SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Mobile Satellite Communications and Navigation Technology (5)

Author: Dr. Franz Teschl
Joanneum Research, Austria

Mr. Veikko Hovinen
Centre for Wireless Communications, University of Oulu, Finland
Prof. Fernando Pérez Fontán
University of Vigo, Spain
Dr. Michael Schönhuber
Joanneum Research, Austria
Mr. Roberto Prieto-Cerdeira
ESA, The Netherlands

LAND MOBILE SATELLITE CHANNEL EFFECTS OF INDIVIDUAL SCATTERERS AND REFLECTORS IN VARIOUS ENVIRONMENTS AT 11.7 AND 17.6 GHZ

Abstract

In 2009 and 2011 two measurement campaigns studying the land mobile satellite channel have been carried out by Joanneum Research under contract of ESA/ESTEC. In both campaigns the same routes have been investigated all located in Greater Linz, Austria. The routes have been chosen to represent various scenarios: rural, urban, suburban, and railroad with overhead power lines (measured below a trolley bus route). The investigated frequencies were 17.6 GHz in 2009 and 11.7 GHz in 2011. The 11.7 GHz measurements used a satellite beacon while the 17.6 GHz measurements were carried out with an aircraft as transmitter platform flying at three different elevation angles (20, 40, and 60 deg). In addition to the narrowband continuous wave (CW) measurements wideband data from a PropSound channel sounding device in SISO configuration are available at 17.6 GHz.

Previously, second order statistics such as the level crossing rate and the average fade duration as well as wideband parameters as delay spread and excess delay have been presented separately for the individual scenarios. However, the question remains how significant the measured statistics are and whether or not the results are transferable to other locations.

In order to make the results transferable, this study aims to describe the effect of individual obstacles that were found along the different routes: detached houses, individual trees, and woodland in the rural scenario; house fronts, metal facades, lampposts, and billboards in the urban and suburban scenarios, and overhead power lines in the railroad scenario. For this purpose the effects of the individual scatterers and reflectors was extracted by using additional position and video data: the GPS position of the van is available for each second and a video from an up-looking camera with fish-eye lens (24 frames/sec) shows not only individual obstacles in the propagation path but also the surrounding that is potentially responsible for reflection. In both campaigns the received CW power was recorded at 500 samples per second. For a driving velocity of 5 m/s, this leads to a rate of one sample per cm driving distance. With this resolution it was possible to compare the fading effects of various scatterers and to define the distance or the time where the echoes from various reflectors disappear. A future perspective is to use these results in a variety of artificial environments where the individual scatterers and reflectors can be modelled realistically.