Optimal impedance matching for power and data transmission in wearable devices

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In recent years, smart wearable devices, which are ultra-small, thin, and patch-type have been developed for bio-monitoring systems in the field of healthcare. Accordingly, the transmission of power and data between the patch and wearable devices has attracted increasing interest. This study proposes an optimal impedance matching for the transmission of power and data developed using the deployment of antennas and it can be easily applied to epidermal electronic patch devices.

Until now, power and data communications have been investigated using horizontally positioned antennas. Such type of antenna deployment can reduce the communication performance and power transmission efficiency owing to the interference of various circuits, ground planes, and communication coils of the smart device. However, if the antenna is deployed vertically, it can effectively reduce the error in tag performance since it is located outside. In this study, the matching circuit has been designed using computer simulation technology (CST), which analyzes the maximum power transmission of the electromagnetic field and the results have been verified through measurement.

The frequency band used is 13.56 MHz, whose high frequency band has a longer wavelength than the very high frequency band and is less influenced by the environment. The size of the receiving antenna attached to the patch device is 8 × 5 mm, and the size of the sending antenna attached to the band of the wrist-type device is 18 × 2 cm; further, these quantities have been measured at a transmission distance of 10 cm. The sending and receiving coils are angularly spaced apart at 90° for optimal impedance matching The number of turns in the sending and receiving coils is 3. The matching circuit has been designed using the advanced design system (ADS) circuit simulator. The maximum reading distance of the proposed method is about 10 cm, which is 2 % more than that of the existing impedance matching method.

Therefore, the proposed method is expected to be applied to mobile medical devices that can measure various bio-signals such as ECG and EEG without a battery in order to improve the accuracy of data transmission and the efficiency of power transmission at an increased transmitter-receiver distance.

* This work was supported by the Mid-career Researcher Program (2016R1A2B3009423) through NRF grant funded by the MISP and the ITRC support program (IITP-2017-R0992-17-1021) supervised by the IITP; grant from the MISP, Korea