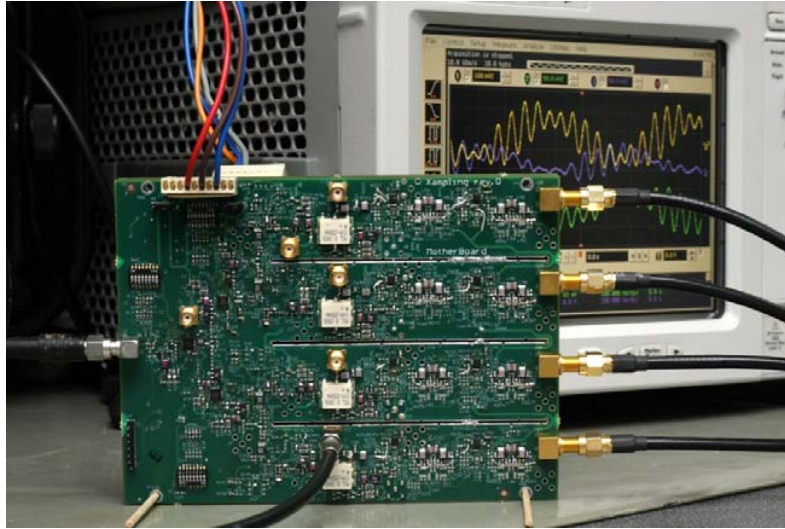


Xampling: Analog to Digital at Sub-Nyquist Rates



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Abstract

We present a sub-Nyquist analog-to-digital converter of wideband inputs. Our circuit realizes the recently proposed modulated wideband converter, which is a flexible platform for sampling signals according to their actual bandwidth occupation. The theoretical work enables, for example, a sub-Nyquist wideband receiver, which has no prior information on the transmitter carrier positions. Our design supports input signals with 2 GHz Nyquist rate and 120 MHz spectrum occupancy, with arbitrary transmission frequencies. The sampling rate is as low as 280 MHz. To the best of our knowledge, this is the first reported wideband hardware for sub-Nyquist conversion. Furthermore, the modular design is proven to compete with state-of-the-art Nyquist ADCs in terms of resolution bits and full-scale range. We describe the various circuit design considerations, with an emphasis on the nonordinary challenges the converter introduces: mixing a signal with a multiple set of sinusoids, rather than a single local oscillator, and generation of highly-transient periodic waveforms, with transient intervals on the order of the Nyquist rate. A series of hardware experiments validates the design and demonstrate sub-Nyquist sampling.