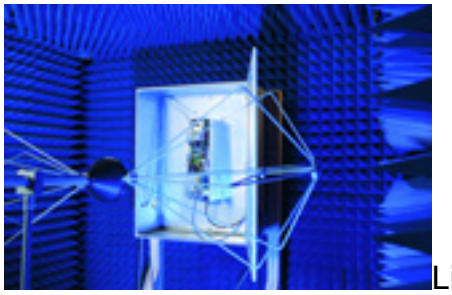
Listening to the Radio Even with an Electric Drive

To enable radio reception in electric vehicles, manufacturers must install filters and insulate cables, since electrical signals will otherwise interfere with music and speech transmissions. Now, using new calculation methods, researchers are paving the way for pure listening pleasure while also helping to lower the associated costs.



Listening to the radio is a favorite German pastime. Every day, more than 60 million people turn their radios on, especially while driving, and studies show that one in two of them are unwilling to give up enjoying radio programs behind the wheel. But in the vehicle of the future, the electric car, listening to the radio is in principle not possible, since electrical interference impedes the reception of radio waves. These disruptions are caused by the frequency converter, which changes electrical energy into mechanical energy so as to control the electric motor's speed and direction of rotation. These converters turn the current and the voltage on and off rapidly and frequently, and the way they chop electrical energy up in fractions of a second produces electromagnetic interference. If this becomes too loud, you can only hear the electric drive, not the car radio.

To get around this problem, not only must the engine's cabling be shielded, the motor itself must also be insulated – but this comes with a high price tag for automakers. Fortunately, researchers at the Fraunhofer Institute for Reliability and Microintegration IZM in Berlin have worked out how to significantly reduce these costs. Dr. Eckart Hoene, director of the Power Electronic Systems research group, and his team have developed a whole series of tools and methods for reducing interference. Using new simulations and calculation methods, the engineers can for instance now determine where in the vehicle components should be positioned to keep their electromagnetic interactions to a minimum.

Interference is affected by parts' position

"The size and position of individual components – including the electric motor, the battery, the air-conditioning compressor, the charging system, the DC/DC converter and the frequency converter itself – play a crucial role. How and in what direction cables are installed is just as important, as is the thickness of their insulation," explains Hoene. "With the help of simulations, we can also advise on the quality of

the insulation and the plug connectors." The scientists have measurement techniques that allow them to pinpoint where exactly in the vehicle interference is coming from and to see how it spreads. What's more, they have developed a symmetrical power module which stops interference from being emitted. This is a component of the converter and already exists as a prototype.

All German automakers have benefited from the Fraunhofer experts' know-how. But as Hoene points out: "We advise not only German automotive manufacturers and suppliers, but increasingly Japanese and American companies, too." Tests and fault analyses can be carried out in the institute's own laboratory.

Electromagnetic interference is not just a problem in electric and hybrid drives. It can be a problem anywhere power electronics are installed: in avionics, or in wind and solar energy facilities, too. "Roofs with photovoltaic arrays will have a solar converter to change the direct current into alternating current, and this can impair radio reception inside of houses," Hoene adds. Thankfully, he and his colleagues can also provide expertise and advice in these situations to help keep interference to acceptable levels.

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