

## Multi-hop shelf power and booster effect wireless power transfer

**This innovation improves on the efficiency wireless power transfer between various points on a shelving unit through use of booster coils. Power is routed between points by allowing each node on the grid to change between transmission, receiving, and boosting modes depending on the path needed.**

### What is the Problem?

Wireless power transfer has been an ongoing field of research for a long time, as evidenced by Nikola Tesla's famous Wardenclyffe tower. In more recent times, inductive power transfer has become popularized for wireless charging of smartphones and other electronic devices. This short-range power transfer concept, at its simplest, uses two coils of wire to transmit and receive power. The transmitting (Tx) coil's alternating current induces a varying magnetic field, which induces a current in the receiving (Rx) coil. Wireless power delivery can be measured in terms of power transfer efficiency (PTE) and power transfer to the load (PDL), which define how well a certain coil configuration can serve to meet the needs of given power delivery requirements.

To transmit over longer distances than the millimeters of a wireless phone charger, multiple strategies can be used to increase PDL, including tuning the Tx and Rx coils or including additional coils to serve as relays or boosters. While these additional coils can effectively increase the distance power is delivered when placed between the Tx and Rx coils, many potential use cases such as medical implants, IoT devices in difficult to access areas, or hazardous industrial settings requiring noninvasive solutions. This innovation tackles this problem, alongside the problem of routing power delivery to multiple different locations depending on changing requirements. In this case, this is applied to delivering power to small devices on a shelving unit incapable of using batteries or getting direct power.

### What is the Solution?

The multi-hop shelf power system is composed of a grid, outfitted on the back panel of a shelf. On each shelf / grid point, two coils (one loop and one spiral) are mounted to this back panel. To route power from one point to another, each point on the grid can operate in 3 modes. First is an Rx / Tx mode, where both the loop and spiral are active and the point is transmitting or receiving power. Second is a relay or booster mode, in which the spiral coil is active and aids in the transmission of power. Third is an "off" mode, if the node is not on the path that power must travel. By controlling these modes, wireless power can be delivered to any point on the shelves at varying power depending on the distance from the source.

### Technology ID

BDP 9150

### Category

Hardware/Electronics  
Selection of Available  
Technologies

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## What is the Competitive Advantage?

This innovation takes the idea of planar multi-hop transfer of wireless power and innovates on it through careful analysis of the geometry and tuning of the booster coils. Through this optimization, measurement of the PTE shows improvement from the baseline linear estimate for efficiency. With the use of this system, power can be delivered in a variety of challenging environments, such as cold temperatures and metal-heavy environments that would often block wireless power delivery.