Software Controlled Mechanically Reconfigurable Antennas for Cognitive Radio

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The ability of a communication protocol to dynamically sense and access the spectrum has increased the efficiency of communication systems. This dynamic communication scheme also known as cognitive radio is intelligent and able to learn and adapt to new environments and wireless communication channels. Cognitive radio has various requirements and depends vastly on the type of communication standard that is available. Thus cognitive radio is divided into two main categories: Spectrum interweave and spectrum underlay. In this work we only discuss antennas for spectrum interweave cognitive radio.

For the spectrum interweave, the antenna system is responsible for sensing the channel and communicating once idle gaps are found. The sensing antenna is usually a wide band antenna used to constantly monitor the channel activity and determine the idle frequencies. The communicating antenna is a separate antenna that is reconfigurable and is able to tune its frequency dynamically to broadcast over the idle gaps of the spectrum.

Several antenna systems have been designed for spectrum interweave cognitive radio environments. Most of these antennas resort to switching components that are incorporated into the antenna structure to achieve surface currents reconfiguration. However antenna researchers have been investigating new and innovative reconfiguration methods to incorporate onto the communicating antenna to achieve tuning ability and dynamic spectrum access.

Software controlled mechanically reconfigurable antennas seem to accomplish the task of frequency tuning and are able to reliably complete the communication process over any spectrum interweave cognitive radio environment. For example, a circular antenna substrate holding five different patches is rotated via a stepper motor to achieve frequency tuning. This antenna is positioned next to a wideband antenna for sensing ability. The rotatable antenna is software controlled by labview and is able to smoothly tune its operating frequency for any band between 2 GHz and 10 GHz. Another antenna is software controlled by an arduino board and tunes its function by dropping or tilting part of its ground plane using linear actuators. The reconfigurable antenna is placed out of plane of the sensing antenna and both achieve excellent isolation properties. This antenna system is easily controlled by a push button switch and the complete system is packaged inside hardened foam chassis to protect from outside interference and to facilitate portability. Even though these antennas may be slower to respond, however their reliability and life cycle is much higher than typical electrically reconfigurable antennas.