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Tools and Technology in Support of Integrated Applications (1)

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MODELLING AND ANALYSIS OF ACQUISITION, POINTING AND TRACKING AND  
ATMOSPHERIC TURBULENCE ON THE OPTICAL QKD CHANNEL BETWEEN A  
CUBE-SATELLITE TRANSMITTER AND OPTICAL GROUND RECEIVER FOR INDIAN  
SUB-CONTINENT.

**Abstract**

Secure exchange of data and information plays a crucial role in modern society, for example protecting the money transfers, commercial transactions, medical data, etc. Efforts are striving towards achieving global network coverage even in remote geographical areas. Quantum random number generators already present a provably secure entropy source for cryptographic applications with many existing physical realizations. Advances in quantum optics are also making these devices even more accessible. In this context, SATQuMA the first Quantum Key Distribution modeling and analysis open-source visualization tool to analyze the satellite QKD model and exchange of data through a dedicated distribution of cube-satellite network with the implementation of a variant of the BB84 protocol for the Indian subcontinent. Its implementation requires a transmitter to encode a random sequence of bits (the key) into four symbols (quantum states) encoded into the polarization of single photons and transmitted using a portable optical ground station. The paper is aimed at designing and prototyping the key elements of a cube-satellite mission that targets the delivery of Quantum Key Distribution (QKD) services, implemented using a constellation that operates in LEO. The rationale behind this vision is to address the growing need for the safe and ubiquitous exchange of data in our society that is becoming of paramount importance for an abundance of unsecured data. The implementation of this project can provide a new paradigm to share the satellite infrastructure required for secure communication based on quantum technologies. The dedicated spacecraft will carry a secure communication system payload based on a quantum link to distribute quantum keys to the dedicated ground. This allows for the implementation of a QKD service that is intended to be used as an integral part of the envisioned QKD solution. Moreover, the combination of this QKD payload and traditional communication channels will contribute in reducing the cost of both services by sharing the satellite platform and studying how LASER communication technologies can further improve synergically, getting benefits from each other's ecosystem. The SatQuMA project is being developed in the vicinity of QWorld with a strong heritage in areas such as quantum cryptography, quantum computing, and optical communication. The objective of the paper is to present an overview of the proposed Cube-satellite for random quantum key data exchange along with preliminary design considerations of the mission and platform to be developed.

**KEYWORDS :** Indian Secure Communication, Free space Quantum key distribution, SATQuMA, Cube-Satellite Random number generator