

Project	IEEE 802.16 Broadband Wireless Access Working Group < http://ieee802.org/16 >	
Title	Evaluation Criteria for RF Propagation and Diversity Techniques (Contribution to IEEE802.16.3)	
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Re:	IEEE802.16.3-00/07r1 document. Response to "802.16.3 Invitation for Contribute" on Evaluation Criteria for the list of Key Characteristics of the Sub-11 Air interface for Session #9.	
Abstract	This document presents a list of evaluation criteria by which the Key characteristics that were established by the 802.16.3 Task Group by the end of Session #8.	
Purpose	This contribution will be presented and discussed within the Task Group in Session #9 for possible adoption for technical assessment of various RF Propagation characteristics and diversity techniques.	
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Evaluation Criteria for RF Propagation and diversity Technique

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Introduction:

The evaluation criteria for the suggested RF Propagation Characteristics and Diversity Techniques by the Task Group in Session #8 are presented here. Assessment of RF propagation models of Sub 11 GHz band and possible application of diversity techniques have to be based on type of communication channel that is identified within the Functional Requirement Document (IEEE 802.16.3-00/02r3) for Fixed Wireless Access for high density residential, SOHO and SME environments. In order to perform an assessment of the RF channel model and selection of an appropriate diversity scheme to combat the deep fades, we propose to verify the following evaluation criteria on each of selected RF channel models:

The evaluation criteria for RF Propagation model and diversity techniques should be based on the following factors:

- RF channel modeling should include various RF propagation impairments:
 - Multi-path and delay spread factor
 - Flat fade channel characteristics
 - LOS and NLOS situation of the channel
 - Frequency selective / dispersive fading channel
 - Ducting / Entrapping
 - Rain/ gas absorption
 - Atmospheric diffraction.
- How to alleviate the dispersive and flat fading by diversity techniques or other techniques:
 - Analyze the applicability of Space diversity, Frequency diversity, or combined techniques
 - Adaptive Frequency Equalizer (AFE)
 - Adaptive Time Equalizer (ATE)
 - Multi-carrier techniques (e.g., OFDM)
 - Increase BS and SS elevation
 - Optimize antenna alignment
 - Implementation complexity and its economical factor of diversity techniques
 - Judgment call on mitigation technique (Return On Investment).

The above list of evaluation factors is important to assess each RF channel modeling in order to evaluate their applicability and to help proposing an approach of minimization of propagation interference within SSs of a BS or within BSs from adjacent cells.

How to apply the above evaluation Criteria:

Most of the factors mentioned above shall be assessed by compiling what is known about RF channel characteristics or determine what sort of empirical tests are to be performed in order to characterize the RF channels realistically. Then, we will require the application of RF channel simulation methods to evaluate the extent of channel impairments and consequently come up with mitigation methods (e.g., Diversity techniques listed above) for various environments that the wireless communication system is expected to operate.

Based on list of services and types of traffic with their Quality of Services (QoS) requirements, and the area of operation of the BWA system which are specified within the Functional Requirement Document, the RF channel models (e.g., multi-path, shadowing, frequency-selective fading channel,...) can be modeled. Based on RF propagation characteristics, an End-to-End network simulation including traffic generation, channel model, and air interface shall be implemented. Then, to combat the channel impairments there shall be diversity techniques or appropriate filtering or equalization techniques that have to be applied. For the evaluation purposes and impact assessment of each RF channel mitigation scheme, we shall include multiple diversity schemes into simulation model and individually generate their system throughput and delay, and other performance profile and compare them with respect to the reference model without mitigation technique.

In addition, based on past experiences on implementation complexity at BS and SS, combining techniques that might be part of diversity schemes, we shall compile all the pros and cons of each RF channel mitigation schemes. Of course, each of above assessment criteria can have different weighting (to be determined) for a final conclusion on various diversity techniques for a selected RF channel model.