN/WPAN/WBAN). Moreover, the emergence of the Internet of Things (IoT) and smart factories (Industry 4.0) makes this type of communications unavoidable in the years to come. The applications developed around these networks are often associated with needs in terms of high data rates and precise indoor localization, whereas traditional access to spectral resources becomes increasingly difficult, given the congestion of the RF spectrum. This context has strongly motivated the development of Impulse Radio Ultra-Wide Band (IR-UWB) [1], characterized by the emission of extremely short pulses with a very low power level. Indeed, the particular characteristics of IR-UWB signals allow for high data rates, multipath immunity and high localization capability, making their use very interesting for indoor applications [2].* *The research we have carried out so far has resulted in various contributions on the blind estimation of the IR-UWB signal parameters, UWB over fiber transmission systems employing semiconductor optical amplifiers, and accurate indoor localization. However, the huge instantaneous frequency band to be processed leads to strong constraints, beyond the specifications of the state-of-the-art digital circuits, especially for some critical tasks such as analog-to-digital conversion or channel estimation.* *The Marie-Curie fellowship aims at dealing with these challenging aspects, by exploring the limits and taking advantage of the capabilities and complementary aspects of both optical and radio UWB systems [3]. Its main objective is to make a major breakthrough in the UWB research field, by developing new signal processing techniques for robust and high performance indoor wireless networks, including a large number of UWB communicating systems.* *The fellow will work on joint digital and optical UWB signal processing techniques, which will be the key for designing highly versatile and intelligent UWB systems, being able to adapt to the environment by optimal waveform adaptive design, channel estimation and automatic receiver reconfiguration. Moreover, such an intelligent UWB system would have the ability, due to its cognitive capability, to transmit more power in the bands where primary users can be identified and avoided. Thus, the signaling*

	and transmission of associated data can be shaped such that one part of the spectrum is used in an overlay mode and another part in an underlay mode, which would lead to a significant increase in the transmitted data rate and effective transmission range. *Relevant approaches include, but are not limited to, compressive sensing, modulated wideband converter, optical ADC, signals with finite rate of innovation, multichannel modulating waveform schemes, and sub-Nyquist sampling.* *Two research teams of Lab-STICC CNRS 6285 will jointly work on this project, which will also benefit from our industrial partnerships and an international collaboration with the research team of Prof. Octavia A. Dobre, from Memorial University, Canada. The involved research teams will provide all the supervision skills, as well as the required measurement equipment and the computing capabilities for developing and testing the new UWB processing techniques, and for handling both the electrical and optical aspects of the project.* *[1] V. Niemelä, J. Haapola, M. Hämäläinen, J. Iinatti, "An Ultra Wideband Survey: Global Regulations and Impulse Radio Research Based on Standards," IEEE Communications Surveys & Tutorials, vol. 19, no. 2, pp. 874-890, Second quarter, 2017.* *[2] R. Bharadwaj, S. Swaisaenyakorn, C. G. Parini, J. C. Batchelor, A. Alomainy, "Impulse Radio Ultra-Wideband Communications for Localization and Tracking of Human Body and Limbs Movement for Healthcare Applications," in IEEE Trans. on Antennas and Propagation, vol. 65, no. 12, pp. 7298-7309, Dec. 2017.* *[3] M. S. Shehata, H. Mostafa and Y. I. Ismail, "On The Theoretical Limits of The Power Efficiency of Photonically Generated IR-UWB Waveforms," in Journal of Lightwave Technology, Early Access, 2018, doi: 10.1109/JLT.2018.2801760.*
Supervisor(s)	*Emanuel Radoi graduated in Radar Systems from the Military Technical Academy of Bucharest, in 1992. In 1997 he received the M.Sc. degree in Electronic Engineering and in 1999 the Ph.D. degree in Signal Processing, both from Université de Bretagne Occidentale. He is currently Professor in Signal Processing at Université de Bretagne Occidentale (Brest, France) and a member of the Communications research team of Lab-STICC. His main research interests currently include, but not limited to UWB signal processing, cognitive radio and sparse signal processing.* *T. Yaacoub, O. A. Dobre, R. Youssef, and E. Radoi, "Optimal Selection of Fourier Coefficients for Compressed Sensing-Based UWB Channel Estimation," IEEE Wireless Communications Letters, vol. 6, issue 4, pp. 466 - 469, Aug. 2017.* *M. Stanciu, S. Azou, E. Radoi, and A. Serbanescu, "A Statistical Analysis of Multipath Interference for Impulse Radio UWB Systems," Journal of the Franklin Institute, vol. 352, pp. 5952-5967, Dec. 2015.*

	R. Akbar, E. Radoi, and S. Azou, "A Non-Data-Aided Rapid Synchronization Method for UWB Impulse Radio," IEEE Communications Letters, vol. 16, no. 8, pp. 1308-1311, June 2012. *https://www.labsticc.fr/en/directory/489-radoi-emanuel.htm*
Department/Research:	*Lab-STICC CNRS 6285* *https://www.labsticc.fr/en/index/* *UWB platform at Université de Bretagne Occidentale* *https://www.univ-brest.fr/plateformes-technologiques/menu/nos-plates-formes/UWB* *UWB Optronics equipment at ENIB*
Suggestion for interdisciplinary / intersectoral secondments	*International collaboration:* *Université de Bretagne Occidentale, Brest, France* *ENIB, Brest, France* *Memorial University, St. John's, Newfoundland, Canada*
Skills Requirements (optional) :	*Fluent in English* *Publications: at least 1 per year since the Ph.D. completion, as 1st author*