

### **Latest activities**

Definition and characterization of the EMC environment due both to vehicles external sources and to on-board equipment. In the framework of this activity the results summarised hereafter came out.

### **Latest results**

The electromagnetic environment where present and future vehicles shall operate has been by taking into account several studies performed by some research organizations. The conclusion is that it does not seem that external electromagnetic environment may represent a threat to automotive equipment and systems. Vice versa mobile transmitters may actually be the source of many troubles especially at frequencies lower than 1 GHz. Transmitters permanently installed in vehicles should be sited in such a manner to minimize the levels of radiated fields in those areas where susceptible equipment are installed taking into account the various vehicle configurations such as the number of passengers, internal layout of new equipment and devices. In the same paragraph we have examined the relationship between equipment and vehicle system immunity test results.

EMC tests at system level are performed only in radiated mode. Because of the presence of the car body structure its resonances may have a large impact on susceptibility test results. The survey of EMC tests performed on FIAT vehicles during 2003 has been conducted. This survey demonstrates that vehicle resonances are the main causes of immunity deficiencies. Also in the literature recently published this issue is pointed out. By examining the test results it comes out that most susceptibilities are determined by the size of the vehicle metal structure, which enhances the amplitude of the internal electromagnetic field limiting its frequency range. With the help of Logistic Regression we have shown that in addition to frequency and field strength level, which are obvious, the vehicle size and in particular its width plays an important role in the susceptibility model.

An investigation, similar to the one performed on vehicles, has been conducted on automotive equipment by surveying the test results during 2003 at FIAT EMC test laboratory. As far as radiated susceptibility tests are concerned one can see that equipment are susceptible in a frequency range larger than the system one. It is interesting to notice that a piece of equipment that in isolation is susceptible in a large frequency range, when installed on a vehicle, becomes susceptible in a smaller frequency range. Moreover by comparing the susceptibility thresholds of radiated immunity tests at equipment level and at system level one can notice that the thresholds of vehicle tests are lower than the ones of equipment tests: this may be due to the enhancing effect of the vehicle resonances.

A wide survey of existing EMC specifications has been conducted trying to understand how the degradation criteria of immunity measurements are defined. Apart some small differences all definitions are based upon qualitative assessments of the equipment or vehicle malfunctions. New specifications such as Directive 2004/104/EC improve the malfunction definition placing more emphasis on the quantitative issue even if the qualitative assessment maintains the dominant role.

In view of this scenario some proposals of quantitative evaluation of immunity test results have been proposed. Even if the principle, which they are based upon, is very simple because it compares the DUT performance in the presence and in the absence of susceptibility signals we have dedicated a special effort to this issue with the aim of finding out a sound theoretical justification.

### **Next activities**

The next and near activities on the Project are relevant to the following topics:

- definition of design rules to increase the immunity of equipment to the EMC environment
- definition of design criteria the car manufacturers should adopt in order to reduce EMC threats due to the on-board EMC environment, e.g. antennas positioning, wiring criteria, cables layout and shielding, bonding and grounding with evaluation and test by simulation of the proposed solutions
- input to enhanced the existing standards for the automotive and equipment design