

## Wireless power transfer system using a new phase conjugated circuit

We are looking to out-license the technology for its commercialization.

***This technology transmits power beams with high accuracy in the direction of the power-receiving devices. A compact power transmission device using simple analog circuits can track and supply power to a power-receiving device with high accuracy.***

### ◆Background

In recent years, more and more IoT devices such as sensors and cameras have been installed in a factory and a facility, and retrodirective microwave power transmission has been attracting attention as a means for supplying power to these devices. In this method, the power supply device estimates the direction of the receiving device based on the signal emitted from the receiving device (pilot signal) and transmits power by emitting a microwave beam (power transmission signal) in that direction. However, this method has several drawbacks. First, the receiving device requires the system to transmit the pilot signals in addition to the power receiving system. Next, the power of the receiving device is required to transmit the pilot signal beforehand. Lastly, the interference between the pilot signal and the power transmission signal makes it difficult to accurately identify the direction of the receiving device.

### ◆Description

Researchers at Kyoto University solved the abovementioned drawbacks by adopting the second harmonic re-radiated by the receiving device (Rectenna: rectifying antenna) in response to the power transmission signal for the pilot signal. This invention is a good fit for applications that require minimizing the weight of the receiving device and ones that transfer power to the fast-moving receiving devices.

#### ➤ Generating a pilot signal without using power from the receiving device

Generating the pilot signal does not consume power from the receiving device. Therefore, power can be transferred to the receiving device even when the receiving device runs out of battery power.

#### ➤ No interference between the pilot signal and the power transmission signal

Because the pilot signal and the power transmission signal have different frequencies, they do not interfere with each other and the direction of the power receiving device can be accurately determined.

#### ➤ Compact and lightweight power transmission device

The pilot signal receiving antenna and power transmission antenna can be integrated into a single unit, and the conjugate circuit is a simple analog circuit, making the power transmission device compact, lightweight, and low-cost.

#### ➤ Capable of transmitting power to multiple power receiving devices or to the power receiving devices moving at high speed

Since the directional identification of power receiving devices is performed by a simple analog circuit, it is possible to transmit power to multiple power receiving devices or to a power receiving device moving at high speed.

### ◆Development Status

The operating principle has been studied. The invention has been verified to work by pilot experiments.

### ◆Applications

- Wireless power supply for smartphones, IoT, etc.
- Wireless power supply for drones and other flying units
- Wireless power supply for AGVs and EVs in factories

### ◆Offer

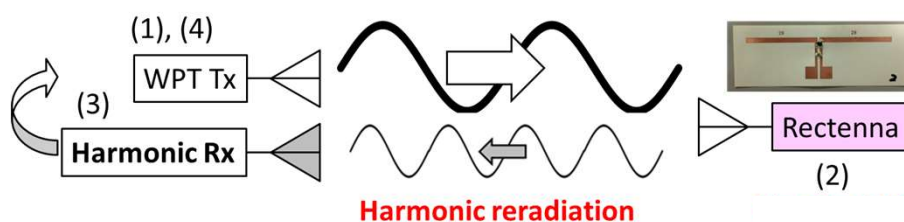
- Patent License
- Option for Patent License (F/S for technical review)

\*This invention is patent pending from Kyoto University.

### ◆Contact

**TLO-KYOTO Co., Ltd.**

E-mail: [event@tlo-kyoto.co.jp](mailto:event@tlo-kyoto.co.jp)  
 TEL: +81(75)-753-9150  
<https://www.tlo-kyoto.co.jp/english/>



Power supply device

Receiving device

Figure 1. Schematic process of wireless power transfer based on this invention

(1) Non-directional power transmission signal (2) Generation of the pilot signal (reradiation of harmonics by rectenna) (3) Reception of the pilot signals (4) Phase determination by a phase-conjugate circuit and transmission of a power transmission signal toward receiving devices

WPT Tx: The wireless power transfer transmitting system, Harmonic Rx: the harmonic receiving system