RS-RS, and RS-MS NLOS Multihop Path Loss Model

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Purpose:
To further clarify the NLOS path model for RS-RS and RS-MS with a comparison to WINNER model

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Introduction

• In this contribution a comparison is made of path loss models for the RS-RS, or RS-MS link in a multihop network, where both ends of the link are below rooftop and are not located on the same street
RS-MS (NLOS)
RS and MS below rooftop and on different streets

- For this case the WINNER [1] channel model for an urban microcell is proposed in [2], with a frequency correction factor:

\[ P(dB) = 65 + 0.096d_1 + (28 - 0.024d_1)\log(d_2) + 20\log\left(\frac{f(\text{GHz})}{5}\right) \]
RS-MS (NLOS)
RS and MS below rooftop and on different streets

- Plot shows a comparison of the WINNER channel model and the below rooftop model proposed in [4]*
  - $d_1=50m$
  - $d_2=950m$
- A discontinuity can be seen at the junction when going from the WINNER LOS to the WINNER NLOS model
- The model from [4] is a combination of:
  - Advanced LOS model [3]
  - Berg NLOS model [4]
  - ETSI over-the-rooftop model [4]
- The model from [4] shows good agreement with measured results (see following slides)

* $\min (modified\_Berg, ETSI\_over\_the\_rooftop)$
Microcell path loss measurements
Central London

- The trial was in central London
- Three “base” sites were used, where the antenna was at a height of 5m

Gower Place mobile location

The “circular car park” base site

- The “mobile” was a trolley with an antenna height of ~1.3m
Microcellular Propagation Results

- **Indoor**
- **Modified Berg model**
- **Outdoor**
- **ETSI over the rooftop model**

**1951MHz**
5m / 1.3m antenna height

- **Pathloss / dB**
- **Distance / m**
Microcellular Measurements

Conclusions

- Excellent agreement is observed between the predicted and measured values
  - The discontinuity in the modified Berg model at ~60m corresponds well with the dimensions of the street layout immediately surrounding the base site
  - Beyond 100m the ETSI over the rooftop model closely tracks the experimental measurements for outdoor locations
  - Comparison of indoor and outdoor locations suggests a penetration loss of ~12dB
Summary and Recommendations

• WINNER LOS and NLOS models have a discontinuity at the street junction and the NLOS model appears to underestimate the path loss

• Recommend modified Berg/ETSI path loss model for RS-MS NLOS case
  – Shows good agreement with measured results in central London at 2GHz
References

[1] ‘Final report on link level and system level channel models’, IST-2003-507581 WINNER, D5.4 v.1.4, Nov. 18th, 2005

