PLANAR ANTENNA ARRAY OVER THE NOVEL METALLIC NANOWIRE MEMBRANE (MnM) SUBSTRATE

Abstract

Given the need for gigabit data transfer rates and the fact that the microwave spectrum is already saturated with a great number of protocols and applications, the mm–wave frequency range, which comprises frequencies from 30 GHz to 300 GHz, is getting more and more attention since early 2000s. Among these, the 60 GHz frequency has been the focus of several researches for household and short-range wireless data transfer applications.

Despite of the reduction in size of lambda-based passive circuits at mm-waves, there is still an issue regarding low-cost integration, especially for antennas, which always occupy a large area. Antennas operating at mm-waves present sizes ranging from hundreds of micrometers up to a few millimeters, which enables the integration of planar antennas with transceivers either as a System-on-Chip- (SoC) or as a System-in-Package (SiP). SiP avoids the complications of using semiconductor substrates and IC manufacturing processes, which are not entirely optimized for mm-wave passive components. Antennas manufactured using the SiP technique can employ alternative substrates, such as low temperature cofired ceramic (LTCC), fused silica, liquid crystal polymer (LCP), and Teflon. They can also make use of gain increasing techniques, such as arrays and beam steering, to compensate loss caused by the abrupt signal attenuation at 60 GHz, and avoid fading issues. In order to reduce passive circuit elements even further, circuits based on slow wave concepts have been presented using different techniques and materials to reduce the phase velocity. However, having the antenna fabricated in a different substrate often leads to extra interconnections using vias, which tend to be lossy, bulky, costly and hard to fabricate at mm-waves.

The metallic nanowired membrane substrate (MnM) allows an easy hybrid integration of slow-wave and classical, non-slow-wave, passive circuit elements on the same low-cost substrate. This great advantage associated to a high substrate dielectric constant, motivated this work. I present the design, fabrication process and characterization of a rectangular patch antenna and of a Yagi-Uda antenna.