Improving Coverage and Capacity in Underwater Acoustic Cellular Networks

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***Abstract*— Underwater acoustic communications systems are challenged by the characteristics of acoustic propagation through the underwater environment. There are a wide range of physical processes that impact underwater acoustic communications and the relative importance of these processes are different in different environments. Acoustic propagation is characterized by three major factors: time-varying multipath propagation, low speed of sound and attenuation that increases with signal frequency. Limited bandwidth in these systems is of paramount obstacles. To overcome this problem the idea of frequency reuse pattern seems to be useful. The key characteristic of a cellular network is the ability to re-use frequencies to increase both coverage and capacity. One element that determines frequency reuse is the reuse distance depending on the cell radius and the number of cells per cluster. Analysis of frequency reuse between adjacent clusters and optimal cell-radius selection criteria has been carried out recently. In other recent woks, the parameters of the cellular networks designing have been calculated based on a rough approximation of the attenuation and propagation model. In our work, after driving the ratio of signal to interference for underwater acoustic channels with more accuracy, the constraints for the cell radius are determined. One of the most important results of this contribution is that, for special parameters like bandwidth, it may be impossible to provide the required signal to interference ratio and bandwidth for the network users. Furthermore, in this paper, the number of supportable users, per-user bandwidth, and the user capacity for a cellular underwater network are determined.**

***Keyword*— Cell Radius, Frequency Reuse, Signal to Interference Ratio, Underwater Cellular Networks, User Capacity**

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