NEXT GENERATION WIRELESS ASKS FOR LARGER BANDWIDTHS AND SPEEDS

Consumer electronic products increasingly include data-intensive applications and have gigabytes of memory. In order to maintain the user experience, accessing the Gigabytes of data should occur virtually instantaneously. Wireless exchange of this massive amount asks for very high speed links. Moreover, the number of users, products and applications is literally exploding. The next generation wireless is facing spectrum scarcity below 10GHz and therefore bandwidth is sought at higher frequencies. The 57-66GHz unlicensed band is available throughout the world and enables multi-Gbit/s wireless communication. The high propagation attenuation at these frequencies allows for frequency reuse. A whole range of new applications comes into sight such as uncompressed data and video distribution in the home, fast downloads of Gbytes of data at video kiosks or between tablets and smartphones and wireless docking of laptops. Today’s downscaled CMOS technologies have high switching speeds and allow the realization of millimeter-wave transceivers with excellent performance. This paves the way to combine the millimeter-wave and digital baseband functionality on a single chip resulting in a low-cost, low-power and highly-integrated radio.

IMEC TECHNOLOGY AND RESEARCH

- Imec’s research aims to develop highly-integrated, low-cost and low-power 60GHz CMOS based phased array radios providing multi-gigabit wireless connectivity. The IMEC research and development covers the system level, IC design and antenna design.
- Imec developed a complete signal processing model for both the Single Carrier and the OFDM physical layer of the IEEE802.11ad standard. It includes algorithmic solutions for synchronization, channel estimation, equalization, tracking and detection and is capable of compensating non-idealities of RF front-end non-idealities. A complementary innovative beamforming algorithm gives high performance even in multi-path environments.
- Imec has developed a 60GHz scalable PHased Array RAdio transceiver technology in 40nm CMOS, called PHARA. The PHARA transceiver is a zero-IF phased array transceiver with electronic beamforming implemented in the analog baseband section achieving low system complexity and power consumption. The PHARA transceiver prototype achieves speeds up to 4.6Gbps. The prototype is integrated with an antenna array into a compact module.
- Imec is developing a new generation 60GHz phased array radio technology in 28nm CMOS. The technology targets 30% reduction in power consumption and speed increase up to 10Gbps. As the digital baseband scales further down, realizing the 60GHz circuits with good performance in 28nm CMOS is a must to integrate the 60GHz transceiver with the digital baseband on a single die.
- Phased array transceiver technology including millimeter-wave front-ends,
beamformer, VGA, low pass filter, PLL, ADC

- Fully integrated Direct Conversion (Zero IF)
- Electronic beamsteering, digital on chip control @ low die size & low power consumption
- RF tuning range: 57GHz to 66GHz
- IEEE802.11ad standard compliant

- Imec IEEE802.11ad standard compliant phased array transceiver technology includes millimeter-wave front-ends, beamformer, VGA, low pass filter, PLL and ADC. The chip architecture is a fully integrated Direct Conversion (Zero IF) architecture. Thanks to clever design and use of down scaled CMOS electronic beamsteering and digital on chip control is realized @ low die size and low power consumption.

- Imec is developing beamforming antenna and antenna interface solutions for 60GHz. The imec 60GHz antenna research aims at improving antenna efficiency, bandwidth and scan range for a better user experience. Different technologies are evaluated to explore the optimal cost/performance/form factor trade-off for imec customers. Silicon interposer technology, medium grade PCB technology, high grade PCB technology and Low Temperature Ceramic Co-fired (LTCC) technology have been evaluated and used in demonstrators.

### 40NM PHARA TECHNOLOGY AVAILABLE FOR LICENSING

- 40nm digital CMOS without RF options (VDD 1.1V) for lowest cost.