Analysis of Low-cost Original Holographic Antenna: Theoretical Overview, Notes, Study, Design, and Easy Implementation

From 2009-07-01 to 2012-06-30, closed project

Objective

The proposal aimed to the theoretical investigation, the numerical study and the experimental characterization of holographic antennas (HA) based on microstrip technology. Studies of holograms have been started at optical frequencies to obtain virtual images as a result of interference of two polarized electromagnetic waves. The first applications of holograms at microwave frequency are date back to 70’, but nowadays the topic is at the edge of the interest of the scientific community. There are various research groups studying antennas based on this principle, since holographic surfaces offer new potentialities in this field. HA indicates a group of antennas in which the radiating aperture is formed by a conductive metallic like pattern on a surface-wave carrying grounded (multi)layer dielectric substrate. The hologram is obtained by recording the resulting interference between two polarized electromagnetic waves at the air-substrate interface. Exciting the hologram with only one of these two waves the second one is generated. The hologram is view as variable surface impedance: its synthesis is realized by width modulated microstrip lines. The periodic arrangement of such structures allows the generation of a substrate that supports slow waves, mandatory for the coupling between the surface and space waves. The control of the phase velocity, i.e. the surface impedance, is achieved by adequately vary the width of a microstrip line inside the unit cells. This method has been recently submitted to be patented. Antennas based on this principle present various advantages. The main important one is the polarization purity of the radiated field. The absence of the feeder in the front of the antenna eliminates the blockage; hence a higher gain can be achieved. The proposed low cost microstrip technology is widely employed in aero spatial application as well, because the reduce dimensions of the antennas and the possibility to build conformal configurations.

Related information

Report Summaries

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