

CHAPTER 1

INTRODUCTION

I. Introduction

The demand of smart antenna for mobile communications is increased recently and the main purpose for applying smart antennas is feasibility for increasing in capacity and efficiency. The application of smart-antenna arrays has been suggested for mobile-communication systems, to overcome the problem of limited channel bandwidth, satisfying a growing demand for a large number of mobiles on communications channels. Smart antennas, when used appropriately, help in improving the system performance by increasing channel capacity and spectrum efficiency, extending range coverage, steering multiple beams to track many mobiles, and compensating electronically for aperture distortion. They also reduce delay spread, multipath fading, co-channel interference, system complexity, bit error rate (BER).

1.2 Objectives

The project has three objectives. The first one is implementation of the digital beamforming by using the digital signal processor. More precisely, the first objective

is aim to implement the switched beam smart antenna for downlink transmission. According to the algorithm, the beam can steer from 0 to 180 degree in azimuth angle base on user direction with any resolution. Second objective of the project is to manage the processed signals in DSP board after digital beamforming and sidelobe cancellation to transmit them to the expansion board. Third and main objective of the project is to design and implementation of baseband channel separation and synchronization by using FPGA board.

1.3 Scope of works

The project involves both of software modeling and hardware implementation. It can be defined as three phases; in the first phase of the project the TMS320C6713B DSP board is used for beamforming. C and Code Composer Studio software is applied for programming this board. Also MATLAB software is chosen for modeling because of some facilities which is provided a Link for Code Composer Studio Development Tools which is let to use MATLAB functions to communicate with Code Composer Studio and with information stored in memory and registers on a target. With this links the transferring information to and from Code Composer Studio. In the second phase of the project FPGA board is applied for performing the channel separation and synchronization and Quartus II software is used for programming this board. In the third phase of the project integration of DSP and FPGA is done by programming the EDMA and McBSP of DSP.

1.4 Thesis outline

This thesis is organized as follows. In Chapter 2, background information and basic principle in smart antenna system is explained. In addition, a brief introduction about switch-beam smart antenna is given. In Chapter 3, digital beamforming by using

DSP board is fundamentally discussed. Moreover, the hardware structure of DSP board shortly reviewed. Also, the model for beamforming is illustrated. In Chapter 4, after FPGA hardware description, channel separation for the project is explained. In this respect, FPGA programming and pin assignment are reviewed. In Chapter 5, integration of DSP and FPGA is discussed and also the model of system which is used in this project is given. In Chapter 6, simulation results for digital beamforming and the channel separation are discussed. In this chapter a comparison between hardware and software simulation results is made between DSP and MATLAB software. At the end of this chapter, final conclusion of the work is presented, and some possible future works are suggested.