

Mantle cloak-loaded loop antenna for mutual coupling reduction

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Recently, a mantle cloak has been developed to control electromagnetic waves. The mantle cloak can achieve the cloaking effect by applying the designed surface reactance on the object. The mantle cloak has been applied to reduce the mutual coupling between monopole, dipole, and slot antennas. This paper presents a square loop antenna loaded with mantle cloak composed of strip conductors to reduce mutual coupling and maintain the radiation pattern.

Figure 1(a) shows the configurations of loop antenna 1 and loop antenna 2. Figure 1(b) shows the configuration of loop antenna 1 and loop antenna 2 loaded with mantle cloaks. The operating frequencies of loop antenna 1 and 2 are 810 MHz and 750 MHz, respectively. The distance between each antenna is one wavelength at 810 MHz. The loop antenna 2 is covered with four mantle cloaks using dielectric substrates with $\epsilon_r = 10.9$ and $\tan\delta = 0.003$. The strip conductors are installed at the center of each face. The length and width of each strip conductor are 56.5 mm and 4.8 mm, respectively. Figure 1(c) shows the simulated S-parameter characteristics. The operating frequency of the loop antenna 2 loaded with mantle cloak is 750 MHz, and a mutual coupling can be suppressed by approximately 50 dB at 810 MHz, which is the operating frequency of loop antenna 1. Figure 1(d) shows radiation patterns on the zx plane at 810 MHz, when the port 1 is excited and the port 2 is terminated in $50\ \Omega$. The radiation pattern of loop antenna 2 is disturbed when the loop antenna 1 is in close proximity. However, the mantle cloak can maintain the radiation pattern of the original antenna. This work was supported by JSPS KAKENHI Grant Number JP24K07500.

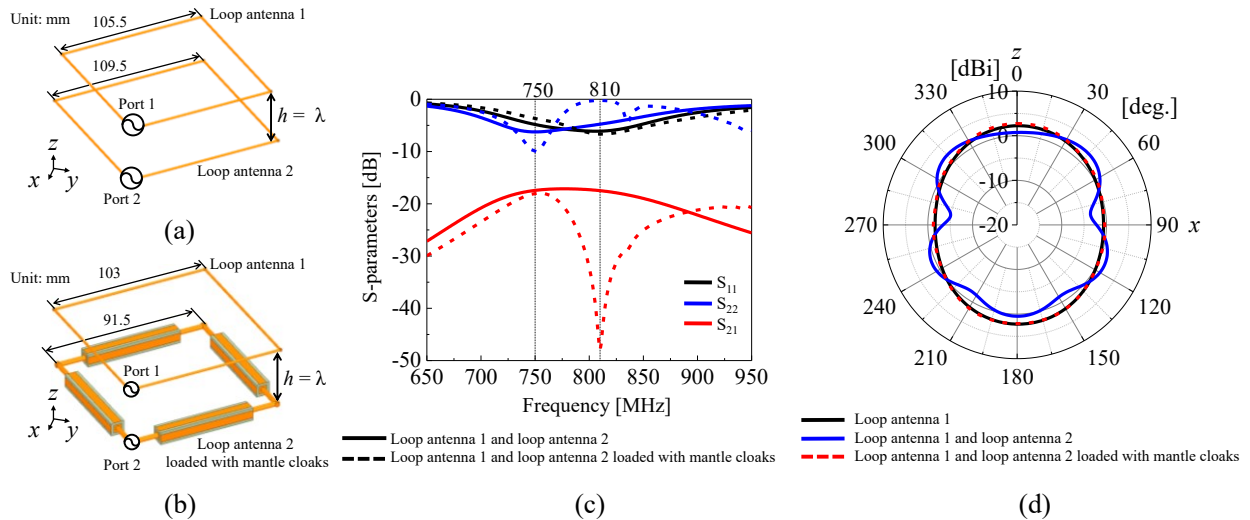


Figure 1. A square loop antenna loaded with mantle cloak composed of strip conductors. Configurations of (a) loop antenna 1 and loop antenna 2 (b) loop antenna 1 and loop antenna 2 loaded with mantle cloaks. (c) S-parameter characteristics and (d) radiation patterns.