A LoRa-Based CubeSat for WPT Demonstrations in Solar Power Satellites

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Abstract

Small satellites have become key enablers of Internet of Things (IoT) communications in the NewSpace era, offering low-cost manufacturing, rapid deployment, and flexible mission profiles that support real-time data exchange across diverse regions. At the same time, the growing need for scalable wireless energy solutions has driven research into large-scale Wireless Power Transfer (WPT) systems, notably Solar Power Satellites (SPS), capable of beaming power over vast distances. Integrating these approaches holds the potential to revolutionize both satellite-based IoT networks and global power distribution. In this context, the proposed project aims to develop a 1U CubeSat platform featuring modular, adaptable hardware/software-comprising LoRa chips that have yet to be tested in space-and a compact 5.8 GHz WPT experiment as the main payload. The integration of a transmitter and rectenna receiver will facilitate in-orbit validation of far-field energy transmission, while a unified chip, encompassing the OBC and the LoRa transceiver, will oversee real-time control and data monitoring. The design's alignment with the constraints of small satellite missions is facilitated by the reduction of hardware complexity and conservation of power. The goal is to develop a flexible 1U CubeSat-based WPT platform that facilitates the study of compact WPT systems in both in-orbit and Earth-based demonstrator scenarios. The long-term plan includes the launch of at least three 1U satellites to gather important experimental data.

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