Indoor Channels Around a Human Subject at 2.4 GHz and 60 GHz

Luca Petrillo, Theodoros Mavridis, Julien Sarrazin, Aziz Benlarbi-Delai, Philippe de Doncker

Indoor Channels Around a Human Subject at 2.4 GHz and 60 GHz

Luca Petrillo*[1], Theodoros Mavridis[1], Julien Sarrazin[2], Aziz Benlarbi-Delaï[2], and Philippe De Doncker[1]

[1] OPERA Dpt., ULB, Brussels, BE
[2] Sorbonne Universités, UPMC Univ Paris 6, UR2, L2E, Paris, FR

The increasing interest for the millimeter wave spectrum (30 GHz to 300 GHz) is due to the large bandwidth available for wireless, high throughput technologies. One of the key applications will be the cooperation with existent wireless technologies at lower frequencies in indoor environments. The propagation channel should be studied along with a human body in the closeness of the mobile device, since the presence of the user can greatly affect the propagation channel at millimeter range. This communication deals with the comparison between 2.4 GHZ et 60 GHz indoor channels around a user, in a zone that can be reached by the arm extension, which represent the region where a user often uses a wireless device like a smartphone or tablet.

The experiments considered a transmitting antenna fixed to a tripod at 1.4 m above the floor of a rectangular room (7 m x 4 m) filled with office furniture (desks, chairs, pc, closets). A human subject was asked to stand still in front of the transmitting antenna at five reference distances spaced by 4λ at 2.4 GHz. Since the user was then asked to rotate, we refer to this position as $\phi = 0$, where ϕ is the azimuthal angle. The receiving antenna was mounted on a stand and moved by the user in front of his torso, in an area that could be reached by his own arm. 10001 temporal acquisitions at the sampling frequency of 12.5 Hz were recorded. Then, for each reference distance, the subject was asked to turn 90° and 180° and the measures have been repeated, still in front of the subject. The entire measurement set has performed for both 2.4 GHz and 60 GHz using two couples of omnidirectional antennas resonating at the frequency of interest.

We exploited measurements to study path-loss, shadowing and temporal fading at both frequencies for three orientations of the human body with respect to the transmitting antenna. Numerical model of path loss and shadowing will be presented. Cumulative distribution functions (CDFs) of the channels were fitted to Rice, Rayleigh, Nakagami-m and Weibull distributions and results will be presented. In particular, effects of small movements of the body will be highlighted and their impact on the channel for the two frequencies will be compared.