

## ABSTRACT

The development of telecommunication technology is currently evolving toward BWA (Broadband Wireless Access) technology and is required in order to fulfill communications with high data rate, large capacity, and high mobility. LTE (Long Term Evolution) is a mobile telecommunications technology which is developed to meet those needs. A problem in LTE is the need for high data rate while the transmission bandwidth is limited. In addition there is also a problem caused by multipath fading channel conditions that can reduce data rate and increase the Bit Error Rate (BER).

Those problems can be overcome by using MIMO (Multiple Input Multiple Output) techniques, which can increase the throughput and has good performance and reliability. Besides MIMO techniques, adaptive modulation technique is expected to maintain the quality of service in accordance with the fluctuating conditions of the propagation channel to be able to achieve a certain BER value.

This research simulates the use of SC-FDMA in the uplink LTE with Adaptive MIMO Switch (AMS) techniques combined with adaptive modulation techniques in order to improve the performance of the LTE uplink. MIMO encoder mode used is MIMO Space Time Block Code (STBC) and MIMO Spatial Multiplexing (SM). Simulations performed with different user conditions, namely at a speed of 0, 3, 30, and 120 km/h. To achieve the BER target of  $10^{-3}$ , the results of simulations show that the use of turbo code with code rate 1/3 gives good performance on the LTE uplink SC-FDMA system with the required energy is 8 dB for QPSK and to 16.8 dB for 16QAM. The addition of STBC MIMO techniques in the system gives a better BER performance in Rayleigh channel and selective fading, while MIMO SM cannot overcome the poor channel condition and requires higher energy to achieve the BER target. The use of adaptive modulation and adaptive MIMO in the systems based on threshold margin provides the advantage of two types of MIMO and different modulation according to the current channel conditions in order to increase capacity and maintain the quality of service in LTE uplink SC-FDMA system.

**Key words: LTE, Adaptive Modulation, MIMO (Multiple Input Multiple Output), Adaptive MIMO Switch (AMS), Space Time Block Code (STBC), Spatial Multiplexing (SM), SC-FDMA**