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Measurement-based Massive MIMO Channel Modeling for Outdoor LoS and NLoS Environments

In this contribution, a measurement campaign for massive multiple-input multiple-output (MIMO) channel characterization in both line-of-sight (LoS) and non- line-of-sight (NLoS) outdoor environments is introduced. The measurements are conducted at the center frequency of 15 GHz with a bandwidth of 4 GHz. A virtual 40 × 40 planar antenna array formed by stepping a vertically- polarized bi-conical omni-directional antenna (ODA) along regularly-spaced grids is used in the receiver (Rx). The transmitter (Tx) is equipped with a single ODA. To in- vestigate channel variation over the Rx array, this 1600- element Rx array is split into multiple 7×7 sub-arrays, and a maximum-likelihood parameter estimation algo- rithm implemented using the space-alternating generalized expectation-maximization (SAGE) principle is applied to extracting multipath components (MPCs) from sub-array outputs. The spatial variability of K-factor, composite channel spreads in delay, azimuth and elevation of arrival are investigated. Based on the estimated MPCs' parameters, multipath clusters are identified and associated across the array to find the so-called spatial-stationary (SS) clusters. From several hundred of SS-clusters extracted, we establish a stochastic model for their life distances in horizontal and vertical directions, two-dimensional life region (LR), and variation of cluster spreads. These findings are important for massive-MIMO channel modeling in the cases where two-dimensional large-scale arrays are considered.

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