Integration of Multiple RF Front-Ends

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The Wireless Gigabit Local Area Network (WiGLAN) project makes use of space-time diversity and adopts multiple antennas to improve the system capacity. Each antenna has a front-end analog circuit consisting at a minimum of an LNA, mixer and filtering before analog-to-digital conversion and subsequent digital signal processing. We will implement multiple RF front-ends on the same chip; however, the coupling between these parallel radios can severely degrade the system performance, imposing major challenges for integration. The coupling can be reduced by adequate isolation among multiple signal paths.

The focus of the research is to explore various isolation techniques and to design schemes to suppress the signal interference and RF coupling. In particular, the emphasis of the research is the interference reduction of the multiple RF front-ends. Balanced circuit configurations, which require two signal conductors for each signal of interest, can significantly reduce radiation and cross-talk, improve noise immunity, and essentially eliminate ground noise. Deliberate partitioning of the system and careful spacing of the building blocks can also reduce signal interference. Building guard rings and isolation structures around sensitive circuits, inserting ground planes or low resistivity layers, adopting heavily-doped or low resisitivity substrate materials can effectively suppress substrate coupling. We will investigate the effectiveness and limitation of different isolation methods and use them selectively with other novel techniques such as using downstream digital algorithms to achieve sufficient isolation for the integration of at least eight RF front-ends in the WiGLAN project.