Electrical

Wireless power transfer with electromagnetic waves for remote charge of wearable terminal

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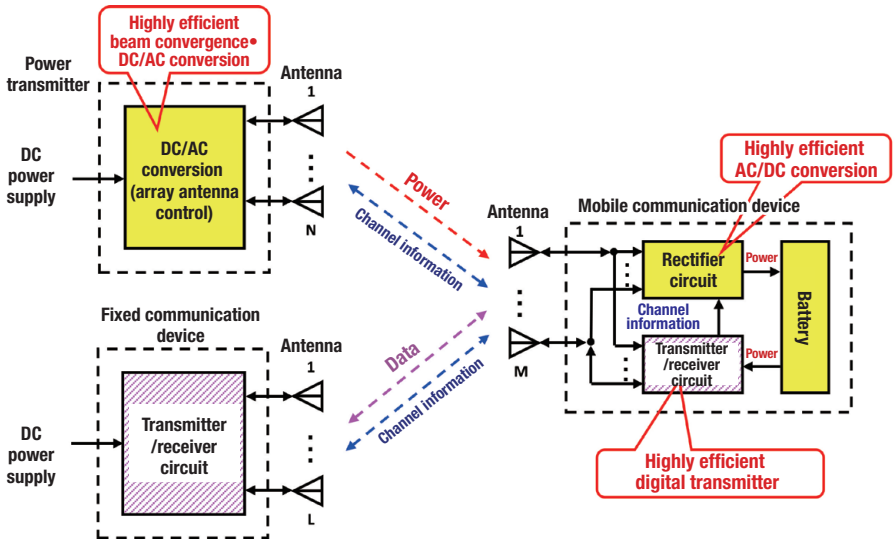
Purpose of Research

Wearable communication terminals, which are powered by a small embedded battery, must be frequently charged. Currently, a wireless charging method using a nearby magnetic field is employed in some devices, but the usability of such devices is significantly limited during the charging. This problem can be solved by a long-range RF power transfer. However, this transfer method has poor efficiency. In addition, the transmitter in current terminal devices consumes a large amount of power and thus requires a large supply of power. The present study aims at solving these problems and developing a chargerless wearable terminal that is powered by 24-hour wireless power transfer.

Summary of Research

In our research, we are building a wireless RF charging system which charges a wearable terminal several meters away with unprecedented high efficiency. In addition, all-digital envelope pulse width modulation technology is applied to the transmitter in the terminal, to easily and consistently achieve highly efficient communication. A millimeter or quasi-millimeter wave band array antenna is used to improve the beam convergence for more efficient charging, so that lower power transmission is sufficient.



Comparison with Conventional or Competitive Technology

A millimeter or quasi-millimeter wave band, shorter than that conventionally used, improves the beam convergence for more efficient power transfer. Using a digital instead of an analog transmitter lowers terminal power consumption and thus the amount of power to be charged.

Expected Applications

- Remote wireless charging for wearable devices e.g. watch, bracelet, glasses, or sewn-in-clothes
- Remote wireless charging of mobile phone, laptop, and other mobile devices

Challenges in Implementation

Design and control of a highly efficient multi-element plane array antenna for RF wireless charging. Reducing quantization noise of the digital transmitter. Radiation exposure and EMC assessments will be necessary.

What We Expect from Companies

Collaboration on RF wireless charging systems using a multi-element plane array antenna, and on power-efficient digital transmitters.

Points

- **Highly efficient wireless charging and power-efficient communication, based on a millimeter or quasi-millimeter wave band and a multi-element array antenna**
- **Simple, constant usability, high efficiency digital communication with less energy consumption**

Future Developments

Continued development of high efficiency signal/power transmission using an easy, continuously usable, highly efficient all-digital transmitter and RF propagation control.

- Associated System: Grants-in-Aid for Scientific Research C.
- Intellectual Property: JP2014-204904 “Signal processing device and transmitter device”
- Prototype: Not made
- Sample: Not available

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