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Advanced Antenna Technology with CRLH Metamaterial for Radiative Wireless Power Transfer

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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 reserch group are studying on an new-type antenna for overcomming 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 fabriccated, 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.

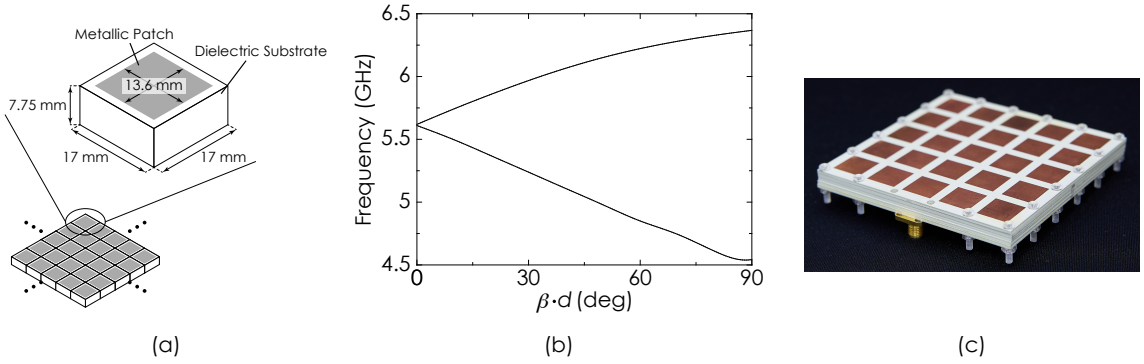

Figure 1. A proposed CRLH metamaterial. (a) a unit cell and a structure. (b) a balanced dispersion characteristic (c) a fabricated zeroth-order resonator antenna.

References

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