Software Radio Implementation of a Smart Antenna System on Digital Signal Processors for cdma2000

Kerem Kucuk[1], Mustafa Karakoc[1], and Adnan Kavak[2]

[1] Kocaeli University, Electronics and Computer Education Department, 41300 Izmit, Turkey
{kkucuk,mkarakoc}@kou.edu.tr
[2] Kocaeli University, Computer Engineering Department, 41040 Izmit, Turkey
akavak@kou.edu.tr

Abstract. This paper presents a software defined radio (SDR) implementation based on programmable digital signal processors (DSP) for smart antenna systems (SAS). We evaluate adaptive beamforming algorithms, namely non-blind-type least mean square (LMS) and blind-type constant modulus (CM) using TI TMS320C6000 high performance DSPs for cdma2000 reverse link. Adaptive beamformers are implemented using TI code composer studio (CCS) that includes assembly language and C code development tools. Performance variation of these sofware radio beamformers in terms of weight computation time and received SINR are compared for different C6000 development boards (TMS320C6701 EVM, TMS320C6711 DSK, and TMS320C6713 DSK) and array topologies under varying multipath propagation conditions. Results show that while antenna array and algorithm type is important for the SINR performance, DSP type becomes important for the weight computation time.

1 Introduction

Software defined radio (SDR) is often described as a radio whose functionality is defined in software [1]. SDR uses programmable digital devices to perform the signal processing necessary to transmit and receive baseband information at radio frequency. This technology offers greater flexibility and potentially longer product life, since the radio can be upgraded very cost effectively with software. Smart antenna systems (SAS) [2] are considered to be prominent technology for CDMA based 3G systems, which provide significant capacity increase and performance enhancement at the base station. These antenna systems employ adaptive beamforming algorithms in order to recognize and track the desired user while suppressing the interference. SAS employs an antenna array that uses the spatial domain to improve link performance and enable other value-added services. It consists of both the software and the hardware objects associated with the additional processing capability. SDR implementation of adaptive algorithms on programmable chips, which are digital signal processors (DSP) and field programmable gate arrays (FPGA), will play a key role in the integration of SASs into 3G base station [3], [4]. Small computational load and high signal-to-interference plus noise ratio (SINR) are desired parameters that enable the SDR implementation of an adaptive beamformer [5], [6].

Our objective in this paper is to find out answers to the following questions, 1) how feasible is the DSP-based software radio implementation of adaptive beamforming algorithms for cdma2000 reverse link? and 2) how the performances of these algorithms are affected by different DSP and antenna topology under varying channel

G. Das and V.P. Gulati (Eds.): CIT 2004, LNCS 3356, pp. 97–106, 2004.