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Electromagnetic Environmental Survey for the Railway Telecommunication Subsystem

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Abstract. This paper describes the intra-subsystem electromagnetic compatibility analysis. Its purpose is to assess the compatibility inside the railway telecommunication subsystem and to provide input data for other subsystems electromagnetic compatibility analysis (intra-system analysis). This survey includes the definition of radio characteristics of each intentional emitter and the assessment of its radiated power and electromagnetic fields in any direction. This paper also includes the electromagnetic emission characteristics for all non-intentional radiators resulting from measurements, calculations or standard compliance.

Keywords: electromagnetic compatibility, electromagnetic environment, electric field, railway system.

1 Introduction

Today, the high spread telecommunication subsystem for the railway system is commonly used for intra-communications, automations, and other purposes. And this makes it necessary for diverse circuits to operate in close proximity. All too often these circuits affect each other adversely. The electromagnetic interference has become a serious problem for circuit designers, and it is becoming more severe in these days [1,2]. With this motivation, this study starts by the electromagnetic compatibility between intentional radiators, then the electromagnetic compatibility between intentional radiators and non-intentional radiators (all the other electronic subsystem and electromechanical equipment), and it ends with the electromagnetic compatibility between non-intentional radiators.

This paper is organized as follows. First, the railway telecommunication subsystem is described in detail from the electromagnetic compatibility point of view. Then the physical implementation with dimensioned drawings is produced. The analysis is carried out considering each main equipment or system as a source of emissions and the other ones as victims. The analysis will be summarized in a cross table which will show that all electromagnetic interactions are taken into account. With verifying all the possible victims, railway system designers can be sure whether the railway

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telecommunication subsystem has effects on its external electromagnetic environments.

2 Railway Telecommunication Subsystem

Investigations of nearby equipment and facilities along the railway system were conducted by the line diagrams provided by the railway company in which all the potential victims and high power equipment (such as power lines) are located. It was done both by visual inspection during site survey and by consulting utilities maps as shown in Figure 1.

The fact that there is some areas with a parallelism between the power lines and the railway intra-communication lines can be highlighted as a good point of unwanted couplings between both lines. This can be verified by both site survey data and route data supplied by the electric power corporation.

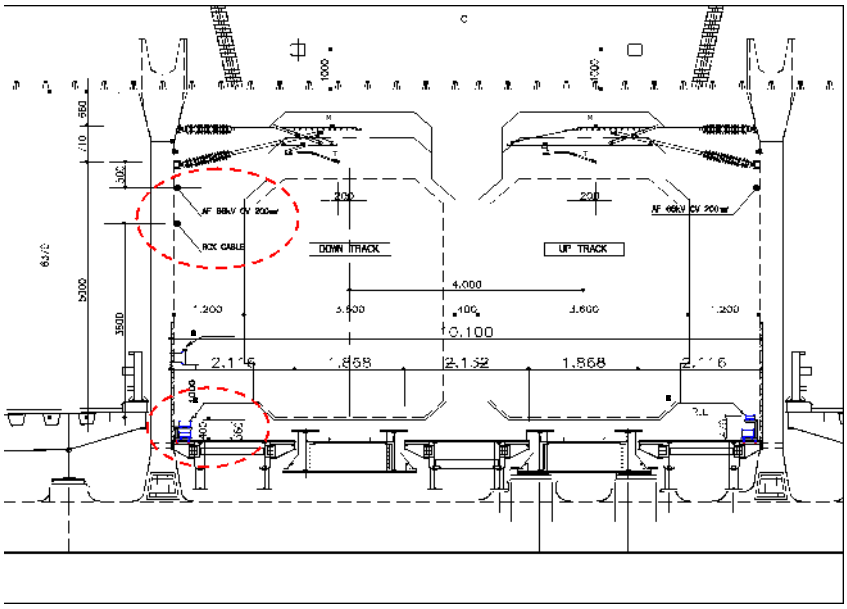

Fig. 1. Scheme of the railway intra-communication subsystem

3 Electromagnetic Environmental Survey

3.1 Assessment of the coupling between railway power lines and telecommunication lines

The frequency components of induced voltage due to power current fundamental and its harmonics is far apart compared to the operating frequency of digital communication subsystems and telecommunication lines, therefore it can be assessed that there is no risk of frequency interference [3-10].

3.2 Assessment of the coupling between railway intra-communication lines and telecommunication lines

As all railway intra-communication cables are shielded and the frequency component of them is far from telecommunication line, in particular concerning the analogue telephone lines, there will be no significant coupling [3-10].

4 Conclusion

As the survey result, all the railway intra-communication cables are shielded line (or installed in a metal cable tray) and all the telecommunication lines are buried. This is just to show how the railway intra-communication cables are installed and one can judge that there may be very little chance of frequency interference between those cables and telecommunication lines.
The radiated electromagnetic emission levels from the railway system model is so considerably low that its induced noise level on the electric power line and telecommunication systems would be negligible.

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References

1. Lee, S. J., Shin, D. H., Kim, Y. H. Lee, J. J., Eom, K. H.: Analysis and Modeling of Noise on 22.9-kV Underground Power Distribution Cable for Broadband Power Line Communication. International Journal of Control and Automation, SERSC, vol. 3, no. 3, pp.1-12 (2010)
2. Hyun, W., Huh, M. Y., Kim, S. H., Kang, S. G.: Considerations on Audience Measurement Procedures for Digital Signage Service. International Journal of Control and Automation, SERSC, vol. 5, no. 2, pp.123-130 (2012)

3. EN50121-1: Railway Applications – Electromagnetic Compatibility, CENELEC, Belgium, (2000)
4. EN50121-2: Railway Applications – Electromagnetic Compatibility (Emission of the Whole Railway System to the Outside World), CENELEC, Belgium (2000)
5. EN50121-3-1: Railway applications. Electromagnetic Compatibility. Rolling Stock. Train and Complete Vehicle, CENELEC, Belgium (2000)
6. EN50121-5: Emission and Immunity of Fixed Power Supply Installations and Apparatus, CENELEC, Belgium (2000)
7. EN55013: Limits and Methods of Measurement of Radio Disturbance Characteristics of Broadcast Receivers and Associated Equipment, CENELEC, Belgium (2000)
8. EN55022: Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement, CENELEC, Belgium (2000)
9. CISPR 16-1: Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods, IEC, Switzerland (2003)
10. ITU. CCIR Report: World Distribution and Characteristics of Atmospheric Radio Noise, ITU, France (1964)