Appl. Phys. A (2017) 123:53
DOI 10.1007/s00339-016-0676-5

Applied Physics A
Materials Science & Processing

Bandwidth enhancement of an array antenna using slotted artificial magnetic conductors

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Received: 5 August 2016 / Accepted: 9 December 2016 / Published online: 21 December 2016

Abstract An artificial magnetic conductor (AMC)-integrated array antenna operating at 9.41 GHz is proposed in this work. The AMC plane consists of an array of 9 × 12 rectangular elements slotted using four circular slots. The rectangular circular-slotted AMC unit cell acts as a metamaterial with high permeability of 10.05 and non-unity permittivity of 1.52, respectively. The integration of the AMC plane into a reference array antenna operating at 9.41 GHz increases the impedance bandwidth by 76%, from 1.12 to 1.98 GHz. Besides that, the efficiency is also enhanced from 95.91 to 96.31%. Both reference and proposed antenna show a satisfactory agreement in terms of simulated and measured reflection coefficients and radiation patterns.

1 Introduction

In most wireless applications, there is a need to enhance the gain of an antenna in the forward directions. This can be typically achieved using a perfect electric conductor (PEC). However, such technique will create an image current that flows in the opposite direction to the original source current, thus canceling its effect and degrading the antenna's radiation performance. This effect can be reduced by adding a $\lambda/4$ gap between the antenna and the PEC, resulting in an increased antenna dimensions. This problem can be mitigated by applying a perfect magnetic conductor (PMC), which forms an image current flowing in the same direction as the source current. The use of the PMC structure typically results in a reflection coefficient with unity magnitude and zero phase [1]. However, PMC is a material that does not exist in nature. An alternative to this is the artificial magnetic conductor (AMC), classified