LTE Optimal Transmission Mode Selection Guidelines over MIMO Channels

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Abstract: - In LTE /LTE -advanced standards, the physical layer is mapped into multiple transmission modes(TM) and each TM should be dynamically selected depending on the time-varying MIMO channel. Besides the single antenna SISO transmission (TM1), multielement antenna (MIMO) technology such as Open Loop Spatial Multiplexing (OLSM) and Close Loop Spatial Multiplexing (CLSM) transmission are also specified by the 3GPP standard for LTE downlink transmission. In this paper, on the basis of study upon interaction between MIMO channel correlations through the correlation metric in terms of the amount of correlation with MIMO Diversity-Multiplexing Trade-off (DMT), we propose an optimal transmission mode switching method by delimiting wisely guards intervals of different correlation environment levels.

Key-Words: - **LTE, MIMO, Spatial Multiplexing, OLSM, DMT, Amount of Correlation, Transmission Mode, OSTBC.**

1 Introduction

Long Term Evolution (LTE) network downlink transmission system differently from others wireless network, is mandated to operate in multiple transmission modes related to MIMO systems[1].Each transmission mode may be consisted of transmitting one or two independent data streams (code words) assisted respectively by precoding matrix (phase matrix indicator), transmit diversity and by a cyclic delay prefix .All of those MIMO transmission techniques can be grouped into transmission modes (TM) 1,2,3,4,5,6,7 and 8 However it should be noted the transmission modes are extended to TM9 and TM10 specifying multiple layers transmission up to 8 layers in LTE-Advanced Release 10. Beyond, it should be noted also that the major and important transmission modes systems that have attracted the major research and operators recently are CLSM (close loop spatial multiplexing) and OLSM (open loop spatial multiplexing) systems. Having their strength and weakness [2][3]in regard with the variation of the MIMO channel state information, the two groups of transmission modes can be then seen complementary to implement a complete transmission system that takes into account the frequency, time and spatial selectivity of MIMO channel.

The strategy of adapting LTE downlink transmission mode is advantageous and well thought as wireless MIMO channel is known to be varying not only time and frequency domain but also in spatial domain. This means that sometimes, the MIMO channel state or variation can be suitable for a given transmission mode and prejudicial to another [2][3][4]. In other words, we may smartly define and delimit environments favorable or unfavorable to a given TM. However, many authors [2][3][4] have often limited themselves by only describing those environments conditions without delimiting or defining properly those conditions. For instance, TM1 can only be enabled in case of MIMO bad channel or one rink matrix case. When the Channel State Information (CSI) or phase matrix indicator (PMI) is not known (resp. is known), the eNode B (base station of the LTE network) can only transmit in OLSM (resp.CLSM) manner. However the transmission mode selection can only be optimal if the spatial correlations environments are perfectly known at the base station .Hence it is well known vaguely that OLSM (resp.CLSM) rank 1or TM2 performance is more robust in high correlated