Ambient RF Harvesting for Powering a LoRa Sensor

Project Overview:

Nowadays, the numerous applications of wireless sensor networks (WSNs) and the emerging Internet of Things (IoT) applications has increased, which required searching for techniques to power these devices and achieve self-sustainability. There exist several sources of green energy such as solar and wind. Such sources can produce large amount of power, however, they all suffer from limited availability and dependence on environmental conditions. On the other hand, ambient RF energy harvesting from cellular base-stations, Wi-Fi and DTV signals is a promising alternative, where the energy is available all the time, for free and the harvested energy can be used to power low-energy devices such as sensors.

An RF energy harvesting system consists of 3 main blocks as depicted in Fig. 1 below:

- A rectenna, which is an antenna with a rectifier circuit to collect RF energy and convert it to dc power
- A DC-DC converter to regulate the rectified voltage and boost it
- A supercapacitor for energy storage to be used to power the sensor

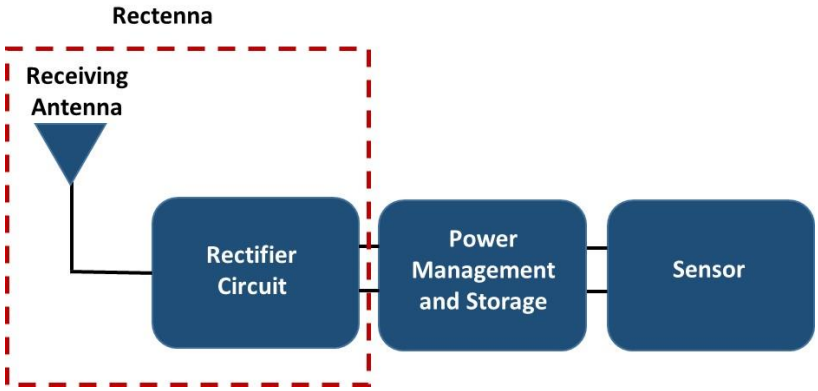

Fig. 1: Block Diagram of a rectenna system

The objective of the project is the design and testing of the different components of a rectenna system and using it to power a LoRa sensor.

Tasks:

- Design of an antenna to harvest RF power available in the GSM 900 and GSM 1800 cellular bands
- Survey on the commercially available DC-DC converters and Supercapacitors to store the rectified power

- Testing the selected system components (boost regulator and supercapacitors) and calculation of the required charging time to power up a LoRa sensor

Eligible Departments:

Electronics	**X**
Communications	**X**
Networking	

Software/Hardware:

- Advanced Design system (ADS)
- CST Microwave Studio

Relevant References:

- David M. Pozar, “Microwave Engineering”, 3rd Edition, Wiley.
- Constantine A. Balanis, “Antenna Theory: Analysis and Design, 3rd Edition”, 3rd Edition, Wiley-Interscience.