Performance Evaluation of Dual Polarized MIMO System Using System Capacity

。Sang-Yub Lee*, Jong-Gwan Yook*
*Dept. of Electrical & Electronic Engineering, Yonsei University
。wow0908@yonsei.ac.kr

ABSTRACT

It has been shown, that exploiting the radio channel in mobile communications systems in a multiple-input multiple output (MIMO) manner highly increases system capacity. The access to such a MIMO channel usually involves spatially separated antennas of the same polarization at the transmitter and the receiver side. In this paper, we focus on the potential of dual-polarized antennas in mobile radio systems, which avoid undesired antenna spacing and promise increased system performance for certain environments. Therefore channel model have to design exactly considering spatial distribution using SCM and polarization/depolarization effect. And the performance of these MIMO channels is evaluated based on system capacity with MMSE receiver including equally allocated transmit power, modulation scheme and instantaneous SNR in channel environments. Through the system capacity, we show that the judicious use of pure spatially separated or combined spatial and dual polarized transmit antennas types can increase system capacity for a particular channel realization.

I. Introduction

Dual polarized antennas are usually referred to as means for exploiting polarization diversity which arises from uncorrelated cross coupling or random orientation of mobile handsets.

However, in highly correlated environments, cross-polarization discrimination (XPD) reduces the mean power of the cross coupled component, and thus, the available diversity benefit due to uncorrelated cross coupling decreases. Also considering random orientation of mobile handsets, dual polarized antennas obviously improve system performance since even for high XPD power loss due to polarization mismatching is avoided.

The value of XPD and the level of channel correlation are the main performance criterion in this paper. The interrelation between the Ricean K-factor, describing the line of sight signal, and XPD has been derived in [1] and is presented in this paper as well. This can be achieved by multiplexing data streams not only over spatially separated antenna elements but also over the two branches of dual polarized antennas.

Thus we quantify the resulting change in capacity and develop a measure to determine the optimal antenna configuration so as to maximize the resultant capacity in certain time varying channel environments.

This paper is organized as follows. We outline the channel model for an SM system with dual polarized antennas in Section Ⅱ. Section Ⅲ develop a measure to determine the antenna types using system capacity and channel environments. In Section Ⅳ we use this measure to show proper antenna configuration via simulations. Section Ⅴ concludes the paper.

Ⅱ. Channel Model

A. SCM (Spatial Channel Model)

Recently, due to the increased interest in intelligent antennas and space time coding techniques, the spatial dimension of the wireless channel has received more attention. Antenna performance prediction requires modeling the spatial dimension of the mobile channel, new spatial models have been formed which add the effect of angular spreading [1].

The various parameters are represented in Table Ⅰ.

Ω	Antenna array orientation
θ	LOS Angle of Departure direction
$\theta_{n,m}$	Absolute Angle for m sub-path of n path
δ_n	Angle for n path
$\Delta_{n,m}$	Offset for m sub-path of n path
v	Velocity vector