Vertical ZOR Antenna Array with Omnidirectionally Steerable Patterns

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In the wireless local network (WLAN), the antennas with omnidirectional beam pattern are very useful due to wide scanning range. However, they have a relatively short scanning length because of a low antenna gain. This limitation could be more critical in higher frequency due to high atmospheric attenuation. To increase the antenna gain, the vertical array was employed (K. Wei, et al., "A MNG-TL Loop Antenna Array With Horizontally Polarized Omnidirectional Patterns," IEEE Transaction on Antennas and Propagation, Vol.60, No.6, pp.2702-2710, 2012). However, the study on omnidirectionally steerable beam patterns is not nearly done.

In this presentation, a vertical zeroth-order resonance (ZOR) antenna array having omnidirectionally steerable beam patterns is designed. It consists of four antennas designed using ZOR mode in composite right/left handed transmission line (CRLH-TL) (J-.H. Park, et al., "Epsilon negative zeroth-order resonator antenna," IEEE Transaction on Antennas and Propagation, Vol.55, No.12, pp.3710-3712, 2007). The ZOR antenna is small size antenna with omnidirectional beam pattern. To confirm the characteristics of the ZOR antenna array, the radiation pattern of antenna array is predicted from theoretical array factor and unit antenna pattern. The result is compared with that from the full-wave simulation (ANSYS HFSS), showing a good agreement. From the results, the optimal parameters such as the vertical distance between unit antennas and the ground size of unit antenna are found. Then, the optimal phase difference of unit antennas to steer main lobe is confirmed by studying the isolation between unit antennas. The feed network suitable for vertical array is applied to the antenna for phase control. Finally, the vertical ZOR antenna array that can steer main lobe on azimuthal plane is deigned and fabricated. Detailed design and performance of the antenna will be discussed in the presentation.