

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

Document Number:

IEEE C802.16j-06/062r1

Date Submitted:

2006-07-12

Source:

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

Venue:

IEEE 802.16 Session #44, San Diego, USA

Base Document: C80216j-06_040:” Multi-hop System Evaluation Methodology (Channel Model and Performance Metric)”

Purpose:

[To further clarify the LOS path model for BS-RS, RS-RS and comparison with WINNER model](#)

Notice:

This document has been prepared to assist IEEE 802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.

Release:

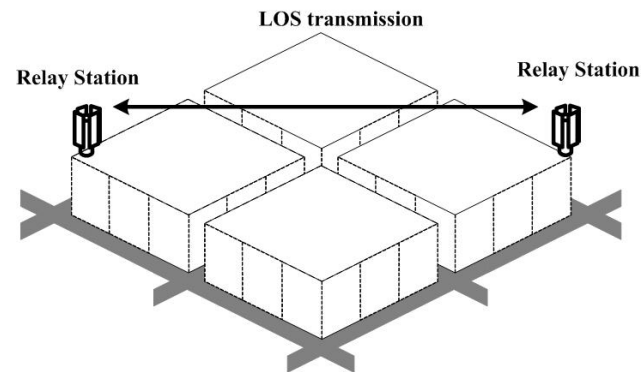
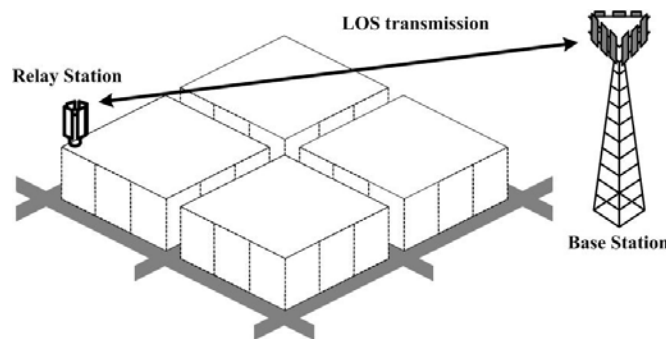
The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.

IEEE 802.16 Patent Policy:

The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures <<http://ieee802.org/16/ipr/patents/policy.html>>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <<mailto:chair@wirelessman.org>> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.16 Working Group. The Chair will disclose this notification via the IEEE 802.16 web site <<http://ieee802.org/16/ipr/patents/notices>>.

Introduction

- In this contribution, a comparison study 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:

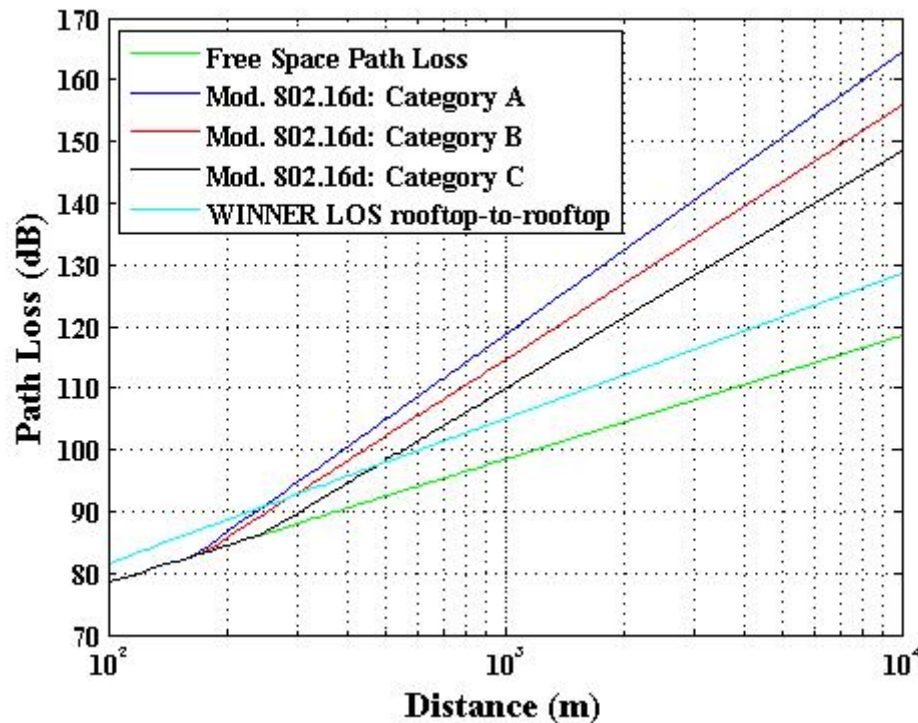
$$P(dB) = 42.5 + 23.5 \log(d) + 20 \log(f / 5)$$

- 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