CHAPTER 1

INTRODUCTION

1.1 Background

In future wireless communications, demand for multimedia based services and the need for high speed data communication increases. This will lead to high occupancy and data rate channels on the limited spectrum allocation. MIMO techniques for wireless communications have been studied extensively over the past decade as a means of achieving signficant capacity gains needed for supporting high-rate wireless broadband applications [18]. Multiple-input multiple-output (MIMO) system is the promising technology for the next generation of wireless communication systems as MIMO system can provide a wide coverage area, a high spectral efficiency, and an increased system capacity[1]. The MIMO system employs the multiple antennas to transmit signals on the same frequency which cause the strong interference signals at the receiving antennas on the same side. These interferences are more pronounced when operating the full-duplex single-channel MIMO system. The full-duplex single-channel (FDSC) system is one of the most interesting technologies for future wireless communications because it can offer double throughput from any conventional system without paying any expenses of spectrum. However, thatôs very possible to make self-interference.

The existing condition of wireless communication system is using half-duplex that transmit data with FDD (Frequency Division Duplex) or TDD (Time Division Duplex) scheme. FDD uses different frequency for sending and receiving data in the same time. TDD uses same frequency for sending and receiving data in different timeslot. In half-duplex method, the utility of timeslot (TDD) and frequency (FDD) are quite low that still found timeslot or frequency in idle mode when not in use.

During the transition to the future wireless communication, BS is required to have a large capacity. Full Duplex Single Channel systems is implemented in the receiver/ BS that use multiple antennas to provide large capability. In the other hand user equipment does not support the technology. This research will be evaluated Full Duplex Single Channel Multi User Single Input Multiple Output systems where multi user transmit using single antenna and receiver/ BS consist of multiple antenna. This system is expected to obtain good uplink performance and increased downlink capacity.

FDSC Multi user SIMO system employs the multiple antennas to transmit signals on the same frequency that cause the strong interference signals at the receiving antennas on the same side. In study [1] has investigated Full Duplex 4x4 MIMO systems which transmitting antenna operating on frequency 2,45 GHz. Self interference (SI) signal consists of component i.e self interference signal (leakage) and mutual interference signals caused by the other antennas.

In this research, FDSC Multi user SIMO communication model with K user single antenna that communicates towards uplink (base station) with multiple antennas using band frequency 60 GHz conducted. High Frequency 60 GHz provide broadband wireless communication which gives high capacity, high data rate and wide bandwidth [5]. The effect of self-interference simulated from 0% to 100%, mutual coupling effects are also taken into account in the calculations and used Maximum Likelihood (ML) detector on receiver.

1.2 Problem Definition

In the transition period to future wireless communication, technology must be able to customize user needs. Technology in the receiver/ BS allows to be adjusted immediately to meet future wireless communication. However, user equipment can not necessarily be replaced and adapted this future technology.

Full-duplex wireless communication system is a future radio communication system that use the same frequency and time to transmit and receive data simultaneously. However, itôs very possible to make self-interference. Self-interference occured when transmit signal from one node interfere the receive signal in the node itself.

1.3 The Research Objective

The objective to be achieve in this research are as follows:

1. Modeling Full Duplex Multi User SIMO System in case the effect of Self Interference.
2. Analyze the systems performance based on Bit Error rate (BER) vs.Eb/N0 with and without the present of self-interference ad mutual coupling on various condition.

1.4 Hypothesis

In Uplink Full Duplex Multi User SIMO System the higher the self-interference value due to signal leakage, the smaller BER will be obtained because of signal leakage is very disturbing the performance of the system, while the mutual coupling value on the antenna has minimum effect on the performance of the BER system because its value is relatively small close to zero.

1.5 Scope of Work

To make this research more focus, there are some limitations that must be applied :

1. Single Channel Full Duplex Multi User SIMO System that use the same frequency and time to transmit and receive data simultaneously
2. Configuration system as follow:
    a) Communication with K user single antenna communicates with multiple antennas at receiver, Focus on uplink communication
    c) The channel that used in simulation is Jakeôs model type 2 with noise Gaussian (AWGN).
    d) Number of subcarriers are 256 subcarriers.
    e) Use MC CDMA Modulation
    f) Perfect Channel Stae Information (CSI)
3. Simulated the effect of self interference for BER and channel capacity with the following specifications:
    a) Range effect of self interference is 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90% and 100%
    b) Transceiver node 2 (BS) transmitting information generated randomly

1.6 Requirement Identification

In this research, analysis and performance eveluation will be performed in system with Multiuser SIMO system and no mobility condition.

The proposed technique is expected to obtain :

- Single Full Duplex Multi User SIMO System Model

- Value of tolerable range of self interference

This research requires the following knowledge, skill and tools:

a. Knowledge
   - Wireless communication system
   - MIMO systems

b. Tools
   - Mathematical Optimization Software
   - Other Support system

1.7 Writing Systematic

CHAPTER 1 INTRODUCTION

This chapter consist of background, problem definition, the research objective, hypothesis, scope of work, description of the proposed method, requirement identification, and writing systematic.

CHAPTER 2 BASIC THEORY

This chapter consist of the basic theory about full-duplex, multiuser SIMO technique.

CHAPTER 3 SYSTEM DESGIN

This chapter consist of flowchart system, configuration system, and scenario. In this chapter, the system was modeled with MC CDMA system.

CHAPTER 4 RESULT AND ANALYSIS

This chapter consist of testing the system and analysis the result.

CHAPTER 5 CONCLUSIONS AND ADVICES

This chapter consist of the conclusions of this study and the advices to develop the research.