Polarization Diversity for Base Station Antennas

Martin Nilsson, Allgon System

The use of space diversity in the reception of mobile radio signals is a well known technique to mitigate fading and is implemented in most wireless systems of today. However, during the last few years we have seen an increased interest in dual polarized base station antennas for mobile communications. The motivation for these antennas is the reduced cost for installation and the smaller space needed using polarization diversity instead of the traditionally used space diversity. Further, in a mobile communication system, base station antennas with a nominal ±45° to vertical linear polarizations are preferred since they provide equal mean power on both antenna branches.

Dual polarized antennas are traditionally characterized in terms of port-to-port isolation and co- and cross-polar patterns. However, in this presentation we identify the critical parameter when the antenna is used as a sensor in a polarization diversity reception system. This turns out to be the far-field coupling between the two channels.

A model for the diversity reception of a ±45° dual polarized base station antenna under Rayleigh fading conditions and different values of the environment cross-polar discrimination is presented. Using this model we calculate the reduction of diversity gain due to non-orthogonal far-fields.

Two types of antenna configurations are analyzed: a dual polarized aperture coupled patch and a pair of slanted dipoles. The antennas are analyzed using both measured and simulated radiation patterns. The results indicate that the aperture coupled patch is superior for diversity reception and that difference in diversity gain, between different antenna configurations, can be in the order of 3 dB.