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Conceptual Design of Multi Power Receivers for Wireless Power Supply of Quench Detector with Highly Insulating Stability under Superconducting High Field Magnet

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The super high field magnets using superconducting wires have been promisingly applied for thermonuclear fusion power generation such as Korea Superconducting Tokamak Advanced Research (KSTAR) and International Thermonuclear experimental reactor (ITER) systems. The quench detection system (QDS) is essential for high reliability in the super high field magnet facilities. Generally, the quench voltage detection system, which uses resistive voltages, has been adopted. Such an ITER magnet, the maximum operation current and voltage of superconducting keeps over 60kA and 50 kV DC. Generally, in the case of medium power, the power transformer has been adopted for QDS as an isolated power due to stable insulating and durable characteristics. However, unfortunately, the magnetic saturation of electric steel for power transformer remained fragile as well as the volume is increased under super high field magnet. From this reason, authors apply the wireless power system for QDS module as a reasonable option instead of power transformer since the wireless power system can supply power with highly insulating stability through air gap. Additionally, since the number of QDS module is required at least over 100-module in a super high field magnet, the multi receivers under single antenna for power supply of the QDS module is one of economic options due to minimize the amount of input power with antenna. In this study, authors suggest conceptual design of multi resonance receivers for various single-antennas combined with inserted strong resonance coils under 100, 370, and 750kHz, based on resonance coupling method of wireless power transfer in order to minimize of input power and improve the power efficiency.

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