Simplified Model for Printed Dipole Antenna Using Conductive Ink

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In recent years, transparent antennas [1-3] have been attracted much attention for greater flexibility in the location of the antenna. Transparent antenna using ultrafine conductive mesh has been proposed [4]. Conductive inks have been considered as mesh materials. Printing technology on ultrafine conductive mesh can be applied to a wide variety of materials and can be manufactured at low-cost. For example, the indoor base station antennas for 5G [2], the digital terrestrial TV antennas [3], and the antennas for RFID tags [4] have been proposed. However, the conductive ink is more lossy than metals. In addition, the simulation is also time-consuming due to the large wavelength relative to the line thickness of the mesh for transparent.

To overcome this problem, this study proposes a simple modeling of a printed dipole antenna with conductive ink. The finite element method is used for the simulation. Figure 1(a) shows that the simplified mesh dipole antenna consists of ultrafine meshes printed with conductive ink with a pitch of 60 µm and a thickness of 250 nm using conductive ink. As shown in Fig. 1(a), the simulation model consists of 33 meshes in the *z*-axis direction and only near the power feed in the *y*-axis direction. The strip width is 2.4 µm. The conductivity σ_1 of the conductive ink is 7.7×10^6 S/m. Figure 1(b) shows the sheet-like model with uniform conductivity. A model with uniform conductivity σ_2 is 4.0×10^4 S/m. A sheet-like model has the same size as the mesh-like model. Figure 2 shows the simulation and measurement results. The simulation results are in agreement with the mesh-like model. Therefore, the mesh-like model can be simplified to the sheet-like model.

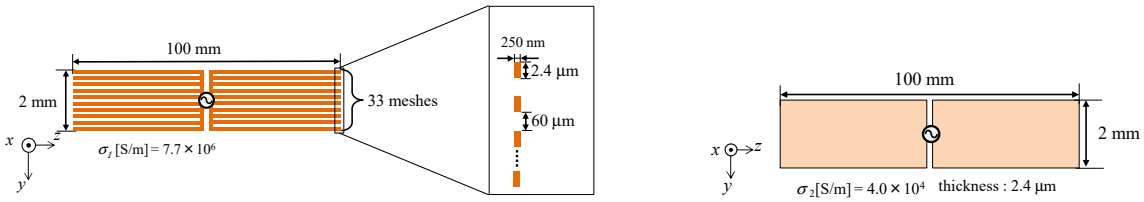

Figure 1. Simulation model. (a) Simplified mesh model, (b) Sheet-like model.

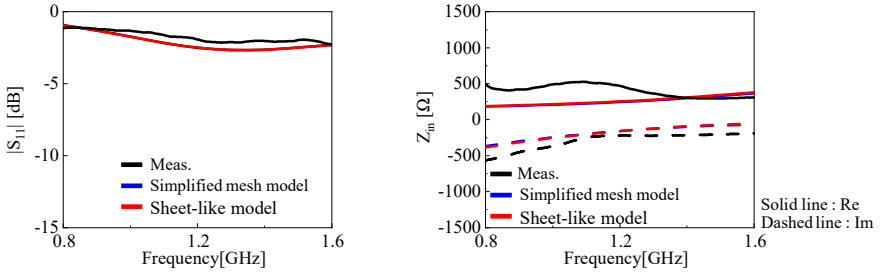

Figure 2. Measurement and simulation results (a) $|S_{11}|$ characteristic, (b) Input impedance characteristic

References

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