Jamming Signal Immunity Tests on GSM-R Communications Compared to EMC Basic Standards

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Abstractð **This paper presents the work being done in SECRET project (European Program FP7/2007-2013 under grant agreement number ñ285136ò) to strengthen the European rail network against the potential jamming of the railway communications. Standardized immunity tests, currently conducted on communication equipment in the presence of electromagnetic (EM) interferences are presented. It then presents the tests carried out in SECRET to assess the resistance of railway communication systems face the signals generated by telecommunication jammers.**

Keywords-component; railway; electromagnetic attack; GSM-R; immunity

I. INTRODUCTION

The evolution of railways with higher speed and capacity, ERTMS and centralized management, automatic actions, sensors and antennas, GSM-R communications makes the railway network more and more vulnerable and an attractive target for EM attacks. A European consortium was then built in order to assess the real risks concerning EM attacks, identify areas for strengthening the railway network and develop detection solution and to design a resilient architecture.

II. INTERFERING SIGNALS

After an analysis of the different EM attack devices, 14 attack devices has been selected and classified according to their power level, the waveform and the bandwidth of the interfering signal. Most of these devices are designed to disturb radio communication systems as GSM, TETRA, Wi-Fi,... From this extensive study the signals can be classified as modulated or unmodulated continuous waves, carrierless signals, pulsesé or can be formed by combination of those basic signals. However, the most accessible jammers emit signals that sweep the frequency band of the system to jam. The jamming signal successively covers each channel and come back in the channel with a fixed time interval.

III. IMMUNITY STANDARDS AND TESTS

A. *Immunity standards*

Current immunity standards (Railway, ETSI EMC and immunity basic standards) and the associated waveshapes have been studied in order to check that the selected EM attack signals are already included or not. However, basic immunity standards are based on useful signals and their spurious as the EM attacks are intentional signals. As our main concern is the communication, the applicable product standards are ETSI standards series EN 301 489-x for radio equipments and services (e.g. EN 301 489-7 for GSM and DSC mobile equipments) [1]. These product standards are referring to basic immunity standards EN 61000-4-x series. The most significant is EN 61000-4-3 concerning radio frequency fields between 80 MHz and 1 GHz, and 1.4 GHz and 2.7 GHz AM modulated 1 kHz80%, considering exclusion bands around the transceiver nominal frequency. These standards do not reproduce the specific time characteristics of the jamming signal.

B. *Immunity tests on GSM-R to jamming waveshapes*

The test set-up proposed to study the impact of jamming signals on railway communications is described in Fig. 1 [2]. Our study concentrates on the following characteristics of the signals: (1) frequency in or out of band, (2) number of periods, (3) interval without signal to emulate the sweeping. Two typical waveshapes are illustrated in Fig. 2.

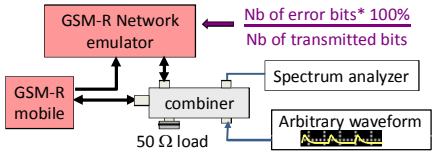

Figure 1. Immunity test set-up.

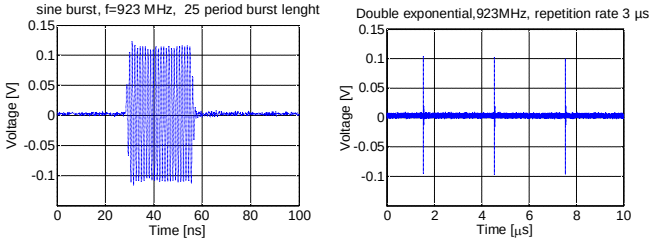

Figure 2. Immunity waveshapes – Sine Burst vs. Double exponential burst.

IV. CONCLUSIONS

The results will be presented during Amerem 2014 in order to highlight the main impacting parameters on the railway communications.

REFERENCES

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