A Test Bed for the Evaluation of Adaptive Antennas

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Abstract- This paper describes an advanced antenna test bed (ATB) which will be used for communications research. The test bed provides a common and realistic environment for testing advanced antenna systems and for evaluation of antenna array algorithms. The test bed was previously used to field test the five current personal communications services (PCS) technology standards in the United States. Results from a typical PCS field trial measurement are presented. The wideband measurement system developed for advanced antenna measurements is then described. The system uses multiple mobile transmitters using maximal length pseudo random noise generators to modulate a radio frequency (RF) carrier. This provides a wideband signal for characterization of the radio channel. Central to the measurement methodology is the capability to characterize radio wave propagation simultaneously on each antenna element of an antenna array. A multichannel receiver employs IF digitization and raw data storage to maximize post-processing capabilities. Its features allow a random sampling of the radio channel suitable for mobile communications research. The receiver also has the capability to continuously stream data that is suitable for modeling and simulation studies of specific communication systems. Current system capabilities include multiple mobile units which can use different pseudo noise codes, variable data bandwidths, and up to 8 simultaneous receive channels.

The system is currently set up for a PCS diversity gain experiment. In this configuration it uses a four channel 1920 MHz RF/IF module. The system is being used to characterize the current test cell called Green Mountain Mesa (GMM). This characterization will include RSS and delay spread measurements. The system will then be used to collect simultaneous data from a non-optimally spaced PCS antenna array and a single mobile transmitter. The receiver antennas are spaced 2λ, 5λ and 10λ apart. In this configuration, data from the four antenna elements will be used to examine the effect of bandwidth and spacing on common diversity combining techniques. These results will also be used to examine the diversity gain for proposed wideband CDMA systems. For this experiment, each data channel is stored independently and different diversity techniques will be tested by post processing the measurements. These results will then be used compare performance of combining algorithms and eventually more advanced optimally spaced antenna arrays and systems.