Validation of predicted 3D field distributions due to vehicle-mounted antennas against measured 2D field mapping
Alastair Ruddle, MIRA Limited, UK

Abstract

Predicted 3D electric field distributions from TLM models of two different vehicle-mounted antenna installations are compared with 2D measurements obtained for similar systems over four horizontal planes that were 9 m long, 6 m wide and 0.5 m apart. The antennas used were simple monopoles located on the rear wing and at the rear of the roof of a passenger car, and the TLM models were derived from vehicle CAD data. In the measurements it was not possible to map the fields over the vehicle interior, so the three measurement planes that were below roof height excluded a region some 5 m long and 2 m wide, which contained the vehicle. Simulation and measurement data was compared at 32,500 points in these three planes for each antenna installation. For the fourth measurement plane, which was above the vehicle roof, data was compared at 40,000 points for each antenna installation.

Sample qualitative (visual) comparisons provide some insight into the sources of some of the differences between the predicted and measured field distributions, such as spurious reflections from the test environment and differences between the antenna locations in the models and the measurements. Quantitative measures, based on analysis of amplitude difference populations, show that these differences are within the measurement uncertainty for more than 83% of the points for the roof-mounted antenna, and for more than 70% for the wing-mounted case. These results are considered to be in excellent agreement, given the various disparities between the models and the measurements.