

## Practical Implementation of Wireless Power Transfer

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**Abstract:** Since the invention of radio (Hertz, Marconi) at the end of the 19<sup>th</sup> century, far-field transfer of energy has been feasible. Although radio has been further developed for the transfer of information, the idea of long-distance Wireless Power Transfer (WPT) was picked up from the beginning by Nikola Tesla and was clearly demonstrated by Harrell Noble from Westinghouse at the Chicago World Fair in 1933-1934, after which interest decreased. The availability of compact, high-power microwave sources regained the interest in WPT and in 1964, William Brown from Raytheon demonstrated a wirelessly powered model helicopter. Again, interest decreased, since radiative WPT cannot, in a practical way, power or charge mobile phones, tablets or laptops over several meters distance. For that, inductive (resonant) WPT over very short distances has been developed. Accepting that 'power through the air' is feasible only for ultra-low power applications, we can concentrate now on IoT devices such as sensors and headphones and remotes. Given the ultra-low power levels, the design of a long-distance WPT receiver is a non-trivial task. In this presentation, the different building blocks of such a receiver, i.e., antenna, rectifier, boost converter and load, will be discussed. This will be done by going through the design steps of a couple of practical, remotely powered applications like an electrical clock, a temperature sensor with display and a wireless temperature and humidity sensor.

**Hubregt J. Visser** is Sr. Researcher at imec, The Netherlands and full professor at Eindhoven University of Technology, The Netherlands. He received the M.Sc. degree in electrical engineering from Eindhoven University of Technology, The Netherlands, in 1989. In 1990, after fulfilling his military service at TNO Physics and Electronics Laboratory, The Hague, The Netherlands, he joined the same laboratory as a civilian. He has participated in projects concerning near-field antenna measurements, monolithic microwave integrated circuits design, and phased-array antenna design. In 1996 - 1997, he was stationed at the European Space Research and Technology Centre, Noordwijk, The Netherlands, where he worked on array antenna modeling. In 2001 he joined TNO Science and Industry, Eindhoven, working on antenna miniaturization. In 2009 he joined imec, The Netherlands, where he works on Wireless Power Transfer. Also, in 2009 he obtained a Ph.D. from Eindhoven University of Technology, The Netherlands and Katholieke Universiteit Leuven, Belgium. Since 2014 he is a full professor at Eindhoven University of Technology where he teaches antenna theory. Hubregt was co-organizer and co-chair of the IEEE 2019 Wireless Power Week in London. He holds 12 patents, has written seven book chapters and is author of the books 'Array and Phased Array Antenna Basics' (Wiley, 2005), 'Approximate Antenna Analysis for CAD' (Wiley, 2009) and 'Antenna Theory and Applications' (Wiley, 2012).