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SOFTWARE DEFINED RADIO IMPLEMENTATION OF A NEGOTIATOR NODE TESTBED FOR FEDERATED SATELLITE SYSTEMS

Abstract

Federated Satellite Systems (FSS) is a novel space systems distributed architecture based on the exchange of resources such as bandwidth, storage and data processing among participant missions. This paper describes the flat-sat implementation of a FSS negotiation node. An FSS negotiation node deals with the protocol translation among different federated spacecraft in order to enable their resource exchange. The communications between federated spacecraft can occur either via dedicated Inter-Satellite Links, or by using already deployed communication subsystems that in general use different frequencies and protocols. Therefore, high flexibility is required from the communication equipment of a FSS negotiator. One possible solution is the design of a transceiver based on Software-defined Radio (SDR). For the experiment described in this paper we have chosen a BladeRF open SDR platform. BladeRF can work in the 300MHz - 3.8GHz RF frequency range and is capable of capturing 40MHz 12-bit full duplex quadrature samples in realtime. A FSS negotiator node should change communications parameters according to the situation. We implemented a testbed where two nodes (using different protocols and different frequencies) can communicate with each other via a negotiator node. Participant A uses FSK modulation and ISM (868 MHz) band, participant B uses QPSK and 2.4 GHz. FSS negotiator node provides real-time protocol-translation and successful data transmission between A and B (with 100 Mbit/s speed). The signal processing was made on host machines with GNURadio software. This same SDR systems were tested before on a high-altitude ballooning campaign, demonstrating its use in real situation and longer link distances, achieved with the adequate power amplification. The FSS negotiator described in this paper can be applied to real missions. The Embedded FPGA of the BladeRF SDR can provide high performance signal processing, which is required for FSS protocols and algorithms.