CABA White Paper Proposal

Title: Multi-MHz Wireless Power Transfer and Its Commercial Applications

The revolutionary development in wireless communications has changed modern society in many ways. Based on the same physics, a much greater amount of energy can also be wirelessly transferred. This concept of wireless power transfer (WPT) was first proposed by Nikola Tesla in 1904. In recent years, there has been a renewed interest in the research and application of WPT due to the urgent need to wirelessly charge many consumer electronic devices (e.g., smartphones, laptops, tablets, computer peripherals, medical implants, etc.). For the first time, information and power can be obtained ubiquitously through the air. WPT not only provides an easier and safer experience of daily charging processes, but also enables a new direction in the management of electrical power, especially in the applications in connected homes and intelligent buildings.

There are various WPT technologies for different applications, such as inductive coupling, microwave and laser radiation. Microwave and laser radiation use far-field to wirelessly transfer electric power, while inductive coupling uses near field. In terms of safety, efficiency, and achievable power levels, the inductive coupling, such as the so-called magnetic resonance coupling, is being widely considered a promising candidate for wirelessly charging various electronic devices, i.e., applications requiring medium power transfer over a medium range. Higher frequencies are often required to achieve a more compact and lighter WPT system with a longer transfer distance and a better tolerance to the coil misalignment. Meanwhile, regulations of the ISM (Industrial, Scientific and Medical) bands and the performance of today's power switching devices impose limits on the available operating frequencies, usually in the range of several megahertz (MHz), such as 6.78 and 13.56 MHz (i.e., multi-MHz).

The questions that we would like answer in this white paper are:

- What are the needs and applications of WPT in connected homes and intelligent buildings?
- What are the pros and cons of various WPT technologies?
- What are the major challenges and limitations for multi-MHz WPT?
- What are the appropriate circuit topologies for the main components?
- How to analytically model and analyze multi-WPT systems?
- How to apply passive parameter design to improve system performance?
- How to implement active control to achieve optimal performance?
- How to model, design and control multiple-receiver WPT systems?
- What are the recent developments of multi-MHz WPT?

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