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SEQBO - A MINIATURIZED SYSTEM FOR QUANTUM KEY DISTRIBUTION

Abstract

As the need for secure communication is becoming increasingly important, new advanced technologies are under development, such as quantum cryptography. The most promising technique is Quantum Key Distribution (QKD) that uses a beam of polarized particles to transmit the encryption key that, once defined, allows for the use of traditional transmission techniques for the safe transmission of data. The possibility of utilizing a satellite for performing QKD was proved by the Chinese mission Micius that exchanged encryption keys with different ground stations over the globe and demonstrated the possibility to securely transmit data. Since this technology is highly promising for a number of different fields, the interest is now to create miniaturize systems to perform QKD compatible with small sat platforms. This in order to be able to develop an operative QKD network leveraging on the flexibility and short development time of small satellites. The goal of SeQBO, a program funded by the Italian Department of Defence and developed by Argotec, Italian aerospace engineering company, and the University of Padua, is to make a prototype of a QKD system compatible with a 12U CubeSat Platform. The system is composed of an On-Board Computer (OBC) and a Quantum Communication System (QCS) and it will reach a final

TRL of 5 in the frame of the project. The On-board computer is composed of two boards, one with a rad-hard CPU and the other one with an FPGA. The system has been designed with a mix of rad-hard and COTS components in order to guarantee high-reliability levels, while having excellent performance and a reasonable cost. The QCS is composed of two main elements: the photon generator and the optical transmitter. The photon generator firstly produces a stream of random numbers and then creates a beam of photons polarized according to the random sequence. The beam is then sent to an optical transmitter (a telescope in quasi-keplerian configuration) that directs the beam towards a desired target to allow the exchange of the key with a receiving station. At the time being, SeQBO has been prototyped and tested in laboratory environment: the encryption key has been successfully exchanged with a simulated ground station and encrypted information has been exchanged between the simulated satellite and the ground station. The system will be soon tested in relevant environment to verify the optical fine pointing system and compatibility with the thermal and mechanical space environment.