COMPACT NOVEL RECONFIGURABLE ANTENNAS FOR MULTI-BAND OPERATION

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There are numerous wireless services that operate over wide frequency ranges and demand different operating electrical characteristics. For example, E-GSM systems operate within 0.89 to 0.96GHz, GPS within 1.57 to 1.58GHz, and UMTS within 1.92 to 2.17 GHz. Meanwhile, WLAN systems utilize different frequency bands (2.4 and 5.2GHz) with additional ranges for other services including Bluetooth, Zigbee, Wimax, among others. Radiation patterns of most of these antennas are omni-directional; however, some of these services require circularly polarized antennas. Antennas at these low frequencies are generally large in size and therefore unwieldy, especially at the 0.80 to 0.90GHz range. Hence, due to their inconvenient size, it is not practical to dedicate one antenna for each service, as they would occupy large real estate area. In addition, their proximity will cause significant performance degradation. Many of these services, such as wireless, are used only when needed, while there may be the need for the continuous use of others, such as Bluetooth and GPS. Therefore, in most cases, we would require automatic switching between the different modes, bands, and standards of operations. Reconfigurable structures are excellent candidates for this purpose, because they can be dynamically reconfigured to address most of these cases and their performance could surpass other configurations[1]. We have developed various reconfigurable antennas where their design is aimed at minimizing the number of switching devices and their overall size. MEMS are used and are preferred for switching, because of their low power dissipation. Eventually, the fabrication of these MEMs would be compatible with CMOS technology. In this paper, we will present the modeling and design of two original concepts: the maze and nested loop antennas. The maze-loop antenna[2] is based on reconfigurable fractal structure, where we would require slight tuning to adjust its fractal resonances to a selected set of frequencies[2]. But recently, we significantly reduced the size of these loop antenna structures at these low-operating frequencies by using symmetry planes and virtual short circuits. In addition, we have developed a novel concept for nesting various patches to obtain a multi-band or reconfigurable multi-band antenna, whenever MEMs devices are used for switching. Efforts to reduce their sizes and minimize the number of utilized switches for reconfiguration will be discussed here in detail.

[1] Reconfigurable Antennas and RF Front Ends for the Development of a Universal Wireless Receiver by C. Zhang, et al.,to be presented at the IEEE Radio and Wireless Symposium, Jan., 2006, San Diego, CA.

[2] A Novel Reconfigurable Maze Antenna for Multi-service Wireless Universal Receivers, by S. Yang, et al. to be presented at the IEEE Radio and Wireless Symposium, Jan., 2006, San Diego, CA.