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# Evaluating the Feasibility of Magnetic Induction to Cross an Air-Water Boundary

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**Abstract :** A magnetic induction based underwater communication link is evaluated using an analytical model and a custom Finite-Difference Time-Domain (FDTD) simulation tool. The analytical model is based on the Sommerfeld integral, and a full-wave simulation tool evaluates Maxwell’s equations using the FDTD method in cylindrical coordinates. The analytical model and FDTD simulation tool are then compared and used to predict the system performance for various transmitter depths and optimum frequencies of operation. To this end, the system bandwidth, signal to noise ratio, and the magnitude of the induced voltage are used to estimate the expected channel capacity. The models show that in seawater, a relatively low-power and small coils may be capable of obtaining a throughput of 40 to 300 kbps, for the case where a transmitter is at depths of 1 to 3 m and a receiver is at a height of 1 m.

**Keywords :** magnetic induction, FDTD, underwater communication, Sommerfeld
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