**ABSTRACT**

Future wireless systems will offer a wide range of multimedia outdoor and indoor communication services (audio and video, high-speed digital data, etc.), which require high transmission capacity. The limited availability of bandwidth has generated great research efforts in subjects related to the general objective of making more efficient use of available channel bandwidth. The spatio-temporal (or multiantenna, MIMO) signal processing in a multipath urban and indoor environment signals processing is an example of the new challenging technologies that allow considerable gains in bandwidth efficiency over traditional single antenna technology. Other technologies such a intelligent antennas make use of the same concept of exploiting the interaction between channel characteristics and the antenna arrangements. Wireless access protocols, when tuned to the channel characteristics and the application environment also make it possible to improve transmission efficiency. High capacity transmission systems such as third-generation cellular and local-area wireless networks will need to incorporate some forms of these technologies in order to make the required data rates compatible with the allocated frequency bands.

Central to the objective of achieving high channel capacity is the need to accurately model and predict the radio frequency signal propagation characteristics and the interaction of these characteristics with the wireless access protocol layers. This is the proposed project's main goal. Within this very broad area, that has been the focus of research of a large number of scientists, certain subjects will be the specific objectives of our work. They are the extension of previous investigations on the subject and have led a significant number of journal and conference papers in the last three years.

(i) We will continue our investigation of the scalar, single input single output (SISO) propagation channel, particularly for fixed wireless applications in the 2.4, 3.5 and 5.8GHz bands, collecting and analyzing new empirical data to propose models that characterize path loss, temporal fading behavior coherence bandwidth and spatial correlation. Specific topics of research are the study of propagation effects due to the high loss walls typically used in seismic prone countries, the determination of coherence bandwidth and coherence times in indoor environments that use wireless LANS (WLAN) and the study of the interaction between temporal channel behavior and the higher layer protocols that use this channel

(ii) We will increase our research work in the area of MIMO systems. A recently built, but limited capacity channel sounder, will be perfected and used for empirical studies, specifically the subject of the interaction between antenna gain and MIMO capacity in fixed wireless type applications. Empirical work will be complemented with computer simulation of typical urban environments similar to the settings in which the measurements are to be performed.

(iii) A strongly related subject is the study of compact multiantenna arrays capable of taking advantage of the spatial characteristics of the channel. In this field the work will also constitute the extension of previous investigations by the proponents, specifically research on low-profile broadband and multi-band antenna elements, mutual coupling of antennas for diversity and MIMO applications, and the effect of directivity and polarization on MIMO channel capacity.

(iv) We will also address the efficient usage of the radio channel for wireless networks by means of tuning access protocol parameters to achieve improved throughput. In this field a great deal of research is being performed for the IEEE 802.11 protocol working in the ad-hoc topology. Less effort has been devoted to the so called infrastructure kind of architecture with the presence of hidden terminals as is encountered in open area environments using highly directive antennas. We intend to focus on this issue since wireless access for mobile terminals to wired backbone networks is a growing field of research and applications. Analytical models will be contrasted with simulation and experimental measurements to characterize throughput performance.

The work to be done includes development of analytical models, simulation, design and construction of appropriate measurement systems, extensive field measurements for specific environments, multiantenna system design and evaluation of results. The findings of this work will be submitted to recognized international journals and conferences. The project has received support and orientation from researchers at Bell-Laboratories, as well as from other recognized scientist that the proponents maintain steady contact with.