

Evaluation of Wet Electrodes Attenuation on Capacitive Coupling Wireless Power Transfer System for Drone Charging Stations

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Applications of drones are growing in varieties of scenes and places[1, 2]. But the drones have a weak point that is difficult to fly a long time by the limitation of battery capacity. To automate the battery replacement work, automatic battery charging station using wireless power transfer (WPT) technique had been proposed [3, 4]. Capacitive coupling WPT system is suitable for this application because the system does not need to have heavy-weight copper wire for coupling coil. To bring the system to the market, power efficiency is important. In addition, it is necessary to consider the usage environment such as rainy weather. Attenuation between Tx and Rx electrodes directly affects to the efficiency in the capacitive coupling WPT. Since a dielectric dissipation factor of water is large compare to the air, wet condition of the electrodes may increase the attenuation. Therefore, we evaluated the attenuation in wet condition.

In the experiment for an evaluation, same configuration of Rx electrodes that will be used for a prototype drone to the experimental capacitive coupling WPT system shown in fig.1 was used. The Tx electrodes are enough large compare to the Rx electrodes. These pair of electrodes were placed in a plastic square tray that is shown in fig.2. After 0.5 liter of tap water is poured into the tray, S parameters at 6.78 MHz are measured by network analyzer. Attenuation is measured as real part of differential mode S parameter S_{dd21} . When the electrodes sink under the water, attenuation was increased from 0.13dB to 0.21dB. We conclude that deterioration of the power efficiency by the water is not so much. We will confirm the power efficiency in these conditions using WPT drone charging system with prototype drone for the next step.



Figure 1. WPT drone charging system.

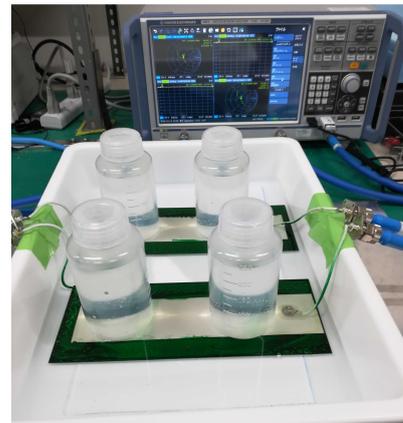


Figure 2. Experiment configuration.

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