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Agenda Item: 7.2.3.1
Document for: Discussion, Decision



WF on O2I penetration for the RMa scenario

Background



- › In RAN1#84bis, a Rural Macro scenario was introduced
 - Channel model parameters in Appendix A in R1-163909 were taken as a working assumption
 - › These parameters were based on the IMT-Adv RMa scenario (ITU-R M.2135)
- › In 38.913, the Rural scenario is defined with 50% in-car users and 50% indoor users
 - Parameters for building penetration loss and car penetration loss need to be agreed

Car penetration loss



- › ITU-R M.2135 contains parameters for outdoor to in-car penetration loss
 - Car penetration loss is 9 dB on average with a 5 dB standard deviation
- › Car penetration loss at 60 GHz is reported in [1]
 - 6 dB for UE at head level of passenger
 - Matches material loss of glass
- › Car penetration loss measurements at 0.6-6 GHz are reported in [2]
 - 3 dB with no coating
 - 6.6 dB with window film
 - 20.7 dB with metallized windows
- › Car penetration loss measurements at 2.6 GHz are reported in [3]
 - 2-8 dB with standard car glass
- › Proposal 1: Adopt a car penetration loss of 9 dB on average with a 5 dB standard deviation
 - Note: This model is valid for at least 0.6-60 GHz
- › Proposal 2: Include an optional car penetration loss model for metallized windows with 20 dB on average with a 5 dB standard deviation

[1] E. Ben-Dor, T. S. Rappaport, Y. Qiao, S. J. Lauffenburger, “Millimeter-Wave 60 GHz Outdoor and Vehicle AOA Propagation Measurements Using a Broadband Channel Sounder”, in Proc. of Globecom 2011, Houston, TX, USA.

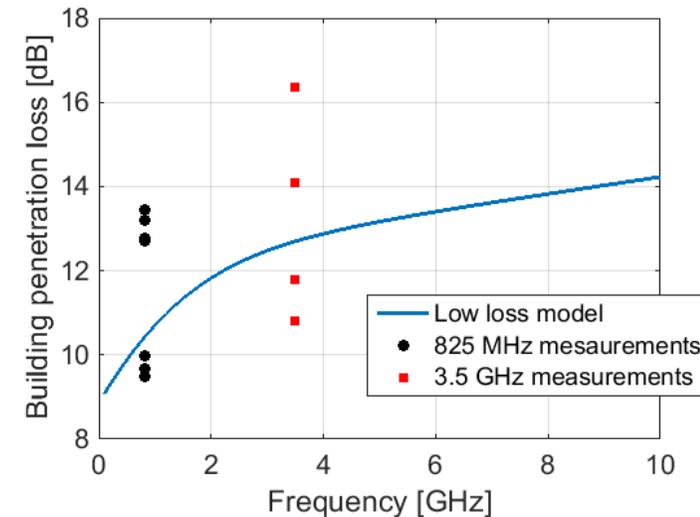
[2] U. T. Virk, K. Haneda, V-M. Kolmonen, P. Vainikainen, Y. Kaipainen, “Characterization of Vehicle Penetration Loss at Wireless Communication Frequencies”, in Proc. of EuCAP 2014, The Hague, Netherlands.

[3] F. Harrysson, J. Medbo, T. Hult, F. Tufvesson, “Experimental Investigation of the Directional Outdoor-to-In-Car Propagation Channel”, IEEE Trans. Veh. Technol., July 2013.

Building penetration loss



- › Building penetration loss measurements in rural areas for 825 MHz and 3.5 GHz are reported in [3]
 - The external wall loss is compared with the low loss model in the figure
 - An indoor loss of 0.6 dB/m
 - › 0.5 dB/m is used for the agreed low loss model
- › It seems as if the low loss model can well capture the RMa penetration loss measurements
- › Proposal 3: Adopt the low loss model for building penetration in the RMa scenario



[3] K. L. Chee, A. Anggraini, T. Kaiser, T. Kürner, "Outdoor-to-Indoor Propagation Loss Measurements for Broadband Wireless Access in Rural Areas", in Proc. of EuCAP 2011, Rome, Italy.

Summary



- › Proposal 1: Adopt a car penetration loss of 9 dB on average with a 5 dB standard deviation
 - Note: This model is valid for at least 0.6-60 GHz
- › Proposal 2: Include an optional car penetration loss model for metallized windows with 20 dB on average with a 5 dB standard deviation
- › Proposal 3: Adopt the low loss model for building penetration in the RMa scenario