Ultra-Wideband M-Sequence Devices

Workshop on
Short Range Ultra-Wideband Systems
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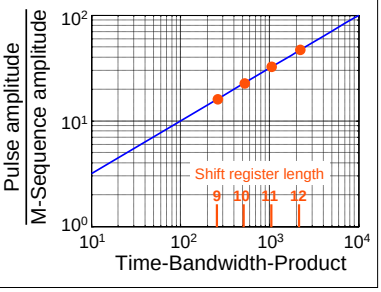
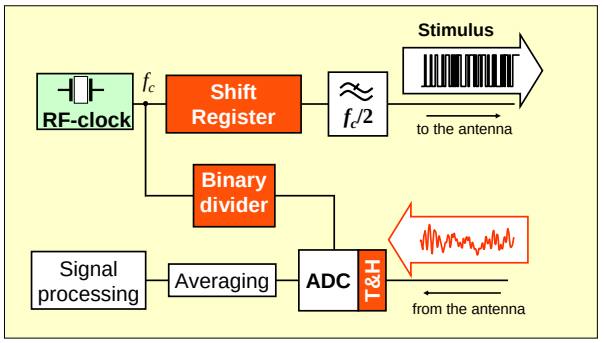
The M-Sequence is a special kind of pseudo-random code. It has a very short and clear auto-correlation function which makes it very suitable for impulse response measurements. Its signal energy is homogenously distributed over the whole signal. In contrast to pulse excitation, this reduces saturation effects in the electronics, avoids overloading of sensible targets and reduces interference. The low signal levels of a M-sequence promotes monolithic circuit integration by low-cost RF-technologies such as SiGe:C-BiCMOS.

In the basic approach, a stable RF-clock pushes a shift register which provides the M-sequence. It stimulates the objects under test. The receive signal is captured by an interleaved sampling method. This drastically cuts down the data rate and reduces the hardware costs. The sampling circuit is controlled by a binary divider which is driven by the same source as the shift registers. This approach guarantees an extremely stable and absolute linear time base. The impulse response is gained via a Fast Hadamard Algorithm avoiding any high peak signal in the analog circuit parts.

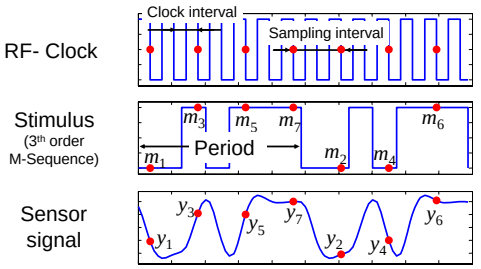
Pulse versus M-Sequence

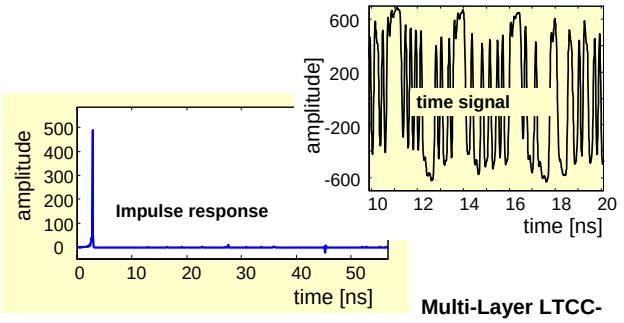


Basic M-Sequence Approach

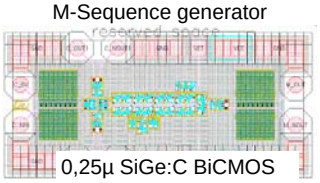


Sampling rate reduction by binary division of the clock-rate

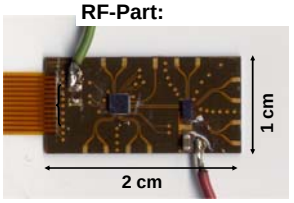




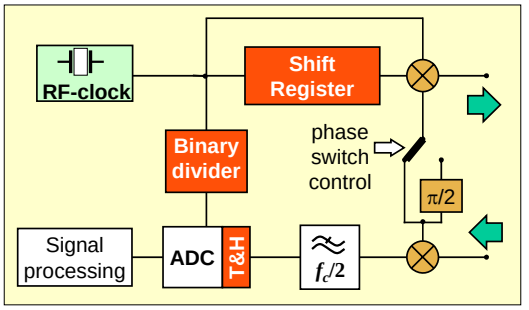
M-Sequence generator



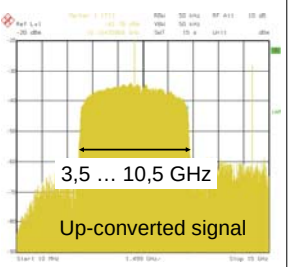
Multi-Layer LTCC-RF-Part:



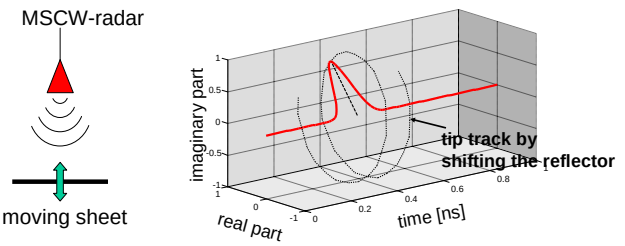
M-Sequence Continuous Wave Approach



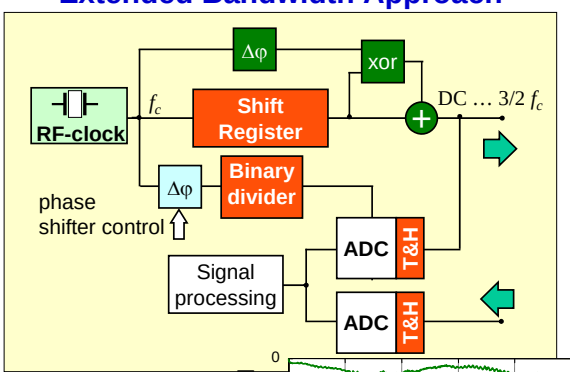
Clock rate: f_c = 7 GHz

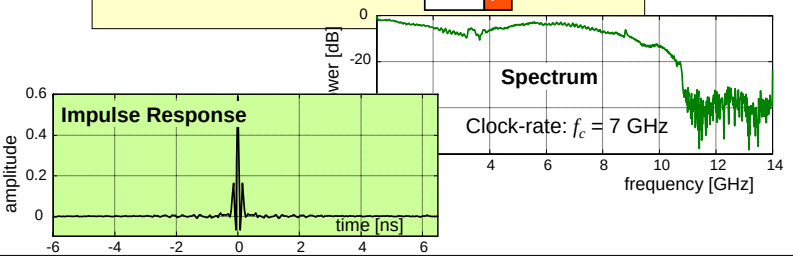


Complex Impulse Response



Extended Bandwidth Approach





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