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Scattering suppression by mantle cloak composed of strip conductors

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Radio waves are scattered and reflected, when the supporting objects such as a pillar exist near the transmitting and receiving antennas of a cellular base station or radar, resulting in low signal to noise ratio and radar clutter. Therefore, the scattering and reflection of incident wave by objects need to be suppressed. Radio wave absorbers can suppress scattering by the objects in the vicinity of transmitter [1]. However, the radio wave from the direction of the objects is attenuated. Mantle cloaking has been proposed to suppress scattering without reflection and attenuation [2]. The incident wave can pass through backward without attenuation by using the mantle cloaking composed of periodic structure surrounding the object. However, the surface impedance of mantle cloaking has frequency-dependent characteristic. In addition, the actual structure for achieving the desired surface impedance is complicated and difficult to fabricate. Therefore, this paper investigates a mantle cloak composed of simple strip conductors. Figure 1 shows the simulation model of the mantle cloak and the simulation result. The mantle cloak is designed by using dielectric substrates with four strip conductors. The designed mantle cloak is mounted to square copper rod, as shown in Fig.1 (a). The strip conductors of the mantle cloak are arranged at the corners of the rod. The operating frequency is 720 MHz. The mantle cloak is periodically installed on the object with spacing or at both ends of the strips mounted on the mantle cloak. The Monostatic RCS reduction of –20 dB is confirmed at 720 MHz as compared to without the mantle cloak in the case of plane wave incidence, as shown in Fig.1 (b). In addition, it was confirmed that the incident wave is not attenuated by the proposed structure in the Bistatic RCS pattern. In the electric field distribution, the incident wave is not scattered on the proposed structure, and passes through backward the objects. As a result, the cloaking effect can be obtained.

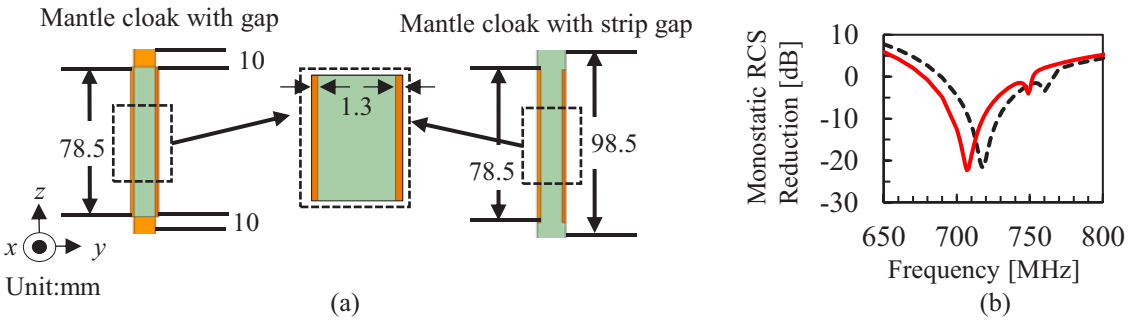

Figure 1. (a) Simulation model. (b) Monostatic RCS reduction, solid: with gap, dash: with strip gap

References

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[2] P. Yuste, *et al*, "A simple and effective microwave invisibility cloak based on frequency selective surfaces," 11*th Eur. Conf. Antennas Propag.*, Paris, France, March 2017, pp. 945-949.