Satellites, Boats, and Planes, Trains, and Automobiles: Wireless Mobile Channel Characteristics Across the Vehicle-Scape

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Abstract

Mobile communications among vehicular terminals has over a century of history, and has involved every kind of vehicle used by humans, from automobiles to trains to boats to aircraft and eventually spacecraft and satellites. From a wireless communications perspective, mobility complicates system design and operation, and since different vehicles usually imply different physical settings, different types of vehicular channels exist, with often significantly different characteristics. Since reliable communications requires an accurate knowledge of the mobile propagation channel, a vast amount of research, engineering time, and capital and financial resources has gone into the topic of mobile channel characterization. In this talk, we first review a brief history of mobile communications and applications. We follow this with an outline of what is required of any channel characterization, both qualitatively and quantitatively, for communications applications. From there we delve into vehicular channel characterization for multiple types of mobile channels. This includes a description of the now-classic cellular channel, maritime channels, and the air-to-ground and satellite (to ground) channels. We compare and contrast these different channels, and also describe some recent research on channels of current interest, including vehicle-to-vehicle, railway, satellite MIMO, and aeronautical channels for unmanned aircraft systems.