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# TECHNOLOGICAL DEVELOPMENT INTO DIRECT SAMPLING ARCHITECTURES FOR HIGH BANDWIDTH SATELLITE COMMUNICATION SYSTEMS

**Abstract**

Zero-IF, IF-based systems, are the most common RF frontend designs for communication systems of satellites. The requirement of a larger bandwidth is always incrementing, generation of such high bandwidth systems using purely analog components is challenging as such components are vulnerable to manufacturing irregularities. The recent development of the Digital-to-Analog Converter (DACs) technology has paved way for the realization of high sampling rate capable DACs that can support various Nyquist zones of operation, where we can generate arbitrary waveforms and also support huge bandwidths.

Plausible Direct sampling architectures for satellite communication systems and innovative techniques for establishing high throughput systems in space have been continuously researched in recent years. The research methodology utilized involves a detailed literature review and background research of existing RF frontend architectures and concepts, fixating upon a base RF frontend design and developments on the comparative advantages of various architectures, the feasibility of the required design.

This paper proposes an innovative hardware design for the direct sampling architecture. A hardware design that utilizes an Integrated circuit that can function as the high sampling DAC, controlled by a radiation-hardened field-programmable gate array (FPGA) with an onboard microcontroller is designed and presented. The boards' architecture is designed compatible with Standard CubeSat PC104 Bus for interface provisions, with integrated onboard power design making it a standalone battery line run system. The paper discusses the inherent advantages of direct-sampling-based hardware design over existing architectures. The paper also showcases the potential of utilizing this hardware system for implementing command and data handling systems integrated with the communication systems.