

Developing the Glass-based Millimeter-wave High-Gain Antenna Aimed At the Use in Automotive Radars and Understanding its Characteristics and Advantages

Jaewon Koh⁽¹⁾, Seongbu Seo⁽¹⁾, Yejune Seo⁽¹⁾, and Sungtek Kahng⁽¹⁾⁽²⁾

(1) Dept. of Info. & Telecomm. Eng., Incheon National University, Incheon 22012, Korea

(2) NS-Satellite RTDC ITRCenter, Incheon 22012, Korea (s-kahng@inu.ac.kr)

Millimeter-wave (mm-W) antennas are required by a radar in order to fulfill the functions of high resolution as well as accuracy. A large bandwidth allotted to a mm-W device can secure rich information on objects ahead. High resolution is obtained by the mm-W array antenna with more elements while its physical size still small due to the short wavelength. Considering the RF signal from the mm-W antenna attenuating fast at an increasing distance, a radiated wave of a high gain must be generated and more care is needed in view of the level of manufacturing and robustness on environmental factors.

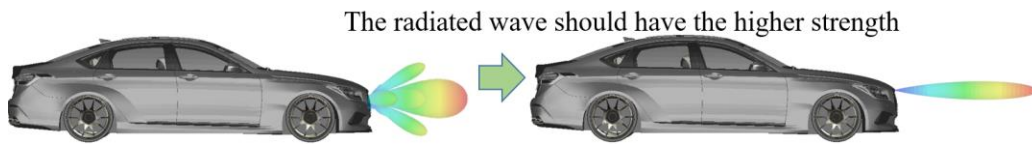


Figure 1. The mm-wave antenna of the car radar must have high directivity.

As is seen in Figure 1, the antenna of the radar is placed in the front near the bumper. The performance of the device is subject to be affected by the heat from the external space. Until this time, developers of antenna systems for the car radar have adopted the structure of PCBs having copper cladded laminated substrates. There are several downsides in the use of the conventional PCB. The RF function at the frequency lower than mmW is not severely affected by errors in the data of the dielectric constants of the substrates, but it behaves poor due to higher sensitivity at the high frequency. Besides, the PCB etching technique is proper for the low frequency, but it is not acceptable by the high frequency because it renders lengths and widths of the radiating elements and tx-lines inaccurate for the mm-W. Therefore, glass is adopted as the substrate going along with sputtering that is known for being accurate at the mm-W.

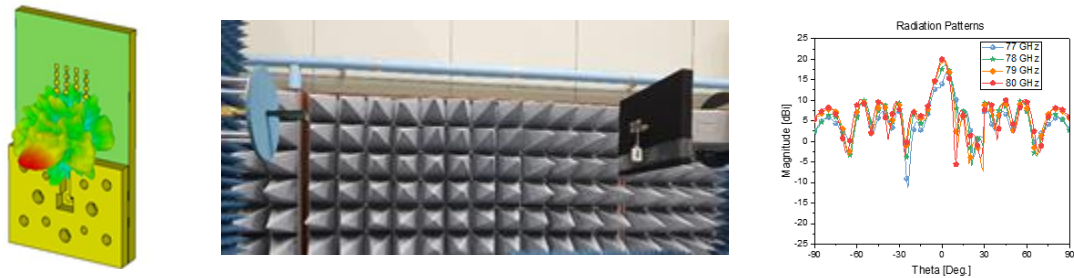


Figure 2. Structure of the mm-wave antenna, and the test setup giving the data of the far-field patterns.

Figure 2 shows a glass-based 4-times-8 series-fed array antenna working for 77 GHz-band and measured results. The high directivity (20 dBi) is observed by the near-field scanner at sample frequencies. Undergoing 80°C in the temperature, the antenna advantageously hasn't changed from the original form.

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