Determining the mounting position of automotive radar sensors

Automotive radar sensors are usually integrated invisibly behind vehicle bumpers or brand emblems (radomes). For the sensors to operate as expected, they must be installed in the intended location precisely behind the area of the bumper or radome that is transparent to radar signals. The R&S®QAR quality automotive radome tester allows pushbutton checking of sensors behind already installed bumpers or radomes for radiation in the right direction and a free view of the surrounding area. Use the R&S®QAR to optimize your production process and verify the mounting position of radar sensors quickly and reliably.

Your requirement
Radar sensors are used in vehicles for adaptive cruise control and for blind-spot, lane-change and cross-traffic assistants. Radar sensors for acquisition of the surroundings are key components for future vehicles with semi-autonomous and fully autonomous driving. Autonomous driving requires radars that reliably detect objects in the surrounding area. It is therefore important to verify in production that radar sensors are installed in the right positions with the right orientations. Even a small angular misalignment due to incorrect mounting can degrade the performance of the radar. For faultless radar operation, the bumper has an area optimized for the radar beam. The radar signal is only transmitted with minimal attenuation in this area. Any misalignment here can have fatal consequences for later operation – obstacles on the road are detected too late or in the wrong place. To avoid this, the radar sensor must be positioned in exactly the right place relative to the bumper or the radome. That way, the radar sensor has a free view of the surrounding area (Fig. 2). For this reason, there is a growing demand among vehicle manufacturers for a new measurement procedure that allows the orientation and position of hidden radar sensors to be determined.

To meet this requirement, the measurement procedure must be able to see through the already installed bumper or radome.

Fig. 1: Determining radar sensor mounting position with the R&S QAR

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Test and measurement solution from Rohde & Schwarz

The R&S®QAR is a millimeterwave imaging system for the E-band automotive frequency range. Its ability to take reflection measurements with spatial resolution makes it an extremely intuitive and high-performance method for assessing the mounting position of radar sensors. For this purpose, the R&S®QAR has a large panel with many transmit and receive antennas for measuring automotive radars in the frequency range from 76 GHz to 81 GHz. The position of the radar and the bumper can be determined with the visualization capability of the R&S®QAR.

Application

The vehicle with the bumper already mounted is positioned in front of the R&S®QAR panel (Fig. 1). The information acquired from the distributed transmit and receive antennas is coherently linked to form the spatially resolved reflection. The resulting millimeterwave image enables a 3D representation of the vehicle front. Since the R&S®QAR operates in the same frequency range as the radar, the area of the bumper or radome intended for the radar appears relatively transparent, giving a good view of the rear-mounted radar sensor. The subsequently applied algorithm analyzes the generated point cloud and compares it with the vehicle’s CAD data. This allows the exact positions of the radome or bumper and the radar sensor to be determined in 3D (Fig. 3). If the CAD data contains the antenna lobe of the radar sensor, the irradiated area in the radome can be calculated. A pass/fail analysis can be made quickly.

Rohde & Schwarz service concept for minimum downtime

<table>
<thead>
<tr>
<th>Basic</th>
<th>Standard</th>
<th>Advanced</th>
<th>Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated downtime:</td>
<td>3 working days</td>
<td>about 4 hours</td>
<td>about 4 hours</td>
</tr>
<tr>
<td>Repair within 10 working days</td>
<td>Replacement panel shipped within 3 days</td>
<td>Replacement panel on site</td>
<td>Replacement panel on site</td>
</tr>
<tr>
<td></td>
<td>Replacement panel repaired within 10 working days</td>
<td></td>
<td>Replacement panel shipped within 3 days to avoid a single point of failure</td>
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To minimize downtime in the event of a defect, four different service levels are offered for the R&S®QAR to meet various customer requirements. For more details, please contact your regional Rohde & Schwarz sales representative.