

# Investigation of Contactless Power Transmission in a Long Distance

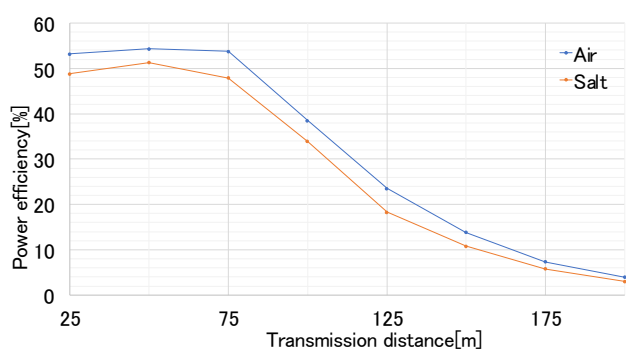


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## Research Objectives

- Analyzation of the cause of efficiency decrease and examination of the transmission performance in a long distance in seawater
- In seawater, the water temperature changes with depth. This study will clarify the effect of water temperature changes on contactless power transmission in seawater.

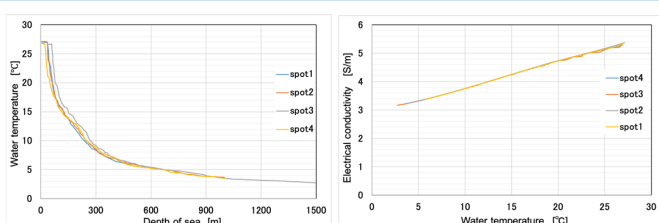
## Contactless Power Transmission



Power efficiency and transmission distance

- The transmission efficiency is lower in seawater than in air.

## Research Background

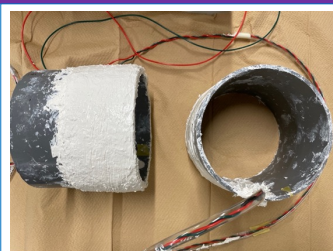


Water temperature vs. depth

Electrical conductivity vs. water temperature

- Water temperature decreases with depth.
- Electrical conductivity also decreases.

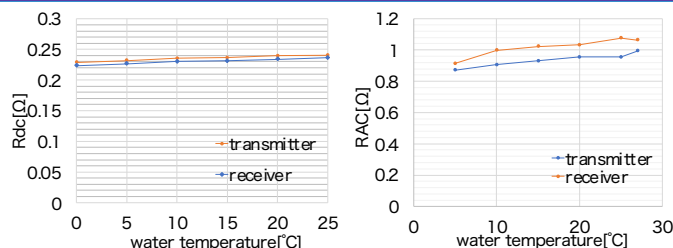
## Coil Specification



Bobbin	Polyvinyl chloride
Winding material	Polyester copper wire
Bobbin diameter	140 [mm]
Winding diameter	1.6 [mm]
Number of turns	30 [turn]

- The solenoid coil used for CPT consists of a polyvinyl chloride pipe and a coil
- In order to make the coil resonate at 85 [kHz], the self-inductance of the solenoid coil is set to 150 [ $\mu$ H]
- The power efficiency of the CPT system with magnetic resonance in seawater need to be measured

## Temperature dependence

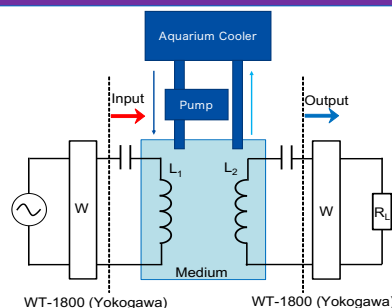


$R_{DC}$  and water temperature

$R_{AC}$  and water temperature

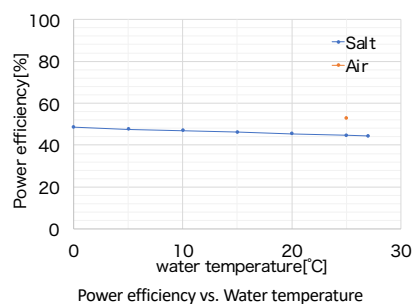
- AC resistance decreases with decreasing sea water temperature.
- DC resistance is also reduced.

## System Overview



- Salt water with a salinity of 3% was used to simulate seawater.
- The temperature of the salt water was controlled by a cooler.

## Power Efficiency



- Efficiency is lower in salt water than in air.

## Conclusion

- In seawater, electrical conductivity changes with changes in water temperature.
- Experiments show that as the seawater temperature decreases, AC and DC resistance also decrease.
- In contactless power transmission in seawater, the effect of water temperature is small, and there is no significant difference in power efficiency.
- In the future, we will also examine changes in salinity.