

Millimeter Wave Circuits for Phased Array Communication Systems in 28nm CMOS Technology

Fabio Padovan
Infineon Technology AT

Abstract— The increasing demand for high data rate in modern communication systems and digitalization are leading to more and more integration of RF/mm-wave communication system using Nano-scaled CMOS technologies where digital processors can be embedded together with the RF transceiver. This demand drives the research communities and the industries to push more and more the performance of RF-mm-wave circuits.

The sub-terahertz Ft of the most scaled CMOS technologies allows the development of transceivers at mm-wave frequencies where the wavelength of the carrier is relatively small and multiple antenna can be integrated in the package leading to saving system cost and complexity. Phased array systems can be therefore efficiently built, leading to smart and highly directive data communications. Those systems are used in many fields i.e. radar, high data-rate backhauls systems, satellite communications etc.

This presentation contains a deep dive into several RF/mm-wave architectures and circuits that are used to push the performance of modern communication systems.

LO generation is one of the most important fields. Efficient IQ generation and low phase noise at mm-wave frequency are needed to build Gb/s rate communication system. Complex modulation schemes require very low SNR. As a consequence, the LO performances are the most challenging bottleneck of the integrated system. Digital PLL architecture are used more and more due to the huge flexibility that can be integrated into the LO generation - especially in phased array systems. On top, digital architecture allows very fast change of frequency channels and modulations, leading to an improvement of the latency in the system.

Up-down conversion is another key building block for a communication system and it can be the limiting factor when the bandwidth of the communication is increasing to allow more complex modulation schemes.

A detailed description of a broadband Image rejection transceivers in Ka-band in 28 nm CMOS is presented in this work together with a Ka-band IQ LO generation and a Digital PLL for phased array systems in 28 nm CMOS technology.