

Tunable SAR based system

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The concept of “Agile Satellite System” (ASS) is an emerging technology that will facilitate and control the increasing connectivity of an integrated satellite systems. It will enable efficiently the inter and intra link satellite communication over remote distances. Furthermore, ASS is a very attractive solution due to its flexibility, signal routing, switching and distribution, which can be achieved within its agile based payload. RF wireless multiplexing using a tunable antenna provides a signal multiplexing techniques that is key enabler for the ASS technology. Agile antennas array will enhance the functionality by providing the wireless terminals with more frequency bands and bandwidth, maintaining the compact size along with reducing the interference and possible cross-talk. Furthermore, ASS is robust systems that can be used - for example- to transmit data and control information across satellite based network infrastructures. Integrating the ASS with current satellite networks will provide additional opportunities for established and newfound satellite operators, especially in connecting remote satellite clusters with each other. ASS applications will require the use of high gain antennas, steerable beam, MIMO capabilities, to communicate free space long distances with the set of satellite of interest. Agile antenna tracking and beam repointing is a must whenever the ground terminal or the satellite or any other flying object in space changes location. Beam steering capabilities are also highly advantageous to simplify installation of fixed terminals operating on conventional satellite networks. For space applications electrically steerable phased arrays are much more preferable over mechanical steerable reflectors. Therefore, the use of tunable phased antenna array along with tunable antenna elements provides adequate gain and beam steering capabilities while keeping to minimum the antenna size and number of radiating elements along with the complexity of the excitation network. Therefore, the development of ASS emerging components require collaborations with different partners from multi-discipline and experts in device engineering and material integration along with system level operations. This proposal addresses the design, fabrication and characterizations of several core components for enabling the proposed ASS. Therefore, the project aims are summarized as follows:

1. Design, implementation and characterization of smart antenna array system (incorporating tunable antenna elements and tunable phase shifters) equipped with the capability for beam steering and pointing towards multiple satellites of interest. Such scattering parameters measurements, impedance matching, radiation pattern, array characterization, near field, cross talk will be conducted. Simulations platforms will be used in the design.
2. The smart antenna will be used for the development of high-resolution synthetic aperture radar (SAR) system for detection of moving or stationary objects in space. Detection and identification characterization and experimentation will be carried out.
3. The smart antenna array will enhance the reception, transmission to overcome spoofing, and multi pathing issues. Multiplexing experiments and control units along with processing methods to be apply.

PhD students profiles

1. One PhD student in the area of Antenna and Microwave Engineering with preferred skills in Strong background in antenna design and characterization. Experienced with electromagnetic

- simulation software like CST, HFSS etc. Significant experience and technical skills in antenna design, fabrication and characterizations. Familiarity with 3D electromagnetic simulation software/tools specially CST. Candidate will plan, perform and manage research projects independently, and as part of a team, and disseminate results via peer-reviewed journals. Excellent communication and interpersonal skills are also required.
2. One PhD student in the area of RF front end electronics with preferred skills in Strong background in antenna array front end design, integration, fabrication and characterization. Significant experience and technical skills in RF electronics circuits design like power combiner, tunable phase shifter, low noise amplifier etc. Familiarity with software like CST, HFSS, ADS, MW Office etc. Experience with GNSS receiver design is a plus. Excellent knowledge of navigation system theory and analog front end design.
 3. One PhD student in Embedded System Design with preferred skills in Strong background in embedded system design, micro controller programming and interfaces and applications. Significant experience and technical skills android/iOS mobile application development. Familiarity with capturing data from a variety of sensors and send signals through Wi-Fi/Bluetooth interfaces Experience with C/C++ is a plus. Excellent knowledge of OS coding techniques, IP protocols, interfaces, hardware subsystems and signal processing are highly desirable.