Abstracts

Wide-scan spherical-lens antennas for automotive radars

B. Schoenlinner, Xidong Wu, J.P. Ebling, G.V. Eleftheriades and G.M. Rebeiz. "Wide-scan spherical-lens antennas for automotive radars." 2002 Transactions on Microwave Theory and Techniques 50.9 (Sep. 2002 [T-MTT]): 2166-2175.

A new approach to wide scan-angle antennas at millimeter-wave frequencies is introduced with special focus on ease of manufacturing and reliability. The system is composed of planar feed antennas (tapered-slot antennas), which are positioned around a homogeneous spherical Teflon lens. Beam scanning can be achieved by switching between the antenna elements. The spherical-lens system is analyzed through a combined ray-optics/diffraction method. It is found that a maximum efficiency of 50%-55% can be achieved using Teflon, Rexolite, or quartz lenses. The efficiency includes taper, spillover, and reflection loss. Calculations also indicate that the maximum lens diameter is 30-40 /spl lambda//sub 0/, which results in a maximum directivity of 39.5-42 dB. Measurements done on a single-element feed and a 5-cm Teflon lens agree very well with theory and result in a 3-dB beamwidth of 5.5/spl deg/ and better than -20-dB sidelobe levels at 77 GHz. Absolute gain measurements show a system efficiency of 46%-48% (including dielectric loss). A 23- and 33-element antenna array with a scan angle of /spl plusmn/90/spl deg/ and a -3.5- and -6-dB crossover, respectively, in the far-field patterns was also demonstrated. The 23-element array resulted in virtually no gain loss over the entire 90/spl deg/ scan angle. This represents, to our knowledge, the first wide scan-angle antenna at millimeter-wave frequencies.

❑ Return to main document.