

In contrast to centralized wireless networks, mobile ad hoc networks (MANETs) do not rely on any pre-built infrastructure and central control function. The network topology may change rapidly and unpredictably due to mobility, joining and leaving of mobile nodes. In addition to numerous advantages, this distributed operation also causes a series of challenges across all layers of a network. This work focuses on the physical layer, the medium access control (MAC) layer, and the cross-layer optimization to find resource-efficient designs for mobile portable devices.

In this thesis, a complete PHY & MAC solution for a low complexity six-antenna technique called simplified switched beam (SSB) is studied, which can achieve a proper balance between network performance and resource requirements. SSB can be applied on both TX and RX sides, and only a slight increase on hardware complexity and power consumption is required, compared to a single antenna system. Therefore, it is suitable for mobile portable applications. Its superior network performance is verified using the network simulation tool SAHNE (Simulation Environment for Mobile Ad Hoc Networks). To evaluate the point-to-point link performance of SSB, a test-bed has been implemented applying the FPGA prototyping system RAPTOR2000. Intensive measurements performed in an indoor short range mobile scenario (with and without interference) show that the SSB receiver can help to suppress fading and interference, increase the received signal power, and provide better performances than the single antenna receiver in terms of the reduced bit error rate. The measured signal to noise power ratio (SNR) gain and amount of fading (AoF) closely approach the theoretical predictions.