

Design of A FSS-Based Patch Antenna for Wireless Internet Applications

Hsing-Yi Chen* and Shu-Huan Wen

Department of Communications Engineering, Yuan Ze University
135, Yuan-Tung Road, Nei-Li, Chung-Li, Taoyuan, Taiwan 32003.

Based on our previous research works (H.Y. Chen, T.H. Lin, and P.K. Li, ACES, 30-7, 717-730, 2015; H.Y. Chen, and S. H. Wen, AP-S Symp. & USNC-URSI, Meeting, San Diego, CA Jul. 2017), we can quickly design a FSS-based patch antenna for arbitrarily specifying any two operating frequencies of 5.8 and 24.0 GHz as shown in Fig. 1. Measurement data and simulation results of antenna properties were obtained by using an Anritsu37369C antenna measurement system in the Yuan Ze anechoic chamber and by using the Ansoft high-frequency structure simulator (HFSS, Ansoft, Pittsburgh, PA), respectively. From the research result, it is found that the simulated and measured bandwidths are 1282 and 1415 MHz at 5.8 GHz frequency band for the impedance matching with -10 dB reflection coefficient, respectively. The simulated and measured bandwidths are 818 and 1099 MHz at 24.0 GHz frequency band for the impedance matching with -10 dB reflection coefficient, respectively. It can be observed that the 3-D radiation pattern shape and beam angle obtained by the simulation and measurement are very similar to each other. The simulated and measured results of radiation patterns in the E- and H-plane at frequencies of 5.8 and 24.0 GHz are broad and smooth. The averaged ratio between co-polarization and cross-polarization is greater than 20 dB. This means that the system power loss due to polarization mismatch may be insignificant. The antenna gains obtained by measurement and simulation at frequencies of 5.8 and 24.0 GHz are close to 3.0 and 6.0 dBi, respectively. This FSS-based patch antenna has a compact size with three dimensions of $22.731 \times 7.577 \times 0.87$ mm which can be fabricated at a low cost using the standard PCB process. This FSS-based patch antenna has the features of low profile, light weight, and broad dual bands. This compact patch antenna is suitable for applications in unlicensed frequency bands of 5.8 and 24 GHz for wireless internet applications, especially, in the near field communication (NFC) such as RFID, Tag, Bluetooth systems, and wearable systems.



(a) Top view.

(b) Bottom view.

Fig. 1 Prototype of the FSS-based patch antenna.