Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**High level requirements for IEEE 802.16m evaluation methodology channel models**
Date Submitted	**2007-03-05**
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Re:	This is a response to call for contribution http://ieee802.org/16/tgm/docs/80216m-07_005r2.pdf
Abstract	High level requirements for IEEE 802.16m evaluation methodology channel models
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For consideration when specifying channel models for the evaluation methodology

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Introduction

This submission considers high level requirements for channel models for the evaluation methodology for IMT-Advanced systems.

In the ITU-R recommendation ITU-R M.1645 the framework for systems beyond IMT-2000 (IMT-Advanced) shows data rates of up to 1Gbit/s for nomadic/local area wireless access, and up to 100Mbit/s for mobile access. To achieve these data rates the European IST WINNER project has devised a method for determining spectrum requirements for IMT-Advanced, and their conclusions are given in [1]. In this report it is stated that in order to achieve the performance targets of IMT-Advanced, sufficiently wide frequency channels need to be provided (i.e. 100MHz channels per transmission direction). In addition, in order to enable several operators to deploy IMT-Advanced compliant systems (to enable competition), several channels of such width are required. Candidate bands for IMT-Advanced are to be considered in 2007 at the WRC-07 conference. When considering candidate bands the WINNER report suggests that the bands below 3GHz do not have sufficient width to achieve the highest performance goals set for future systems. This presents significant challenges in particular for wide area mobile access, due to the increase in path loss with frequency, but is likely to be less of a problem for the shorter range nomadic local area wireless access.

Link level channel model requirements

Link level channel models are usually in the form of a tapped delay line model. For example, three taps are used for the IEEE 802.16d SUI tapped delay line models [2], and six taps are used for the ITU models for IMT-2000 [3]. However, the six tap ITU models were devised for 5MHz bandwidth channels, and as the bandwidth increases, the resolution in the delay domain increases so that more taps are required for higher bandwidth channel models. Each resolvable tap consists of a number of multipath components so that the tap fades as the mobile moves. As bandwidth increases there will be less multipath components per resolvable tap so that the fading characteristics of the taps are likely to change. The tap fading is likely to become more Ricean in nature (increasing K-factor with bandwidth) and the Doppler characteristics will not have the classic shape. This also means that the coherence times/distances for the tap fading will most likely be longer for higher bandwidths.

The above effects need to be incorporated into a link level channel model. This suggests that measurement data is required for bandwidths up to 100MHz to obtain the appropriate channel statistics (and their variation with transmission bandwidth). Also, fading generators are required which are more flexible than existing Rayleigh fading generators (eg. [4], [5], [6], [7]), allowing for Ricean fading, and user defined Doppler characteristics. Therefore, new fading generators need to be developed and these need to be designed such that their complexity is manageable with a link level simulation (i.e. the run time must not be too high).

The link level channel models also need to be able to model MIMO channels, and this means including appropriate branch power ratios (i.e. the ratio of received powers on different branches/antennas), and path correlations for different antenna configurations. The correlations can be calculated using spatial channel models, such as the SCM from 3GPP [8], or the SCMe (enhanced) from the WINNER project. SCMe is most appropriate for wide bandwidth channels. Ideally the model would include azimuth and elevation angle for the

multipath components, and also include polarization conversion in the channel. This would allow proper combination of the multipath components with realistic antenna patterns at the base and terminal, and out of this kind of analysis path correlations and branch power ratios can be determined.

System level channel models

For system level modeling a number of channel models will be required, including path loss and shadowing models. IMT-Advanced systems will almost certainly include relaying techniques to achieve good coverage for the new high data rates, and therefore it may be possible to use many of the channel models defined for IEEE 802.16j. However, this very much depends on the frequency bands that are defined for IMT-Advanced, and if the bands are above 3GHz, further measurements may be required to develop good path loss models for the complete set of links required for a multihop (relaying) network, particularly for frequencies above 2GHz, which is the upper specified limit for most of the standard path loss models in use today.

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