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# Wireless Power Transfer Safety: A Fully Automatized Compliance Testing Procedure for WPT Systems Including Implant Safety

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Wireless power transfer (WPT) is one of the fastest growing technologies in the energy sector, with applications in numerous areas of daily life, from the charging of small personal wireless devices to that of large and heavy electric vehicles (EV).

The WPT market is expected to exceed 10 Billion USD by 2022 [1]. However, the global introduction of WPT technology is at stake due to persistent regulatory uncertainty related to the general safety of WPT sources. To date, reliable methods to accurately assess WPT exposure and demonstrate safety are missing. In addition, recent research has shown that medical implants can substantially amplify the local *in vivo* energy deposition for exposures at WPT frequencies.

The lack of tools to test safety for the general public, and particularly for persons with passive and active medical implants, poses a substantial risk to investors and any multinational corporations entering the market. As WPT systems are typically not installed in controlled environments and the emitted power could reach levels > 10 kW, manufacturers are faced with the challenge to ensure safety for the entire population, including people with implants. Indeed, studies have proven that the presence of a conductive medical implant can results in large localized field enhancements in the human body, given the electrical conductivity of the implant is much greater than the one in the surrounding tissues [2-3]. However, the current safety guidelines specifically exclude persons wearing medical implants. Lack of scientific data and methods to determine the risk prevent standardization committees to derive conclusions regarding safety limits of implant wearers at WPT frequencies. The issue is even more complex, as safety must be demonstrated for any type of past or foreseeable future implant.

Therefore, we are developing a new WPT Safety Test procedure, consisting of instrumentation with advanced data processing that allows to demonstrate compliance and safety for any WPT system. It involves three major steps: (i) measurement of the near-field emitted by the WPT using a novel gradient field probe which records field in a reference coordinate system relative to the location of the WPT source; (ii) field distribution reconstruction *in silico* from the spatially distributed measurement data; and (iii) evaluation of compliance with induced field and absorbed power limits (i.e. basic restrictions) defined by the safety guidelines, using a novel EM solver and post-processor to assess worst-case *in vivo* induced fields and estimate enhancement by the presence of medical implants.

1. Wireless Power Transmission Market by Technology (Induction, Magnetic Resonance), Implementation, Transmitter, and Receiver Application (Smartphones, Electric Vehicles, Wearable Electronics, and Furniture) and Geography- Global Forecast to 2022

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3. Park SM, Kamondetdacha R, Amjad A and Nyenhuis JA, 2005, MRI Safety: RF induced heating on straight wires, IEEE Trans Magn 41: 4197-4199.