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| Project | **IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>** |
| Title | **Comments on "Multi-hop System Evaluation Methodology (Channel Model and Performance Metric)"** |
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| Re: | Response to a call for contribution for the Relay TG, see C802.16j-06/006.pdf |
| Abstract | This document comments on C802.16j-06/040, "Multi-hop System Evaluation Methodology (Channel Model and Performance Metric)", and recommends various channel modeling scenarios for evaluation methodology. |
| Purpose | System evaluation methodology including Channel Model, and comments for contribution to the C802.16j-06/040. |
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# Comments on “Multi-hop System Evaluation Methodology”

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## 1. Comment-1: section 1.1 [1]

Following the simulation methodology outlined in Fig 1 [1], detailed description of the requirements and specifications should be specified in the document and the following two new sections should be added:

1.1.1 Link level simulations

1.1.2 System level simulations.

For system level modelling, the following need to be defined :

- Definition of the ‘realistic traffic’.
    - Would the realistic traffic modelling be done for the central cell only, or for all the neighbouring cells as well.

## 2. Comment-2: section 2.1 [1]

- Simulation scenarios of BS-RS, irrespective of the LoS or NLoS link, need to conform to QoS criterion to guarantee the link quality.
- The deployment of the Fixed RS will depend upon the following characteristics:
    - Location/environment
    - Height of the antenna
    - User density
- For Nomadic and Mobile RS, an independent (or inter-dependant) set of parameters need to be defined.
- For consistency amongst various 802.16j’s sub-groups, it is recommended :
    - to follow the definition of usage scenario/model [2] for all channel modeling cases,
    - all figures existing in the document [1] should be changed accordingly.
- Furthermore, all the figures should be more general, instead of depicting a very specific scenario.
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Please use the following table (Table-1) as reference model for each scenario. And, based on our analysis and review, WINNER model [3] appears to be more suitable for meeting the requirements of a relay-based system.

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Relay channel modelling upon to usage scenarios [2] should be categorised Fixed Relay, Nomadic Relay and Mobile Relay. Each can be further categorised into MMR_BS-RS link and RS-MS link. For each link, LoS and NLos have to be considered. Table-1 presents recommended channel models based on scenarios and conditions, where (O) represents Optional and (M) represents Mandatory.

**Table-1**: Recommended channel model based on scenarios and conditions

| Scenarios | Link and conditions | | | Recommended Channel Model | Criteria | Note |
|---|---|---|---|---|---|---|
| **BS-MS(16e)** | LoS | | | WINNER C1 (LoS) model [3] | | Meet requirements of standards |
| | NLoS | | | WINNER C2 (NLoS) model [3] (M)<br>WINNER C1 (NLoS) model [3] (O) | | |
| **MMR_BS-MS** | LoS | | | WINNER B1 (LoS) model [3] | | Relay enabled |
| | NLoS | | | WINNER B1 (NLoS) model [3] | | |
| | | | | | | |
| **Fixed Relay** | MMR_BS-RS | | LoS | WINNER B5a [3] (O)<br>SUI Model [4] (M) | QoS criterion to guarantee the link of BS-RS | Please refer to Figure 1 in [2] |
| | | | NLoS | WINNER B1 model [3] (O)<br>SUI Model [4] (M) | | |
| | RS-MS | | | Same as MMR_BS-MS (both LoS and NLoS) | | |
| | | | | | | |
| **Nomadic Relay** | Indoor | MMR_BS-RS | LoS | Same as BS-RS link (fixed relay – LoS) | QoS criterion to guarantee the link of BS-RS | Please refer to Figure 2 & 3 in [2] |
| | | | NLoS | WINNER B4 model [3] – low speed<br>WINNER C4 model [3] – high speed | | |
| | | RS-MS | LoS | WINNER B3 (LoS) model [3] - Large space<br>WINNER A1 model (LoS) [3] | | |
| | | | NLos | WINNER B3 (NLoS) model [3] - Large space<br>WINNER A1 model (NLoS) [3] | | |
| | Outdoor | MMR_BS-RS | LoS | Same as BS-RS link (fixed relay – LoS) | | |
| | | | NLoS | Same as BS-RS link (fixed relay – NLoS) | | |
| | | RS-MS | | Same as RS-MS link (fixed relay) | | |
| | | | | | | |
| **Mobile Relay** | MMR_BS-RS | LoS | | WINNER B1 model (LoS) [3] - low speed | | Please refer to Figure 4 |
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| | | | | Should be micro-cell high and low speed model (needs new model), though 16e claims to be supporting high mobility upto 150 km/hr. It is recommended to use ITU Vehicular model [5] for high speed. | | in [2] |
| | | NLoS | | WINNER B1 model (NLoS) [3] - low speed<br>Should be micro-cell high and low speed model (needs new model), though 16e claims to be supporting high mobility upto 150 km/hr. It is recommended to use ITU Vehicular model [5] for high speed. | | |
| | RS-MS | MS carried by RS (e.g. bus, train, etc) | LoS | WINNER A1 model (LoS) [3] - Indoor small space | | |
| | | | NLoS | WINNER A1 model (NLoS) [3] - Indoor small space | | |
| | | RS, MS motions independently (e.g. man-carried RS) | LoS | WINNER B1 model (LoS) [3] - Outdoor space<br>[NOTE]: Same channel model as MMR_BS-MS | | |
| | | | NLoS | WINNER B1 model (NLoS) [3] – Outdoor space<br>[NOTE] : Same channel model as MMR_BS-MS | | |

**Note :**

(M) – Mandatory

(O) – Optional

~~~~~~ End of text contribution ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

## 3. Comment-3: section 2.1.13 [1]

- Antenna patterns should be general. These can be defined as sectorised antenna, directional antenna and omni antenna for system study, wherever needed.
- Refer to Usage Model document [2].

## 4. Comment-4: section 3 [1]

- For traffic models, they should all meet those in IEEE802.16-2004 and IEEE802.16e-2005.
- Relay should have the capability to support all those traffic models. However, the deployment of the relay stations should not have any impact on the traffic models.
- Is there even a need to discuss traffic models in this document?
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The traffic models defined in this document is to further clarify traffic service upon to 802.16-2004 and 802.16e-2005. Relay deployment will not alter any traffic service supported by 802.16-2004 and 802.16e-2005.

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## 5. Comment-5: section 4 [1]

We propose the following into the performance metric:

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4.1.6 End-to-end delay

Delay defined between traffic source and traffic destination. End-to-end is also defined as MMS-BS to MS(s). The total delay between MMS-BS to MS(s) is measurable. Number of hops between the MMS-BS and MS(s) is not counted in this metric.

4.1.7 Blocking probability

Blocking probability shows that in certain times schedulability does not arise, while it causes traffic to be blocked. Blocking probability is a function of the link utilization, since traffic blocking can possibly lead to low link utilization.

4.1.8 Drop probability

Drop probability is defined as a percentage of packets dropped upon to handover. This metric becomes important for relay since relay deployment increases handover probability with regarding to mobility.

~~~~~~~ End of Text contribution ~~~~~~~~~~~~~~~~~~~~~~~

## 6. References

[1] IEEE C802.16j-6/040, “Multi-hop System Evaluation Methodology (Channel Model and Performance Metric)” May, 2006

[2] IEEE C802.16j-6/ UMAHtemp_r5.doc, “Harmonized Contribution on 802.16j (Mobile Multihop Relay) Usage Models – Revision R5” July, 2006

[3] IST-2003-507581 WINNER, D5.4 v 1.4, “Final Report on Link Level and System Level Channel Model”,

[4] IEEE C802.16a-03/01, “Channel Models for Fixed Wireless Access” June, 2003

[5] ITU-R Recommendation M.1225: “Guidelines for Evaluation of Radio Transmission Technologies for IMT-2000, 1997”