Chapter One

1.1 Background

The increasing numbers of users demanding service have encouraged intensive research in wireless communications. Cooperative communications is a new way of communication that draws from the ideas of using the broadcast nature of the wireless channel to make communicating nodes help each other of implementing the communication process in a distribution fashion and of the same advantages as those found in Multiple Input Multiple Output (MIMO) systems. This results in a set of new tools that improve communication capacity, speed and performance. It also reduce power consumption and hence improve battery life and extend network lifetime; increase the throughput and stability region for multiple access schemes; expand the transmission coverage area and provide cooperation tradeoff beyond source channel coding for multi-media communications[1].

Multiple wireless paths are used in MIMO system to transmit and receive signals via multiple antenna at transmitters and receivers respectively. Thus, with the development of MIMO systems, an efficient mode of communication with enhanced error performance and transmission reliability between the transmitting and the receiving side equipped with multiple antennas has been achieved. But then, with the high cost, big size and hardware complexity, a MIMO system with multiple collocated antennas are often regarded as impractical in applications such as sensor or ad hoc networks [2].

Cooperative communications is highly dependent on the relays situated in between the source and the destination. There are different protocol to obtain cooperative diversity such as: Amplify and Forward (AF), Decode

and Forward (DF) and Quantize and Forward (QF) [3].

At the receiver side, the independent fading paths associated with multiple receive antennas are combined to obtain a signal that is then passed through standard demodulator. There are several types of combining techniques such as: Maximal Ratio Combining (MRC), Selection Combining (SC) and Equal Gain Combining (EGC) [1][2].

1.2 Problem Statement

The problem with the wireless communications is the unreliable medium through which the signal has to travel. Signal fading in wireless communication system due to multipath propagation is a major limitation in the performance of wireless communication System.

1.3 Proposed Solution

To overcome signal fading in wireless communication, cooperative communication is used. The cooperative communication protocol used are; Amplify and Forward (AF), Decode and Forward (DF) and Quantize and Forward (QF)).

1.4 Objectives

The objectives of this thesis are;

- To simulate the system using matlab.
- To compare the performance of Amplify and Forward (AF), Decode and Forward (DF) and Quantize and Forward (QF) protocols.
- To test the effect of the combining technique Maximal Ratio Combining (MRC) at the receiver.

1.5 Methodology

Matlab software will be used to test the performance of the different protocols; Amplify and forward, Decode and Forward and Quantize and forward. The combination method, Maximal Ratio Combining (MRC) used at the receiver will be investigated. The performance of the cooperative communication protocols will be simulated for a single relay and multi relay in Rayleigh fading channel, using M-ary Phase Shift Keying (M-PSK).

1.6 Thesis Outline

This thesis consist of five chapters as follow:

Chapter Two: Provides the related work and an overview of the cooperative communication principles and protocols.

Chapter Three: Provides the cooperative system model and performance of cooperative protocols.

Chapter Four: Provides the simulation and discusses the results.

Chapter Five: Provides the conclusion of the work done, and a list of recommendations.