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WIRELESS ANTENNA MULTIPLEXING USING TUNABLE ANTENNA FOR SPACE APPLICATIONS

by

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Abstract: Recent development in the communication technologies shift the communication paradigm from point to point to multi user wireless system. These developments eased the use of mobile telephone, satellite services, 5G cellular, smart application, and the Internet of Things. The proliferation of mobile devices has necessitated an elaborate mechanism to serve multiple users over a shared communication medium, and multiplexing approach is introduced to serve this purpose. The multiplexing refers to a method which aims at combining multiple signals into one signal such that each user would be able to extract its desired data upon receiving the multiplexed signal. This spectrum sharing allows wireless operators to maximize the use of their spectrum to accommodate a large number of users over fewer channels. In Space applications, where sensors like temperature, attitude, IR, Magnetic etc. send information using antennas operates at different frequency, there is a need to collect all or some of these data using a single device. Wideband antenna requires a filtering process in order to remove unwanted signals that leads to a complex circuit design. Furthermore, the use of multiple antenna ends up with larger size and additional complexity. Therefore, tunable antenna is an excellent candidate which provides a perfect solution for such scenarios. A tunable antenna whose frequency characteristics shifted by applying tuning action can be used to operate as a multiplexing device that can collect signals from different surrounding antennas; each operates at fixed frequency. A system architecture for wireless multiplexing using tunable antenna is proposed in this project. An electronically tunable antenna using varactor diode as tuning element used as the multiplexing device that can collect signals from different surrounding antennas. The system consists of RF front end and a control circuit/system for wireless multiplexing. The RF front end consists of a tunable antenna, tunable phase shifter, tunable band pass filter, low noise amplifier, mixer, voltage controlled oscillator and an intermediate frequency filter. The control unit comprises a microcontroller, DAC, CMOS oscillator, power module and a USB interface for communication with a custom-built software installed on a PC. The device has functions for control, digital signal processing and de-multiplexing. The device is fed with an input multiplexed signal, and the de-multiplexed output signals are extracted and displayed on the graphical user interface of the software. Due to the re-configurability and programmability of the device, it presents a flexible, cost effective solution for a variety of real-world applications.

Keywords: *Wireless multiplexing, reconfigurability, tunable antenna, smart systems, space communications, varactor diode, information technology.*