Wireless power transmission on surface of the human body using resonant coil of thin-film type

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A wireless power transmission using magnetic coupling has various application areas, but its application to a power transmission on the surface of the human body has not been studied. For example, energy can be harvested from activities of the human body using an energy conversion device which converts a physical activity, e.g. bending a joint of the body, into energy. Then, the harvested energy needs to be wirelessly transmitted to provide the energy for a mobile device or battery located on the surface of the human body. This study presents a wireless power transmission using a resonant coil in which power is transmitted on the surface of the human body. A resonant coil is designed in a thin-film type, so it can be easily integrated inside clothes and a small device. This technology can be applied to a wireless power transmission for various devices on the human body, such as an energy-harvesting device, health-monitoring sensor and mobile device.

Simulation was conducted to analyze the effects of the human body on a resonant frequency and transmission efficiency. Also, various design parameters, including a thickness of a resonant coil, were optimized to achieve a high transmission efficiency. For measurement, a resonant coil having a thickness of 0.035 mm was fabricated on the surface of a flexible PCB, so it has enough flexibility to be easily integrated inside clothes. A single-turn coil was formed in parallel with the resonant coil to minimize return loss at an input port. To measure transmission efficiency, resonant coils were located on various parts of the human body: the arm, leg or head. A transmission distance was between 2 cm and 20 cm depending on the location of the coils, and the corresponding resonant frequency changed in the range from 10MHz to 20MHz. Even though the resonant coil had a very thin thickness for the integration inside the clothes, it showed a very high transmission efficiency from 15% to 50%, so it can be applied to a wireless power transmission requiring low transmission loss.

In comparison with the previous technologies using a wire-type resonant coil, the technology in this paper uses a low-profile coil for easy integration inside clothes or a small device. Despite using a low-profile coil, this technology shows a high transmission efficiency comparable to the previous one, so it could be used for a power transmission in an energy harvesting technology based on human body's activity. Also, it could be applied to provide power for multimedia devices including a MP3 player, smart phone, and goggle-type displaying device.