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Novel thin wideband radar absorbers

Keywords

Thin absorbers, Periodic MoM, Transmission line method, Binary optimization, FSS, Bandwidth, Angular stability

Background

Radar absorbers are structures which cover a device and minimize the reflection of incident electromagnetic waves. Different types of absorbers such as pyramidal absorbers, Salisbury screens and Jaumann absorbers are developed for various applications. Among them planar absorbers are of special interest because of their susceptibility for integration into different devices and environments. However, these kind of absorbers are usually narrow band devices and they are quite bulky for operating in lower frequencies. With the appearance of the metamaterial concept, some new absorbers based on frequency selective surfaces (FSS) have been proposed. These absorbers are usually much thinner than those mentioned above. Nonetheless, since the operation is based on resonance effects, they still suffer from narrow bandwidths. The problem of narrow bandwidths for planar absorbers was always a challenging problem in the absorber industry through the years.

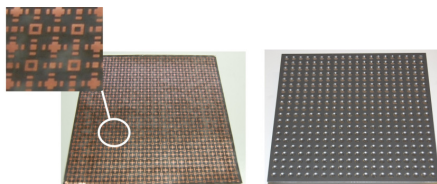


Fig. 1. The perforated FSS absorber consists of printed patches on the substrate (left) directly attached to the perforated substrate (right).

Invention

The presented invention provides an alternative absorber with improved absorptive properties. “Perforated FSS absorbers” were introduced, comprising a periodically perforated lossy substrate fully grounded on one side and covered by a FSS pattern on the other side (Fig 1). This design has the advantage that the holes in the substrate affect the resonance properties of the structured metallic layer and the spectral absorption of the whole device. This subsequently allows broadening the spectral response of the absorber. Interestingly, the investigations proved that a simple structure for the holes, i.e. a single cylindrical hole, suffices to achieve considerable enhancement. The optimization results show that absorption properties of the perforated FSS absorber can be enhanced more than 100% by drilling one hole per unit cell in the substrate (Fig. 2C).

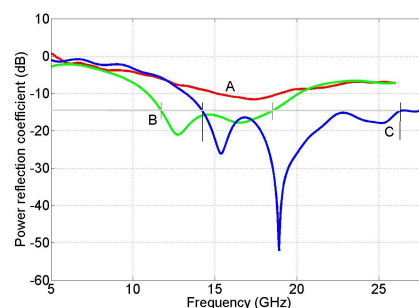


Fig 2. The perforated FSS absorber leads to a very broad absorber range (C) compared to a homogenous absorber (A) and a FSS absorber (B).

Patent Status

- Patent pending PCT

Features & Benefits

- Very broad operation bandwidth (14 - 26 GHz)
- Stable angular behaviour compared to homogeneous absorbers
- More degrees of freedom for designing thin absorbers
- Simple fabrication process, only one hole per unit cell is required
- Thin absorbers with reduced weight

Field of Application

- Defense industry: tracking applications to reduce the radar cross section (RCS) of aircrafts or ships
- Electronic packaging and building industry: shielding electronic circuits, equipments and living environments from electromagnetic interference
- Building industry: absorption of the incident radiation to buildings located around airports
- Mobile and telecommunication industry: protecting humans from electromagnetic radiation

References

- A. Fallahi, et al. Thin Wideband Radar Absorbers, IEEE TAP, *in press*.

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