

Design of Dual-Band Dual-Polarized Antenna with Frequency Selective Surface Cover and Artificial Impedance Surface

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Recently, much interest has been drawn to the periodic structures that have useful characteristics. Such periodic structures include Photonic bandgap (PBG), frequency selective surface (FSS), artificial impedance surface (AIS), and artificial magnetic conductor (AMC). PBG structures have been used to improve the antenna performances by preventing surface wave or using as a reflector that acts like magnetic conductor. Nowadays PBG materials are used as the cover of patch antenna or dipole antenna and those structures which operate like Fabry-Perot resonator enhance antenna directivity dramatically.

To use PBG materials as Bragg mirror in Fabry-Perot cavity, two or more layers are required and those layers are bulky for antenna applications. Thus we use one FSS layer instead of PBG layers in order to reduce total antenna height. FSS is composed of slot arrays and it has less than 10% of transmission ratio. Patches or dipoles are periodically loaded on substrate and they can be considered as artificial impedance surface. The proposed antenna is fed by microstrip patch antenna which is placed on the center of AIS. Figure 1 shows the basic structure of proposed antenna (feeding antenna is not shown).

The distance d between two surfaces (FSS and AIS) determines resonant frequency which satisfy the following equation:

$$2\beta_0 d - \varphi_{FSS}(f) - \varphi_{AIS}(f) = 2\pi n$$

here, $\varphi_{FSS}(f)$ and $\varphi_{AIS}(f)$ are reflection phase on FSS and AIS, β_0 is phase constant in free space and n is integer.

Because the element patch or dipole of AIS is not square, reflection phases are subject to the polarization of the incident wave. Therefore, proposed structure can support two orthogonal polarizations and they have different resonant frequencies. Thus, the proposed antenna has dual operating frequencies with dual polarizations in one antenna structure. Moreover, resonant frequency is controllable by changing not only the distance d but also the element size of AIS.

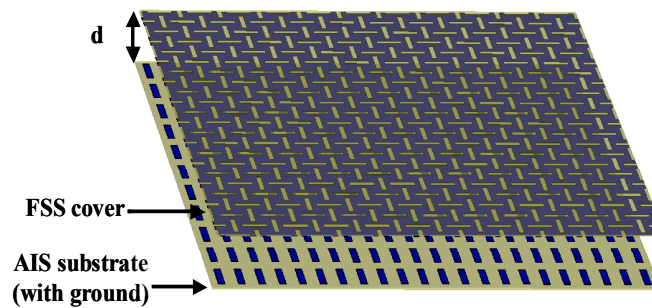


Figure 1. Basic structure of proposed antenna with FSS cover and AIS