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| Project | IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**> |
| Title | Text Proposal for Shadowing Modeling |
| Date Submitted | 2006-07-03 |
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| Re: | Response to a call for contributions for the Relay TG, see C80216j-06/001.pdf |
| Abstract | This document captures correlated shadowing model and path loss dependent shadowing model for IEEE802.16j |
| Purpose | Text proposal for IEEE C802.16j-06/040 |
| Notice |  |
| Release |  |
| Patent Policy and Procedures |  |

# Text Proposal for Shadowing Modeling

## 1 Introduction

This is a text proposal input to the contribution IEEE C802.16j-06/040:"Multi-hop System Evaluation Methodology".

++++++++++++++++++++*Start Text Proposal* ++++++++++++++++++++++++++++

### 1.1.1 Shadowing modeling

[Editor's note: adopt the model in [7]]

Place holder for the text, update required

#### 1.1.1.1 Correlated Shadowing

$$L(dB) = \begin{cases} -1.5\sigma\cos\left(\left|\phi-\phi_s\right|\right)+\sqrt{\dfrac{2\sigma}{3N}}\displaystyle\sum_{n=1}^{N}\cos\left(k_n^r r+\psi_n^r\right) & \text{for } \left|\phi-\phi_s\right|<5^\circ \\ \sqrt{\dfrac{4\sigma^2}{N}}\displaystyle\sum_{n=1}^{N}\cos\left(k_n^r r+\psi_n^r\right)\cos\left(k_n^\phi \phi+\psi_n^\phi\right) & \text{for } \left|\phi-\phi_s\right|\geq 5^\circ \end{cases}$$

where,

$\sigma$ = standard deviation of the lognormal shadowing

$\phi$ = mobile bearing from the basestation

$\phi_s$ = Street orientation at mobile location

$r$ = range of mobile from basestation

$k_n^r$ = n$^{th}$ wavenumber in the radial direction

$k_n^\phi$ = n$^{th}$ wavenumber in the $\phi$ direction

$\psi_n^r, \psi_n^\phi$ = Random phase terms

#### 1.1.1.2 Path Loss Dependent Shadowing

$$\sigma(r) = \sigma_u \left[ 1 - e^{-\frac{|P(r) - P_{fs}(r)|}{4}} \right] + 1.5$$

where,

$\sigma_u$ = Maximum standard deviation

$P(r)$ = Mean path loss (dB)

$P_{fs}(r)$ = Free Space path loss (dB)

- For BS-RS with RS above rooftop:-
  - For wanted BS, assume RS is deployed with LOS back to BS. σu=1.9dB
  - For neighbouring BS's, no guarantee of LOS so shadowing will be greater. σu=4.5dB
- For BS-MS/BS-RS with MS/RS below rooftop:-
  - Use (Okumura equation [1] – 1.5) for σu
- For RS-MS with MS on same or different street:-
  - σu=6.5dB

++++++++++++++++++++*End of Text Proposal* ++++++++++++++++++++++

## 2 References

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