Automated analysis of the effects induced by radio-frequency pulses on embedded systems for EMC Functional Safety

C. Kasmi [(1)] and J. Lopes-Esteves [(1)]
(1) French Network and Information Security Agency-ANSSI, Wireless Security Lab., 75007 Paris, France, www.ssi.gouv.fr

Many studies were devoted to the test (M. G. Bäckström and K. G. Lövstrand, *IEEE Transaction on EMC*, 46, 3, 2004, pp. 396-403) and the analysis (Y. V. Parfenov, W. A. Radasky, B. A. Titov et al., *In Proc. of the URSI General Assembly*, China, 2014) of effects induced by intentional electromagnetics interferences on electronic systems. One of the main limitations encountered during the testing of devices remains the detection of short or temporary failures as it generally requires a manual analysis of the system.

Recently, it has been proposed to rely on the operating system logs (C. Kasmi, J. Lopes-Esteves, M. Renard et al., *IEEE Transaction on EMC*, *early access*, 2014, pp. 1-4) in order to monitor in real time the health status of IT systems. The key limitation of the proposed approach is directly related to the possibility to extract software logs from the device and to push modified software in order to gain a real-time access to hardware failures. Due to security features, this kind of methods can be hard to apply to closed systems where the access to users is highly reduced.

However, functional safety requirements of electromagnetic compatibility (Institution of Engineering and Technology - IET, Overview of techniques and measures related to EMC and Functional Safety, online, 2013) aim at defining software and hardware agents which detect and record failures due to electromagnetic parasitic coupling. We applied the last methodologies to analyze the susceptibility of sensitive sensors and hardware components, such as the gyroscope, the magnetometer and the altimeter, from a set of embedded systems.

During the presentation, it will be shown how this set of sensors can be derived into a set of physical observables and instrumented to monitor their susceptibility to RF pulses. Moreover, smart RF pulses have been tested in order to analyse the possibility of controlling the data gathered by a specific targeted sensor to achieve the highest level of effects criticality (F. Sabath, *International Symposium on Electromagnetic Compatibility*, 2008, pp. 1-5) where the system fails to accomplish its main mission.