

Spacechips Ltd; Advancing Software-Defined Radio for Space Applications

Executive Summary

This CEOI-funded R&D has explored the concept of placing an external Sample & Hold circuit in front of an ADC with a view of extending the bandwidth, linearity and performance of the latter. A recent advance in SiGe, Sample & Hold technology suggests this may be used to directly digitise carriers up to Ku-band, offering the potential of smaller, lighter, less-power consuming and more affordable, satellite sub-systems.

The project started by investigating the feasibility of Sample & Hold technology for space applications and analysis of the circuit design, radiation hardness and its fabrication suggests it will be suitable.

System-level modelling proved the concept and highlighted the importance of correctly synchronising the timing between the external Sample & Hold circuit and the ADC.

Circuit simulation of a front-end of a digital, satellite transceiver predicts good transient and frequency behaviour as well as RF match. Analysis has shown that third-party simulation models of ADCs need to be improved to correctly reproduce high-frequency effects.

Hardware testing using a commercial version of a space-grade ADC and an external Sample & Hold circuit demonstrated the concept and measured results have shown that the bandwidth, linearity and performance of ADC can be improved by placing a 'master' Sample & Hold circuit in front of the latter.

Discussions are continuing with a semiconductor provider of Sample & Hold circuitry to advance the early TRL of this technology and to understand how best to package, industrialise and ultimately qualify a discrete Sample & Hold for space applications.

The project has fully achieved the Success Criteria listed in the Technical Proposal made during this GEI application:

1. Sample & Hold technology will allow future satellite sub-systems to directly digitise carriers up to Ku-band without the use of traditional RF down-conversion. Future spacecraft will become smaller, lighter, less power consuming and more affordable.
2. This project has strategically positioned the UK space industry to exploit and offer the benefits of Sample & Hold technology to enable the next generation of missions.
3. The project has continued the growth of a new, UK, space start-up and discussions held during the first week of April suggests Spacechips Ltd. will sign a contract with a major OEM to deploy a Sample & Hold circuit into a new, payload demonstrator.

Spacechips Ltd. is pleased that the R&D performed by this GEI award will develop the British space sector as described in the Space Innovation and Growth Strategy. The work undertaken

fully aligns with the NSTP's strategy and technology roadmaps, supports the six Pathways to Growth published in the UKSA Civil Space Strategy, and endorses the five recommendations of the Space Growth Action Plan listed in the space IGS.

Spacechips Ltd. would like to thank the CEOI for the award of an GEI and our partners for the loan of hardware, test equipment and design software.