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EFFICIENT LUNAR-EARTH COMMUNICATION SYSTEM BASED ON SOFTWARE DEFINED RADIO FOR THE EMIRATES LUNAR MISSION

Abstract

With the Moon being our closest neighbor in space, lunar exploration is having a great scientific and technological impact on the exploration of our solar system. Recently, several missions have been launched to the Moon, and the ultimate goal is to establish a permanent human presence on the Moon. Enabling the robust and reliable communication between the Moon and Earth is of thus of highest importance.

Although rockets and larger landers do not necessarily suffer from limited availability of electrical power, it is a major challenge for other – smaller – lunar vehicles such as rovers and small payloads. Also, the connection between a small rover on the lunar surface and a ground station on Earth might require real-time communication, for example during drive operations, where the rover would have to download a massive amount of data in the form of images or videos. High throughput with low power consumption systems are therefore required. Efficient error correction coding and high order modulation schemes are currently one of the key technologies to increase the throughput and reliability of the communication systems.

The aim of this paper is to describe, evaluate and present an efficient communication system which is integrated into Rashid rover, the core of the Emirates Lunar Mission (ELM). The proposed system is based on software defined radio (SDR), which allows reduction of hardware complexity, and consequently reduce the communication systems' power and mass budget. The link budget for the described SDR system will be presented, as well as its newly developed compact antenna, which continues to drive down power consumption and mass requirements for the system, while maintaining high bandwidth to enable basic lunar surface operations.