Design of Vehicle On-Glass WiBro Antennas

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Recently, wireless broadband internet (WiBro) commercial service has been launched in Korea, and some studies have been conducted to enable WiBro service in a moving vehicle. To improve the SNR of the WiBro service in a vehicle, an antenna with broad matching bandwidth and omni-directional characteristic should be installed. Generally monopole-type antennas, such as micro and shark fin antennas, can be used for WiBro applications. These antennas, however, suffer from a lack of durability and an undesirable appearance, because they protrude from the vehicles body. To mitigate these problems, on-glass antennas that are directly printed on the vehicle's rear or side windows can be used. But these on-glass antennas usually show performance deterioration in urban environments where multi-path fading predominates channel characteristics [1]. To improve the receiving performance, diversity on-glass antenna systems that incorporate several separated antennas can be used in a vehicle.

In this paper, we propose a diversity on-glass WiBro antenna that is able to maximize channel capacity. First, we optimized an individual bow-tie antenna to achieve a broad matching bandwidth and a high radiation gain. The structure of the optimized antenna consists of a triangular-shaped stripline and an inner patch. Then, to obtain higher diversity performance, feeding positions of the antennas were varied, as shown in Fig. 1. Each antenna can be placed at left or right and upper sides of the rear window.

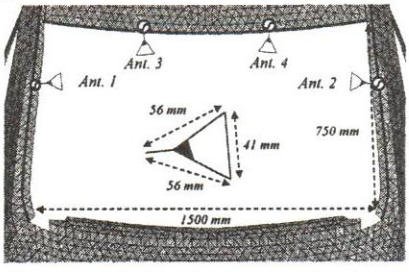

Fig. 1. The antenna structure and the feeding position

Fig. 2 shows the simulated radiation patterns of the four antennas in the azimuth direction at 2.35 GHz. The average gains of all antennas are greater than -2 dBi but the antennas at the side frame (Ant. 1. and Ant. 2) and the antenna at the upper frame (Ant. 3. and Ant. 4) show dissimilar radiation patterns. Ant. 1 and Ant. 2 have a higher gain along the bore-sight direction (θ = 90°, ϕ = 0°) and a gain variation of about 25 dB along the azimuth direction. In contrast, the radiation patterns of Ant. 3 and Ant. 4 are similar to an omni-directional radiation pattern of gain variation less than 10 dB. The correlation coefficients among the four antennas are less than 0.3 and the channel capacity is about 11.0 bps/Hz.

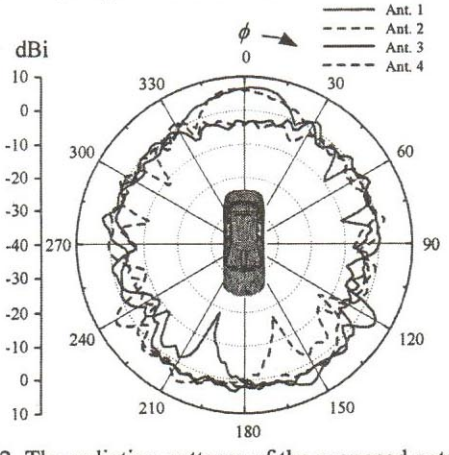

Fig. 2. The radiation patterns of the proposed antenna

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