A comprehensive model base of the high-speed railway radio channels for a GSM-Railway based control system

Author(s) - Institution(s):
Ruisi He, BJTU
Zhangdui Zhong, BJTU
Bo Ai, BJTU

Corresponding author email: ruisi.he@ieee.org

Corresponding WG group: TWGV , WG1

Abstract:

High-speed railways (HSR) have been widely introduced to meet the increasing demand for passenger rail travel. In the design of the communication-based control system for the HSR, a deep understanding of the propagation channel is required. Compared with the conventional cellular communications, there are two important features of the HSR communications: i) the presence of many HSR-specific environments, e.g., viaduct, cutting, station, etc., ii) and the deployment of the directional base station (BS) antennas. The HSR channels are thus different from the conventional cellular channels. A comprehensive model base of HSR, covering the impacts of the above features on radi o channels, is highly required for the HSR network design.
In this report, we present a comprehensive narrowband model base of HSR at 930 MHz for the GSM-Railway (GSM-R) based control system. We conducted a large body of measurements in China, with over 6000 HSR cell realizations, using a practically deployed and operative GSM-R system. The measurements cover 7 typical HSR environments and the realistic BS parameters of GSM-R. The model base includes some most important parameters for a narrowband system, e.g., the path loss model, standard deviation of shadowing, autocorrelation and the neighboring BSs cross-correlation models of shadowing, small-scale fading distribution and Ricean K-factor model, etc. The results are helpful for the HSR system designers to gain a better tool in the system planning, and propagation researchers to assess where the most pressing needs in the modeling of HSR channels lie.