Programmable Analog Devices

A technology is desired to provide a software programmable analog component. This “programmable analog array” would consist of basic elements including filters, amplifiers, couplers and mixers whose frequency of operation, bandwidths and gains can be changed by software command. The signal flow in the component itself will be reconfigurable by software and firmware loads in a manner similar to that of Field Programmable Gate-Array (FPGA) digital devices. Desired components will be capable of operating in the S- and Ku-bands. Maximum flexibility in configuration is also desired with the goal of producing a generic “sea of elements” rather than an integrated system on a chip.

Low-Overhead Software-Defined Radio (SDR) Implementations

NASA is interested in SDR architectures and implementations that optimize flexibility and interoperability between different SDRs, but are based on extremely efficient core architectures and low processor overheads. Algorithms that can be implemented in current space flight capable hardware are especially encouraged.

RF Component Technology

A wide variety of general advances in component, material and manufacturing technologies are required to support future NASA mission requirements. These technologies include innovative approaches to enable higher frequency, miniature, power efficient Traveling Wave Tube Amplifiers (TWTAs) operating at millimeter wave frequencies and at data rates of 10 Gbps or higher. Wide band-gap semiconductor (WBGs) based devices for high power, high efficiency microwave and millimeter wave solid-state power amplifiers (SSPAs), as well as low noise amplifiers in the same ranges. MEMS-based RF switches are needed for use in reconfigurable antennas, phase shifters, amplifiers, oscillators and in-flight reconfigurable filters. Frequencies of interest include S-, Ku-, Ka-, and V-band (60 GHz).

Bandwidth Efficient Channel Coding

To support extremely high data rates in a limited frequency spectrum, bandwidth-efficient channel coding is required. NASA is interested in algorithms that provide lossless data compression and efficient error correction at
data rates greater than 1 Gbps for links between Earth orbit and Earth ground stations.

RF Materials and Structures

NASA is interested in materials that can be efficiently manufactured and effectively used in the construction and deployment of thin-film based RF antenna systems. Methods for deploying very large, lightweight, aperture structures on-orbit are needed. Inflatable structures, as well as “shape memory” alloy-based implementations, capable of withstanding launch and deployment forces are encouraged.