

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

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Dean Kitchener, Mark Naden
Nortel
London Road
Harlow, Essex, CM17 9NA

Voice: +44 1279 403118
Fax: +44 1279 402100
E-mail: deank@nortel.com

Wen Tong, Peiyong Zhu,
Gamini Senarnath, Hang Zhang, David Steer, Derek Yu
Nortel, 3500 Carling Avenue

Voice: 613 7631315 613 7658089
Email: wentong@nortel.com pyzhu@nortel.com

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Purpose:

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

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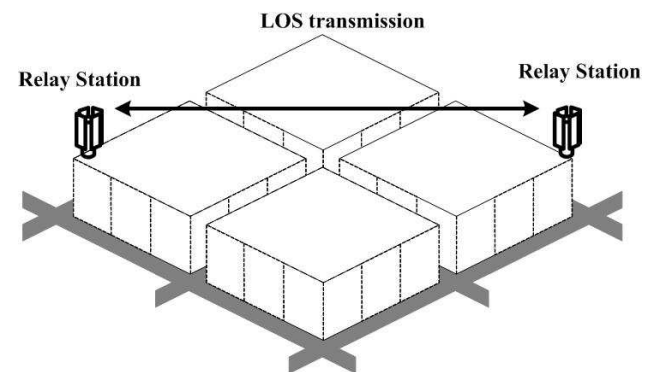
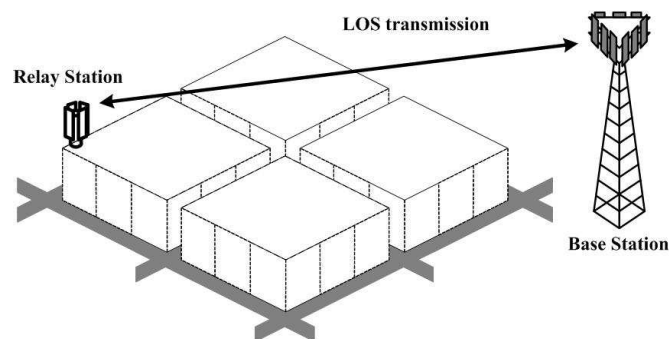
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Introduction

- 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:

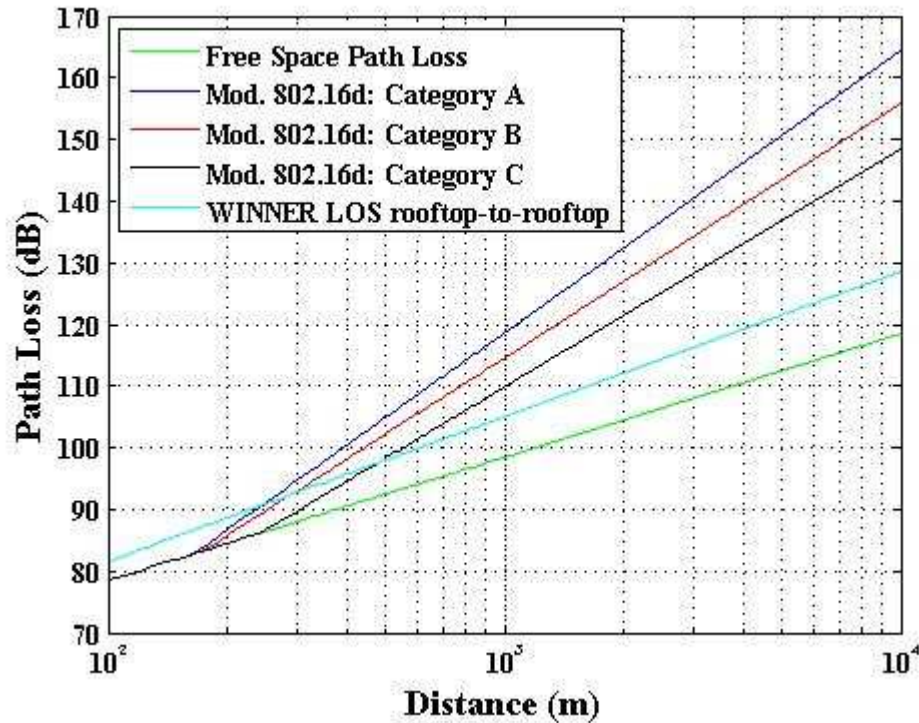
$$P(dB) = 42.5 + 23.5 \log(d) + 20 \log(f / 5)$$

- 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 $< 1\text{km}$
- 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