

Triple-Band Spiral Antenna Array fed by Composite Right- and Left-Handed Power-Divider for Gain-Enhancement as a Flat Structure

Kyeongnam Jang⁽¹⁾, Sungtek Kahng*⁽¹⁾, Inkyu Yang⁽¹⁾, Kyungseok Kahng⁽¹⁾, and J. K. Cho⁽²⁾

(1) Dept. of Info. and Telecomm. Eng., University of Incheon, Incheon, Korea

(2) Eltronix Co., Ltd., Seoul, Korea

Spiral antennas have been adopted a lot over the linear polarization counterparts, since the circular polarizations of their far-field patterns can improve the versatility of wireless communication in multiple-fading and multiple-reflection environment. Nonetheless, there are shortcomings from the conventional spiral antenna systems, which are poor channel selectivity and large physical volumes. Most of the spiral antennas take tapered-shaped metal patterns to have the wide-band, since the basic winding of a uniform line to a circle of a growing radius reduces to a narrow-band. The footprint of the aforementioned antenna should be large for a higher gain. With this, because the balanced feed assures the desirable spiral antenna performance, the differential feed or vertical balun is connected to the input port of the antenna, which makes it accompany a cavity beneath the metal pattern. Especially, when the main radiator is above the bottom PEC of the cavity by the quarter-wavelength, the volume of the cavity-backed and balun-fed spiral antenna becomes improper for portable devices and attachment to a vehicle.

In this paper, a novel flat spiral antenna array is proposed. It is featured by a triple-band for channel selectivity and gain enhancement as well as a low-profile. To increase the antenna gain, the unit spiral antenna should be expanded to an array. Before this, the array element should have three bands of 2.4 GHz, 4.8 GHz, and 7.2 GHz, not in the form of a bulky cavity-backed geometry, but a planar structure. If the footprint of this element antenna is not enlarged, it has about the gain of 3 dBi. If this is wanted to grow up to 7 dBi, an array is needed. Two elements of planar spiral antennas are needed, and they need to be fed by a power-divider. Coming up with a planar triple-band spiral antenna is a challenge, but the design of the power-divider to handle the three bands is harder than anything else, considering the existing power-divider technology. A thought can be given that the operational band of a power-divider is wide enough to include the three bands. However, the conventional technique for a wide-band power-divider elongates the physical structure by cascading sections or smooth transition of the branches. To eliminate this problem, a short CRLH(composite right- and left-handed) power-divider is suggested to be combined with flat spiral antennas for the triple-band array.

