LTE for Railways: Impact on Performance of ETCS Railway Signaling

The Global System for Mobile Communications-Railways (GSM-R) is an obsolete mobile technology with considerable shortcomings in terms of capacity and data transmission capabilities. Because of these shortcomings, GSM-R is becoming the element limiting the number of running trains in areas with high train concentration, such as major train stations. Moreover, GSM-R cannot support advanced data services. Hence, modern technologies, such as long-term evolution (LTE), have to be evaluated as possible railway communication technologies to replace GSM-R in the future. This article analyzes the characteristics of the LTE railway radio access network in terms of eNodeB (LTE base station) density and eNodeB transmission power. Based on this analysis, a set of computer-based simulation scenarios (e.g., OPNET) with varying numbers of eNodeBs is evaluated regarding the achieved transfer delay and data integrity of European Train Control System (ETCS) messages.