

Chapter XLII

Bluetooth Devices Effect on Radiated EMS of Vehicle Wiring

Miguel A. Ruiz

University of Alcala, Spain

Felipe Espinosa

University of Alcala, Spain

David Sanguino

University of Alcala, Spain

AbdelBaset M.H. Awawdeh

University of Alcala, Spain

ABSTRACT

The electromagnetic energy source used by wireless communication devices in a vehicle can cause electromagnetic compatibility problems with the electrical and electronic equipment on board. This work is focused on the radiated susceptibility (electromagnetic susceptibility [EMS]) issue and proposes a method for quantifying the electromagnetic influence of wireless radio frequency (RF) transmitters on board vehicles. The key to the analysis is the evaluation of the relation between the electrical field emitted by a typical Bluetooth device operating close to the automobile's electrical and electronic systems and the field level specified by the electromagnetic compatibility (EMC) directive 2004/104/EC for radiated susceptibility tests. The chapter includes the model of a closed circuit structure emulating an automobile electric wire system and the simulation of its behaviour under electromagnetic fields' action. According to this a physical structure is designed and implemented, which is used for laboratory tests. Finally, simulated and experimental results are compared and the conclusions obtained are discussed.

INTRODUCTION AND BACKGROUND

In the current vehicle coexist electronic and communications systems whose advantages are clear for the user but whose possible problems are not

contrasted. The increasing use of radio frequency transmitters by automobile users makes it necessary to evaluate the risk caused by the coexistence of information and communication technologies in the reduced space inside the vehicle. In this

context, the present work appears in order to bring up methods and results that contribute to establishing the possible risks limit of the use of wireless devices inside the automobile, and more precisely those based on Bluetooth technology.

To centre the problem, it is mentioned the tendencies in the automobile field that bet for the incorporation of new electrical and electronic systems (X-by-Wire technology) (Leen & Hefferman, 2002; Mazo, Espinosa, Awawdeh, & Gardel, 2005) front of the current mechanical systems, aspects of automotive electromagnetic compatibility (EMC) standard 2004/104/EC (2004) for evaluation of susceptibility/immunity in vehicles are detailed, it is justified the interest to focus the study on the extended Bluetooth wireless communication technology. However there are nonregulated questions by the 2004/104/EC concerning the use of Bluetooth devices what rise uncertainties around the risk derived from its use.

To get a better knowledge of this issue, we lay a few questions regarding the increase of the electronic equipment role in the automobile, the characteristics of commercial Bluetooth devices, some notes about the EMC European Directive involved in vehicles, and last but not least, some of the directive gaps concerning Bluetooth wireless devices in this context.

The Increase in Electrical and Electronic Components in Automobiles

It is clear that nowadays on board electronic components play an important role on vehicles (Bannatyne, 2000; Leen & Hefferman, 2002; Mazo et al., 2005), as much for the increase in the number of electronically controlled units (ECUs) as for the complexity of the communication system (field buses) implemented.

Continuous development in the industrial automobile sector means that dynamic systems that have traditionally been of a mechanical and hydraulic nature, such as the steering, braking, and acceleration are being replaced by electronic ones, which leads to the proposal of networks such as X-by-Wire with its own protocol (Mazo et al., 2005).

Taking advantage of the trend towards the use of DC voltage supplies of 36-42 volts instead of the 12-14 volts currently used, an increase in electronics is being adopted to control key elements of the automobile such as the steering, braking, and acceleration. For example, the car uses a range of electric actuators and also has an innovative driver interface. The driver has all the vehicle functionality in a special steering wheel, which is used for acceleration and braking as well as for steering and gear shifting. The vehicle uses a conventional engine for propulsion but electromechanical actuators for braking, clutching, and gear shifting (Larses, 2003).

With the progress of X-by-Wire technology, in-vehicle data traffic is always growing. Conventionally, individual wire harnesses were used for data transfers between control units and their associated sensors or display devices. As the number of control units and associated devices increase, the number of wire harnesses and interconnections required is swelling. The in-vehicle local-area network (controller area network [CAN], local interconnect network [LIN], and FlexRay) provides an answer to this problem: it minimises the use of individual wire harnesses for data exchanges and reduces both interconnections and vehicle weight, trying to improve consumption, power, security, and comfort.

However, associated with these electronic and communication innovations new sources of potential equipment failure appear, leading to the necessity to continue working on both diagnosis and prognosis in the automotive sector.

Bluetooth Devices and Applications in Automobiles

The presence of radio frequency transmitters in automobiles as a way for multiple wireless communication appliances continue to grow. Apart from the well known uses for the assistance and entertainment (GPS, laptops, PDAs, digital cameras, portable multimedia devices CD/DVD, etc.), others such as remote diagnosis, traffic control, accident assistance, and so forth are being promoted (Campos, Mills, & Graves, 2002; Mazo et al. 2005).

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