

A PLANAR ANTENNA WITH NO-GRATING LOBES AT 60 GHZ

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Millimeter waves have attracted much attention for construction of novel wireless applications such as car radar systems and high bit-rate wireless communications. Indeed, several kinds of millimeter wave front-ends have been developed in many institutes and companies. It is important that the development of antennas compatible with millimeter wave integrated circuits is an indispensable technology for high performance millimeter wave systems. Actually, printed transmission lines such as a microstrip line and a coplanar waveguide were used as antenna feeders. These printed transmission lines have good performance at centimeter frequencies, but they suffer from a considerable conductor loss at millimeter wave frequencies. To solve this problem, a planar antenna fed by a high permittivity LSE-NRD guide radiator was designed at 60 GHz. Grating lobes in a previously-developed planar antenna were suppressed because the planar antenna consists of radiating slots, which were spaced by a period of less than a free space wavelength on a dielectric substrate and were fed by an oversized waveguide with filling of the Teflon material. A pencil beam was observed at the broadside direction, but the direction of the main beam was tilted by 15 degrees compared with that of a theoretical result. It is considered that this issue was caused by change of an effective relative dielectric constant of the oversized waveguide because a Teflon surface and a surface of the dielectric substrate with the radiating slots may be not attached each other due to deflection of the dielectric substrate. With this in mind, we developed a planar antenna fed by an oversized hollow metal waveguide to obtain a pencil beam in the broadside direction. To suppress the grating lobes, the spacing of the slotted arrays was set at 0.95 wavelengths. In this structure, the antenna gain and the antenna efficiency were measured to be 33 dBi and 40 percent, respectively.

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