ON THE REALIZATION OF A COMMUNICATION SYSTEM FOR ATMOSPHERIC PROBES BASED ON LORA TECHNOLOGIES: PRELIMINARY MEASUREMENTS AND RESULTS

Lorenzo Carosso [1,3], Silvano Bertoldo [1,3], Miryam Paredes [1,2], Marco Allegretti [1,2,3]

[1] Politecnico di Torino, Department of Electronics and Telecommunication (DET), Corso Duca degli Abruzzi 24, 10129, Torino, Italy
[2] Envisens Technologies s.r.l., Corso C. Menotti 4, 10138, Torino, Italy
[3] Consorzio Interuniversitario Nazionale per la Fisica delle Atmosfere e delle Idrosfere (CINFAI), local research unit c/o Politecnico di Torino, Torino Italy

ABSTRACT

Characterization of atmospheric properties remains a latent ambiguity for weather forecasting and climate models since their characteristics depends on multidisciplinary processes in a wide range of natural scales. The development of ultra-small light disposable radio probes is important to understand this properties Being light-weighted, the probes will have a fluid-dynamic behavior to allow them to "float" inside clouds of fall through different atmospheric layers after been released, thus simulating the behaviour of small particles (e.g. drops). Each disposable probe is equipped with compact size microprocessors (presently the first prototype uses Arduino© Nano), controllers, and a set of sensors for the measurement of atmospheric parameters (e.g. velocity, acceleration, pressure, temperature). The probes collect, store and then send the coded information to a base station located at the ground through a dedicated radio transmission link. It is to be noted that long-range communication link (10 km) should be assured with low power consumption technology: a network based on the Long Range (LoRa©) technology to connect and exchange data within the end-modules and the base station is the potential adopted solution. In order to realize the communication system for the atmospheric probes, some prototypal links and networks have bene realized using the Adafruit Feather 32u4 LoRa Radio RFM95 modules. It is an embedded module, which contains a LoRa transceiver RFM95 and an ATmega32u4 microcontroller. The radio module can be powered using 3.3 volts either by using a micro USB or an external battery and it can transmit from +5 dBm to +20 dBm, which are theoretically enough for the purpose of this study. The present work presents the preliminary measurements made both in indoor and outdoor environment considering different configurations (spreading factors, transmitted power, bit rates, antennas…) in order to find the best set of parameters to work in the harsh environment to acquire information about warm clouds and send them to the ground receiver. Particularly detailed measurements have been made in harsh environmental conditions (e. g. rain, fog, drizzle…) in order to simulate a set of possible environmental conditions that can be found inside a warm cloud. The measurements techniques and results are presented together with the realization of a first operational prototype of both probes and ground receiver.

Corresponding Author: Lorenzo Carosso