# BS-RS and RS-RS LOS Multihop Path Loss Model

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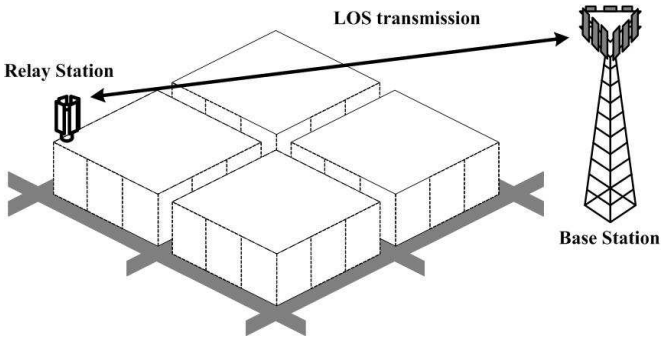
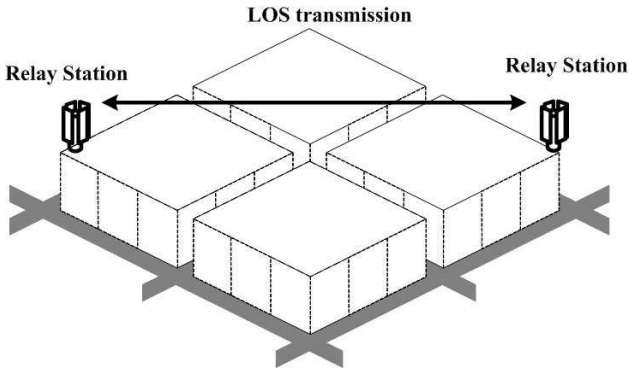
Purpose:
To further clarify the LOS path model for BS-RS, RS-RS and comparison with WINNER model

# Introduction

- In the following slides a comparison is made of path loss models for the BS-RS or RS-RS link in a multihop network, where both the BS and RS are located above the rooftop, and have a LOS link with each other



# BS-RS/RS-RS: RS above rooftop (LOS)

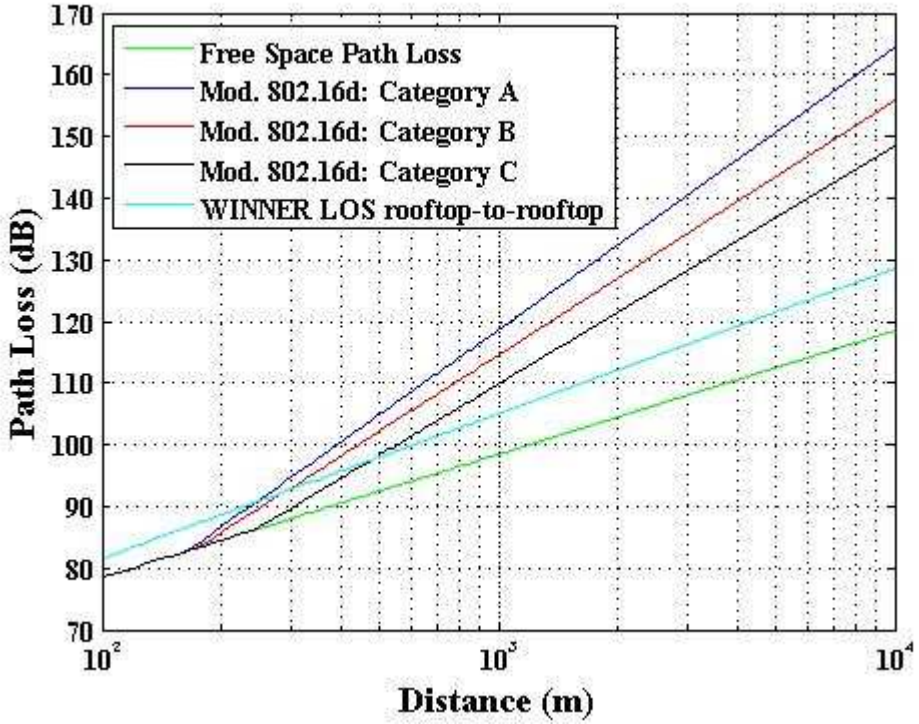
- In [2] it was recommended that one of the WINNER [1] path loss models can be used for this case:

$$P(dB) = 42.5 + 23.5\log(d) + 20\log(f/5)$$

- $d$ is the distance in meters, and $f$ is the frequency in GHz
- The WINNER report [1] states that this model is valid between $30<d<2000m$. This is not specified in [2], but should be if it is to be used in 802.16j since the model gives a path loss which is less than free space path loss at some distances less than 30m. Alternatively, this could be accounted for by specifying the model as:

$$P(dB) = \max\left(20\left(\frac{4\pi d}{\lambda}\right), 42.5 + 23.5\log(d) + 20\log\left(\frac{f}{5}\right)\right)$$

# BS-RS/RS-RS
## RS above rooftop: Path loss plots




- WINNER channel model compared to free space path loss and modified IEEE 802.16d path loss [3].

  Base height = 43m
  Terminal height = 16.5m
  Frequency = 2GHz

- For this scenario the RS is assumed to be above the rooftop and have a LOS back to the BS. The WINNER model is based on measurements at 2.5GHz using the parameters given above. It is close to free space loss and represents a good model for this case.

- The IEEE 802.16d model for terrain category C gives similar results for distances up to 1km. It gives higher path loss at distances > 1km, which is realistic due to reduced probability of LOS at larger distances. This may therefore be a better model in terms of predicting interference levels.

# Summary and Recommendation

- The modified IEEE 802.16d Category C path loss model is similar to the WINNER channel model for distances < 1km
- The WINNER channel model assumes a LOS between the BS and RS.
  - This will not be the case for interfering basestations in a multicell environment
- Recommend using the modified IEEE 802.16d Category C channel model for BS-RS above rooftop links in multicell simulations

# References

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

[2] ‘Channel Models and Performance Metrics for IEEE 802.16j Relay Task Group’, D.Chen, I-Kang Fu, M.Hart, W.C.Wong, IEEE C802.16j-06/020, 1/5/2006

[3] ‘Multihop Path Loss Model (Base to Relay and Base to Mobile)’, Dean Kitchener et al., IEEE C802.16j-06/011, 1/5/2006