4G Mobile Networks - DTU Orbit (13/12/2018)

4G Mobile Networks: An Analysis of Spectrum Allocation, Software Radio Architectures and Interfacing Technology

This thesis has investigated 4G radio access networks covering spectrum allocation methodologies, eNB software radios and architectures including interfacing performance aspects relevant for IMT-Advanced requirements. Dynamic spectrum allocation is an alternative to fixed allocation methodologies. Although 100 MHz of spectrum per antenna will require frequencies re-allocation - initial rollouts with bandwidths of 40 MHz leveraging Carrier Aggregation and MIMO antenna techniques are foreseen within a 3-years time horizon. MultiRAN and high-power eNB configurations are expected to operate in the 1.7-2.6 GHz bands. Likewise, SingleRAN low-power configurations will operate in the 2.6-3.8 GHz bands allowing equipment manufacturers to focus on a limited number of systems and configurations. An SCR architecture is proposed based on SoC integration of both digital and analog functions allowing modularity and flexibility with a reduced footprint and equipment cost reduction. Baseband to radio interfaces were analyzed representing the future of open and distributed eNB architectures. A contribution on carrier grade capacity analysis and interface interoperability enhancements was presented. Likewise, system synchronization and delay management - relevant because of the remote nature of OBSAI/CPRI equipment supporting reliable multi-hop applications - were thoroughly analyzed. A new architecture for a serial receiver circuitry - the main source of interface delay measurement inaccuracy - is presented enabling 100 ps of theoretical resolution for delay variance.

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