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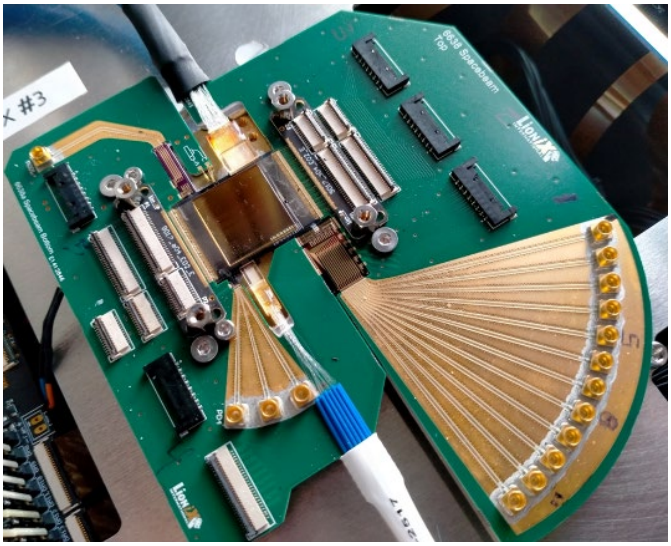
Photonics for satellite radars: the SPACEBEAM project

Abstract

Synthetic aperture radar is a remote sensing technology finding applications in a wide range of fields, especially related to Earth observation. It enables a fine imaging that is crucial in critical activities, like environmental monitoring for natural resource management or disasters prevention. In this picture, the scan-on-receive paradigm allows for enhanced imaging capabilities thanks to wide swath observations at finer azimuthal resolution achieved by beamforming of multiple simultaneous antenna beams. Recently, solutions based on microwave photonics techniques demonstrated the possibility of an efficient implementation of beamforming, overcoming some limitations posed by purely electronic solutions, offering unprecedented flexibility and precision to RF systems. Moreover, photonics-assisted RF beamformers can nowadays be realized as integrated circuits, with reduced size and power consumption with respect to digital beamforming approaches.
This talk presents the design analysis, the challenges of the development, and the resuls of a hybrid photonic-integrated circuit as the core element of an X-band scan-on-receive spaceborne synthetic aperture radar, developed during the H2020 project SPACEBEAM [1]
The photonic-integrated circuit synthetizes three simultaneous scanning beams on the received signal, and performs the frequency down-conversion, guaranteeing a compact 15 cm^2 form factor, less than 6 W power consumption, and 55 dB of dynamic range. The whole photonics-assisted system is designed for space compliance and meets the target application requirements, representing a step forward toward a deeper penetration of photonics in microwave applications for challenging scenarios, like the observation of the Earth from space.



Picture of the functional model of the SCORE-SAR receiver developed during the SPACEBEAM project

References

[1] www.spacebeam-project.eu