

Broadband measurements in tunnels for communications (LTE, DVB, WiMAX)

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In the last few years, there has been an intense proliferation of broadband wireless communications (DVB-T, LTE, WiMAX, ...) with excellent results in open areas. However, there is a lack of knowledge regarding how such broadband signals are propagated inside the tunnels. Transmission of these signals could be used for the management systems and traffic control, as well as television stations or cellular data networks.

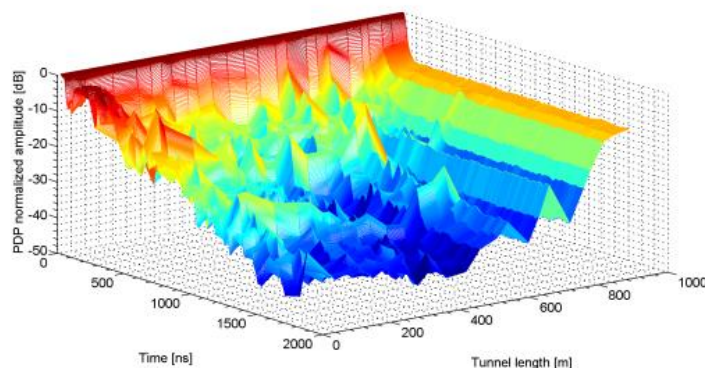
Therefore, the aim of the presented measurements is to model the response of the broadband signals in tunnels. For this purpose a measurement campaign has been conducted in the Metro of Madrid [1], focusing on three types of scenarios: subway stations, straight tunnels and a train blocking the signal.

Broadband measurements are based on Power Delay Profile (PDP) which gives the amplitude of the signal received in every instance through a multipath channel as a function of time delay. From these curves, certain channel parameters can be extracted, such as the delay spread which in turn is useful to determine the number of channel taps, one of the key parameters needed for signal propagation models [2], [3].

Both transmitter and receiver have been synchronized by using the baseband pulse (Pulse) generated on the transmitting side and the received signal was demodulated by the logarithmic amplifier "log amp" (Delay Profile). These measurements were carried out at two different frequencies: 2450 MHz and 1000 MHz.



Taking in broadband measurements



Three-Dimensional Plot

- [1] TECRAIL project: <http://tecrail.lcc.uma.es/>
- [2] Sen, I.; Matolak, D.W., "Vehicle-Vehicle Channel Models for the 5-GHz Band," *Intelligent Transportation Systems, IEEE Transactions on*, vol.9, no.2, pp.235,245, June 2008. doi: 10.1109/TITS.2008.922881
- [3] Liu Liu; Cheng Tao; Jiahui Qiu; Houjin Chen; Li Yu; Weihui Dong; Yao Yuan, "Position-Based Modeling for Wireless Channel on High-Speed Railway under a Viaduct at 2.35 GHz," *Selected Areas in Communications, IEEE Journal on*, vol.30, no.4, pp.834,845, May 2012. doi: 10.1109/JSAC.2012.120516