

## **ABSTRACT**

As mobile service demands increase dramatically, interest in cellular system structure with hierarchical terrestrial/satellite architecture has emerged. Without satellite participation, terrestrial cellular systems would be primarily restricted to regional service. For the network to have seamless radio coverage and sufficient capacity to accommodate anticipated high teletraffic demand, integration of satellite network and terrestrial cellular system is indispensable. In this research project, a space/terrestrial mobile radio communication network with multiple hierarchical cellular overlays is considered. In the lowest hierarchical level, microcells serve the highest teletraffic density, while overlaying macrocells serve both calls from areas that are difficult to be covered by microcells, as well as overflow traffic from microcells. At the highest hierarchical level, satellites focus their spotbeams to serve satellite-only users sparsely distributed and act as teletraffic relief for the terrestrial segment. At each hierarchical level different priority schemes are used to privilege handoff requests. Reserved channel scheme (RCS) is applied in the microcell layer, both RCS and sub-rating scheme (SRS) are used in the macrocell layer, while in the spotbeam cell layer, RCS, SRS, and queuing priority scheme (QPS) are implemented. An analytical teletraffic model is developed to evaluate the proposed architecture. Numerical results are presented and discussed for the new call blocking, handoff failure, forced termination and noncompletion probabilities. The work presented in the thesis will help understanding the next-generation communication network and thereby allows better engineering of its resources.