

# **Design of a Diversity On-Glass Antenna for Receiving FM Radio**

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Recently on-glass antennas printed directly on rear or quarter glasses of a vehicle are widely used for receiving AM/FM radio due to their high durability and low-cost fabrication. The receiving performance of on-glass antennas, however, is relatively inferior to a monopole antenna that protrudes outside the vehicle, since the stripline of the antenna body is printed on the glass with high dielectric loss and the conductivity of the stripline is also limited to be used as heat rays. In addition, the size of the antenna is restricted by a given shape of a vehicle window. Thus they usually show low radiation efficiency with narrow matching bandwidth. To enhance the receiving performance of the on-glass antenna, various methods such as adding an additional amplifier, using antenna arrays or adopting diversity techniques can be used. In particular, diversity systems with multi-antennas have an advantage of better signal reception in an urban environment which usually exhibits multi-path fading channels.

In this paper we propose a diversity on-glass antenna that incorporates two FM antennas. The diversity gain can be increased when the two FM antennas have a low correlation coefficient. To obtain the minimum correlation coefficient, in general, the radiation characteristics of each antenna such as the radiation pattern and polarization should be different. In addition the mutual coupling is also considered, since the spacing between the two antennas in a vehicle window is much smaller than the wavelength. The optimum design structure of the diversity on-glass antennas that exhibits the minimum correlation coefficient are explored by using a Pareto genetic algorithm in conjunction with a full wave EM simulator. The optimized antenna is then built on a commercial vehicle and its performances such as radiation patterns and gains of the individual antennas are measured in a semi-anechoic chamber. Finally, the FM reception performance of the proposed antenna with a diversity tuner is tested in various environments and the test result will be presented.