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# RECONFIGURABLE SPATIAL MODULATION BASED DIGITAL TRANSMITTER FOR NANOSATELLITES COMMUNICATIONS

**Abstract**

Currently, nanosatellites are being developed by many organizations and universities due to their low cost and short development cycle. Nanosatellite's design has many limitations such as limited downlink data rates. The use of Multiple Input Multiple Output (MIMO) technology in nanosatellite's communication increases the downlink data rate at the cost of increasing the power consumption. However, the available power in nanosatellites is limited. Spatial modulation was introduced in wireless communication to overcome the limitations of existing MIMO technology. In this research, a spatial modulation digital transmitter was implemented on the Artix-7 FPGA board for nanosatellite communication subsystem. Spatial modulation in the digital transmitter is implemented to allow the use of multiple antennas while maintaining limited power consumption using only one RF circuit. The design implemented in this study is considered as a transmitter for a 3U nanosatellite project. The design was compared to a Commercial off-the-shelf (COTS) transmitter in terms of system budgets such as mass, power, link, and data budgets. The results show that the implemented design increases the data budget while maintaining the overall system's budget of other subsystems. In addition, the results show that the implemented design improves the downlink by increasing the data rate without any overhead on system performance. Therefore, the system can be used for nanosatellite communication without exceeding any of its limitations.