EMPIRICAL CHARACTERIZATION OF A 2X2 MIMO CHANNEL IN AN OUTDOOR-INDOOR SCENARIO AT 2.4 GHz.

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ABSTRACT

The unquestionable advantages of MIMO channels will have a strong influence on the new wireless systems. The characterization of the MIMO channel in different environments and operating frequencies is a crucial factor in the design of new systems and standards and for an adequate planning of the existing systems. Numerous studies of MIMO channels can be found in the literature, many of which have been used for the development and parameterisation of stochastic models for this type of channels [1],[2]. Of the parameters considered by these models, the most difficult one to establish is that which refers to the spatial correlation among the different subchannels, since this depends on the particular environment of propagation in which the located arrays are found. There are very few experimental works on MIMO channels corresponding to outdoor-indoor scenarios [3]. It is important to analyse this type of scenario for fixed wireless access applications.

This paper presents the experimental results, which lead to the characterization of a 2x2 MIMO channel at a frequency of 2.4GHz in an outdoor-indoor scenario. The channel characterisation includes the analysis of the correlation between the subchannels of the MIMO channel and its impact on the system capacity. The influence of visibility conditions and of the relative orientation between arrays on the channel correlation will be considered.

A measurements campaign is carried out between two buildings of the University of Cantabria, the building of Civil Engineering School (ETSICCP) and the building of Telecommunications Engineering School (ETSIIT), separated from each other by a distance of 120m. The transmitter array is synthesised using sequential transmission at two different positions of the same antenna. The receiver array is made by means of the movement of a single antenna along linear trajectories, forming a virtual receiver array with variable separation between elements. The transmitter array is located on the terrace of the upper floor (+3) of ETSICCP building. The ETSIIT building has eight floors (from –6 to +1). The upper floor (+1) is dedicated mainly to laboratories equipped with computers, work desks, measuring equipments, closets, etc. On ETSIIT floor +1 the mobile receiver system was placed in four different positions, or local areas where the channel can be considered stationary in the wide sense. The height of the virtual receiver array and the transmitter array were 1.5m and 2.0m respectively. Both transmitter and receiver are frequency locked to a GPS disciplined clock. The measurements were made at night in the absence of people and cars moving around to investigate time stationary environments

On the basis of the capacity results obtained, a proposal is made for the use of a 2x2 MIMO system in an outdoor-indoor scenario for FBWA applications in metropolitan environments. The proposal is based on the hypothesis, verified experimentally, that the path loss due to building penetration can be compensated by the diversity gain of 2x2 systems. In this way, direct coverage can be achieved without increasing the power transmitted and without repeaters inside the buildings, with the same capacity and performance as a SISO (Single Input–Single Output) channel in a line-of-sight (LOS) situation. The extension of coverage insides of the building in non line-of-sight (NLOS) situations would offer the option of mobility to users of FBWA systems.

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