

Time-space Modeling of MWS Systems Working in Millimeter Wavebands

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ANNOTATION

The very tight competition in the telecommunication market leads network operators and service providers to seek new effective and efficient ways of data transmitting and system deployment. The moving into new, previously unused high frequencies (tens of GHz), promises higher frequency bands to be allocated to each service and consequently higher bit rates offered to customers. Fixed wireless access (FWA) systems and especially Local Multipoint Distribution Systems (LMDS) or Multimedia Wireless Systems (MWS) are nowadays emerging as a technology that features several techno-economics advantages over wired and mobile solutions.

The deployment of newly emerging communication systems working in the millimeter-waves frequency bands is a challenge for designers also from electromagnetic waves propagation point of view. This poster deals with main phenomena that affect signal propagation for Local Multipoint Distribution Systems at frequencies above 30 GHz. A new propagation simulation tool for LMDS is presented. Some of the simulation results are depicted as well.

Propagation in mm bands

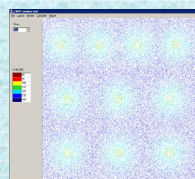
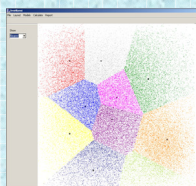
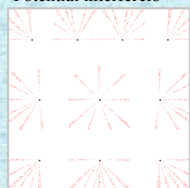
- Due to higher losses on obstructions in mm waves the propagation in line of sight (LOS) are required between subscriber terminals and base stations in LMDS systems.
- The attenuation due to rain is the main factor limiting the range of high-reliability microwave links above 30 GHz. Precipitation very often causes almost 40 dB fades in receiving signals and is source of additional interferences.
- Water vapor resonance occurs at 1.3 cm (23 GHz), thus the signal absorption due to gases or due to dielectric state of the atmosphere should be considered as well.
- Almost 20 % of possible subscribers are obstructed by vegetation. For the links the movement of leaves due to blowing wind causes signal fluctuation. Therefore attenuation through trees as well as dynamic vegetation effects must be considered.

The signal propagation simulation tool

➤ Coverage of investigated area by selected number of hubs

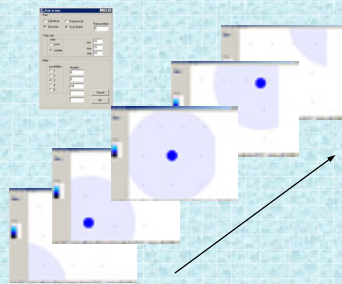
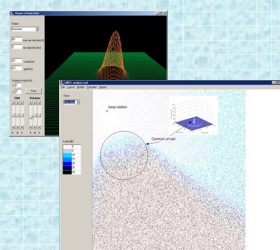
➤ Received signal level

➤ Potential interferers



➤ Availability of service in area influenced by time variable rainfall

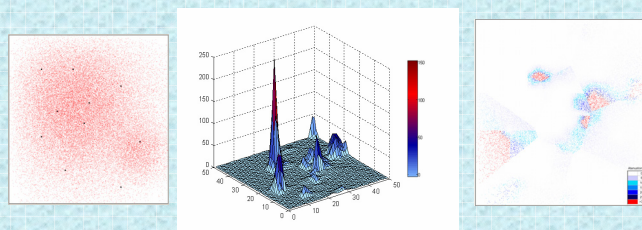
➤ Attenuation through rain



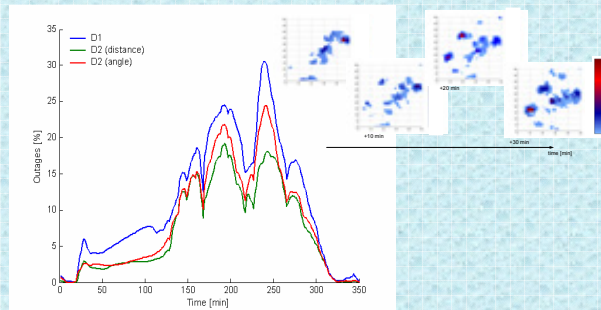
- Diversity improvements
- Carrier to interference C/I
- Attenuation statistics of path-angle diversity

Examples of simulation results

- Example of simulation results: left - rain rate [mm/h] distribution in 50 x 50 km area for a specific time; right - corresponding rain attenuation as seen on terminal stations [dB]



- Example of simulation results: time dependence of system outages during the rain storm moving across the service area; D1 - no site diversity for terminals. D2 (distance) - a site diversity used; a terminal can be connected to two nearest hubs. D3 (angle) - site diversity used; the hubs are selected according to maximum angle separation in azimuth



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