Path Loss Assignment Probabilities

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Purpose:
To discuss the probability assignment for RS above and below rooftop and the standard deviation of lognormal shadowing distribution

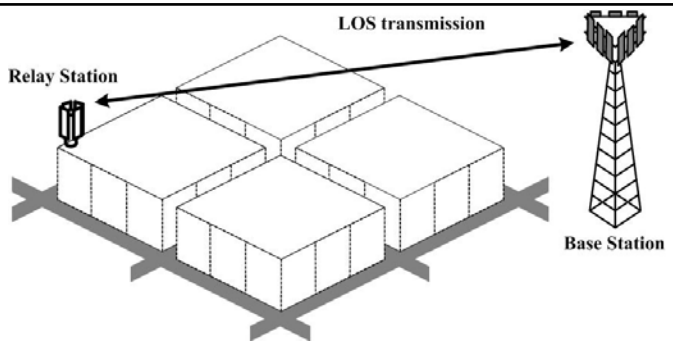
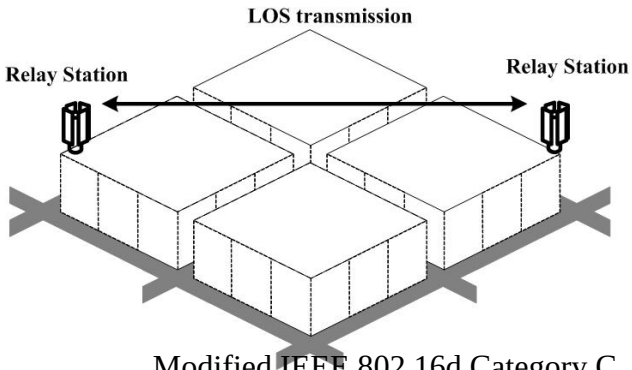
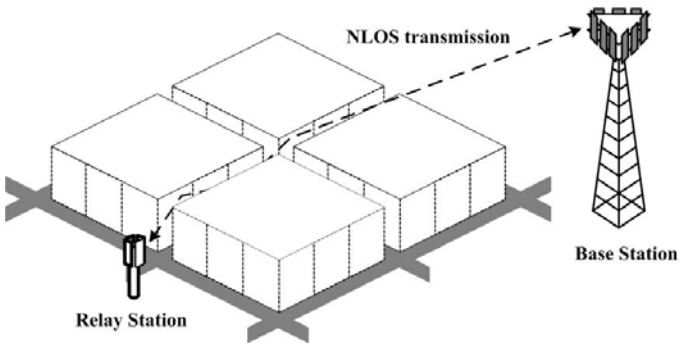
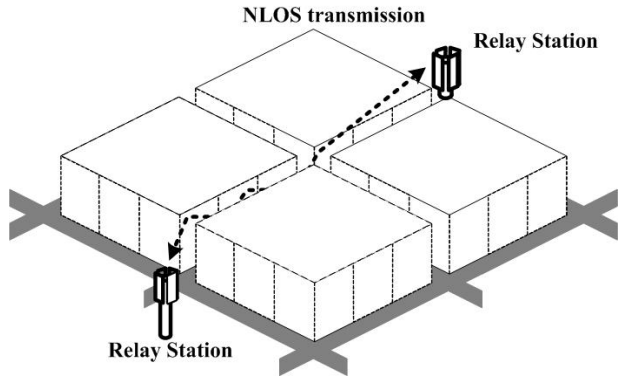
Introduction

- In this contribution, some assignment probabilities are proposed for the different multihop path loss models, and some recommendations are made for the lognormal shadowing standard deviation for different links

Recommended path loss models

- BS-RS/RS-RS rooftop-to-rooftop
  - Modified IEEE 802.16d Category C [1]
- BS-RS/BS-MS/RS-MS rooftop-to-below-rooftop
  - Modified IEEE 802.16d [1]
- RS-MS/RS-RS below-rooftop-to-below-rooftop on same street
  - Advanced LOS model [2]
- RS-MS/RS-RS below-rooftop-to-below-rooftop on different streets
  - Modified Berg/ETSI over-the-rooftop model [2]

Assignment Probabilities (1)

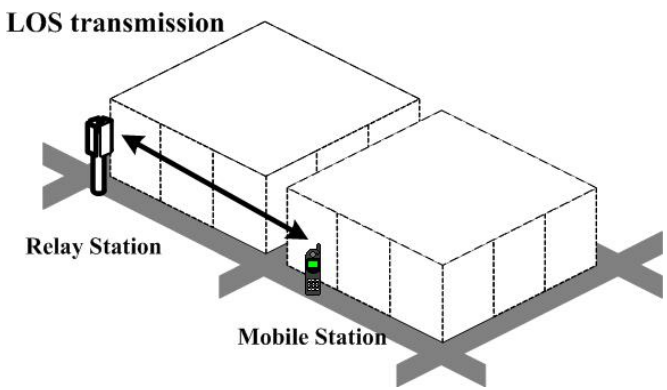
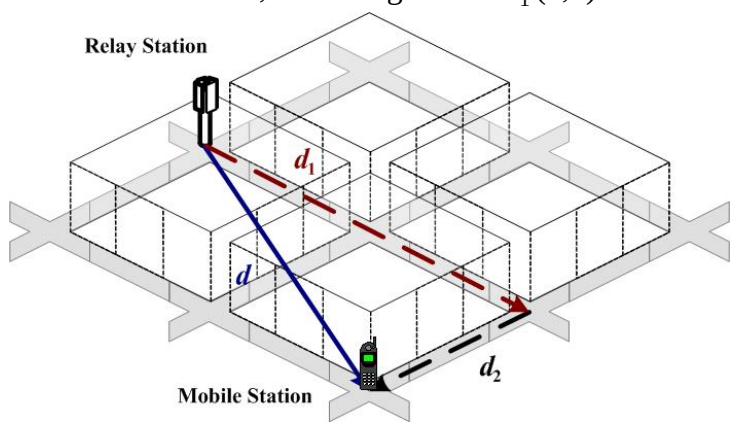
	First Hop		K^{th}- Hop
30%	 Modified IEEE 802.16d Category C	60%	 Modified IEEE 802.16d Category C
70%	 Modified IEEE 802.16d	40%	 Modified IEEE 802.16d

For the BS-RS link → for user self deployed scenarios

Probability of RS above rooftop = 0.3
Probability of RS below rooftop = 0.7

Assignment Probabilities (2)

For the below rooftop case (RS-RS/RS-MS) the assignment probabilities indicated below can be used. The advanced LOS model is used if the RS and MS are located on the same street, and the Berg/ETSI model are used if they are located on different streets.

	Last Hop		
30%	 Advanced LOS model	**70%**	Given d, uniform generate d_1 (0,d)  Modified Berg/ETSI model

Shadowing standard deviation

Propose a shadowing standard deviation dependant on excess path loss over free space. This ensures that shadowing is reduced when the path loss model is close to free space loss.

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

where,

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

Summary

- **Regarding location of user deployed RS**
  - **1st hop**
    - **Probability of RS above rooftop = 0.3,**
    - **Probability of RS below rooftop = 0.7**
  - **Kth hop**
    - **Probability of RS above rooftop = 0.6,**
    - **Probability of RS below rooftop = 0.4**
- **Regarding the RS and MS location in the urban**
  - **Probability of RS-MS at same street = 0.3,**
  - **Probability of RS-MS at different street = 0.7**
- **Recommend shadowing standard deviation which is dependant on excess path loss**
  - **Ensures shadowing is reduced when path loss is close to free space loss**

References

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

[2] ‘Below Rooftop Path Loss Model’, Dean Kitchener et al., IEEE C802.16j-06/010, 1/5/2006

[3] ‘Multihop Network Simulation with Street Layout’, Dean Kitchener et al., IEEE C802.16j-06/012, 2/5/06