28GHz Low-Profile Beam-Steerable Planar Lens Antenna

Jungsuek Oh* [(1)], Seungtae Ko[(2)] , and Wonbin Hong[(2)]
(1) Inha University, Incheon, South Korea
(2) Samsung Electronics, Suwon, South Korea

Millimeter-wave applications have been paid great attention by wireless communication society due to their fundamental capacity of wide bandwidth. Recently, this prompts many efforts on development of novel millimeter-wave hardware technology in industrial domain as well as academic domain. One of the technical challenges in this area is to secure needed link budget by appropriately addressing high attenuation of millimeter-wave signals at such high frequency bands. In order to compensate the channel loss, it is essential to employ high-gain antenna solutions having beam steering capability. One of the well-known high-gain antenna solutions is lens antenna. In this-type antenna a lens structure is positioned in front of a feed array and thus the radiation aperture of feed array is magnified to be as large as lens aperture. Conventional lens antenna employs a curved dielectric lens that suffers from bulky size and high cost. Utilization of planar lens technology instead of the curved dielectric lens can improve the aforementioned drawbacks of this-type antenna. However, this planar configuration still needs to be improved for compact wireless devices. This demands new design techniques to reduce the distance between the antenna and the lens.

This paper presents a 28GHz low profile planar lens antenna having beam steering capability. In the antenna a planar lens structure is designed based on novel synthesis of spatial filter responses to provide short distance (=1λ) between the lens and the feed array. Feed array is designed to support the low profile configuration and beam steering capability. Full-wave simulation results of the whole structure of the lens antenna are shown and the overall performance of the proposed antenna is discussed. In addition, fabrication process used to enable this antenna structure is introduced. Finally, it is shown that measurement results validate the simulated performance and features of the proposed antenna.