Advanced Antenna Technology with CRLH Metamaterial for Radiative Wireless Power Transfer

T. Yamamoto\(^{(1)}\), K. Matsumoto\(^{(1)}\), and H. Kubo\(^{(1)}\)

\(^{(1)}\) Graduate School of Sciences and Technology for Innovation, Yamaguchi University

In a general radiative WPT system, some array antennas, for example, linear array antennas, and microstrip array antenna\(^{[1]}\), are used as a transmitting and a receiving antenna. Some power divider/combiner circuits are required in these array antennas. For transmitting/receiving large power in radiative WPT, large antenna aperture is one of the effective methods. A lot of antenna elements are necessary for realizing of the large antenna aperture, then a lot of power divider/combiner circuits are also required. These circuits can cause a serious loss in a radiative WPT system. Our research group are studying on an new-type antenna for overcoming of the loss\(^{[2]}\). In this paper, an advanced antenna with composite right-/left-handed (CRLH) metamaterial\(^{[3]}\) for radiative wireless power transfer (WPT) is discussed.

Figure 1 shows a structure of a proposed CRLH metamaterial (a) and a dispersion characteristic of the material (b). This structure is known as “Dirac-cone” metamaterial\(^{[4]}\), and this structure can have a balanced dispersion characteristic with appropriate structural parameters. At Γ-point frequency in the dispersion characteristic shown in Fig.1, a zeroth-order resonance phenomenon can be obtained, and a zeroth-order resonance antenna can be realized by using the resonance mode. One of the issues in this structure is low radiation efficiency. The radiation efficiency depends on a gap between metallic patches in adjacent unit cells. Therefore, an optimum gap is designed for maximizing of the radiation efficiency. A zeroth-order resonator antenna composed of Dirac-cone metamaterial is fabricated, and some characteristics of the fabricated antenna are measured. The manufactured antenna is shown in Fig.1 (c). In our presentation, the measured results will be shown.

![Figure 1. A proposed CRLH metamaterial. (a) a unit cell and a structure. (b) a balanced dispersion characteristic (c) a fabricated zeroth-order resonator antenna.](image)

References


