Spacechips Ltd; Advancing Software-Defined Radio for Space Applications

Project Summary

All satellites and spacecraft use RF transponders to communicate to and from the ground. Those containing digital payloads first have to use a traditional, RF, superheterodyne receiver to downconvert the RF carrier to an intermediate or baseband frequency prior to digitization.

From 2008 to 2012, the author pioneered the use of ADC/DAC Direct Conversion for space applications allowing satellites and spacecraft containing digital transceivers to directly process L and S-band carriers. For the first time, RF stages have been eliminated and this innovation has allowed satellite manufacturers to offer payloads which are 20% lighter, 40% less power consuming, 40% smaller, together with significantly lower non-recurring and recurrent costs.

The objective of this project is to investigate advances in Sample & Hold technology to assess their suitability for future space applications. This innovative circuit offers the potential to deliver future spacecraft without any RF, frequency down-conversion: imagine the next generation of satellites being able to directly process carriers up to Ku-band without any RF front-end! This would be a radical change and profound advance in space communications, allowing the next generation of satellite, digital transceivers be significantly smaller, lighter, less power consuming and much more affordable.

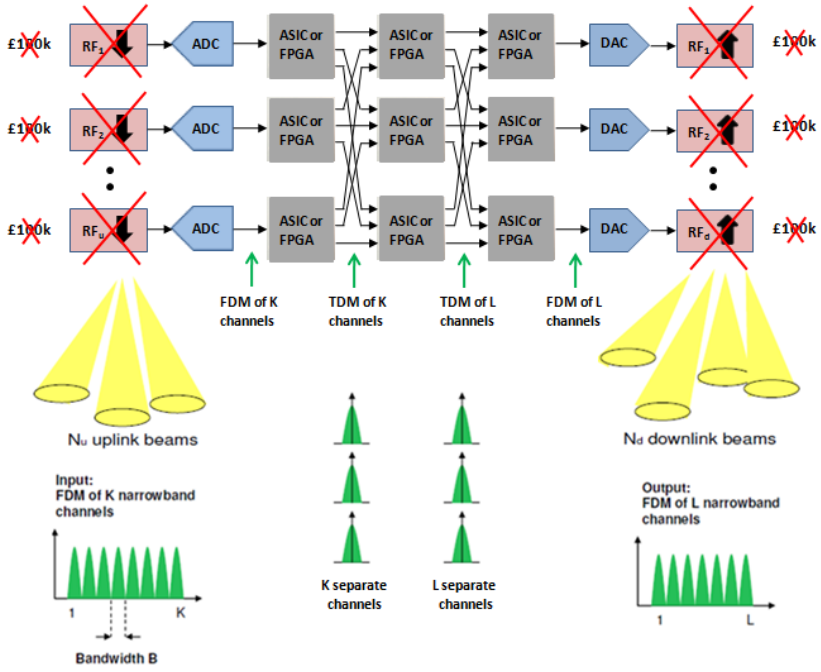

Figure 1 : For UHF, L/S and low C-band satellite communications, the RF frequency conversion stages can be completely eliminated. For missions up to Ku-band, this GEI application proposes to completely remove the RF, frequency, down-conversion stages from the transponder receiver by exploiting advances in Sample & Hold technology. For Ka-band, only one stage of RF down-convert will be necessary, from a maximum of 40 GHz to an intermediate frequency of Ku-band. Each RF down-convert stage costs £100k which can be now be eliminated!