Project	**IEEE 802.20 Working Group on Mobile Broadband Wireless Access** **<http://grouper.ieee.org/groups/802/20/>**
Title	**Issues on Power Setting for the Simulator Calibration**
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Source(s)	David Huo 67 Whippany Road Whippany, NJ 07981 Voice: +1 973 428 7787 Fax: +1 973 386 4555 Email: dhuo@lucent.com
Re:	Simulation Calibration
Abstract	This document makes proposal to resolve problems related to the power setting for the simulator calibration.
Purpose	Discuss and adopt.
Notice	This document has been prepared to assist the IEEE 802.20 Working Group to accomplish the simulator calibration process.
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1 Introduction

We have agreed[1] to calibrate the simulation tools used for the evaluation efforts by starting with simple network layout: 2 tiers of hexagonal cells. In order for the calibration to be really helpful, we need to focus on those components that are technology indepedent. In case it is not avoidable to deal with technology depedent componets, simple assumptions need to be made, keeping in mind that the calibration has no role in evaluating certain technologies, rather it helps to iron out possible wrinkles in the simulation tools. In the following one of those cases is explored.

2 Estimate the Mean Transmit Power

Generally speading, the signal-to-noise ratio received is

$$C/I = \frac{gP}{N_0 + I} \tag{1}$$

where gP is the received power with the path gain g and I is the total static interference power and N_0 the noise power. Here, $G = E\{C/I\}$, evaluated over tha fast fading, is called the geometry. The sensitivity of the receiver provides a lower bound of the receiver performance given by the maximum signal-to-noise ratio $(C/I)_{max}$ via the relation

$$(C/I)^{-1} + (C/I)_{max}^{-1} = (C/I)_{result}^{-1} \tag{2}$$

where $(C/I)_{result}$ is the actual signal-to-noise ratio of the receiver. Let $(C/I)_{desire}$ be the desired receive quality. Then

$$(C/I)_{desire} \leq \frac{1}{(N_0 + I)/(gP) + (C/I)_{max}^{-1}} \tag{3}$$

Thus, the necessary transmit power is determined by

$$P \geq \frac{I + N_0}{g \cdot [(C/I)_{desire}^{-1} - (C/I)_{max}^{-1}]} \tag{4}$$

This value can be viewed as the convergent transmit power of the transmitter as a result of closed-loop power control. Note that the term of interference I is not further specified, as it depends on the technology deployed, as well as whether the uplink or downlink is considered. Following are two examples

Base Station: For mobiles with fixed locations, the base station transmit power can be estimated as $E\{P\}$, where the average is taken over all mobiles. For instance, when a base station serves n mobiles in equilibrium, the estimate

$$\bar{P} = \frac{1}{n} \sum_{i}^{n} \frac{I_i + N_0}{g_i} \cdot [(C/I)_{desire}^{-1} - (C/I)_{max}^{-1}]^{-1} \tag{5}$$

could be used as an estimate of the average transmit power by the base station. It was assumed that I_i is measurable and fed-back by the mobile station, and g_i is estimated by the base station.

Mobile Station: Then, based on closed-loop power control, the desired mobile station's transmit power can be estimated as

$$P_i = \frac{I_i + N_0}{g_i} \cdot [(C/I)^{-1}_{desire} - (C/I)^{-1}_{max}]^{-1} \tag{6}$$

where it is assumed that I_i is measurable and fed-back by the base station, and g_i is estimated by the mobile station. From the network's perspective, this value may be reviewed with respect to the feasibility and adjusted during the operation.

Parameters used in the above examples can be assumed known and set by hand in the simulation, which may be more appropriate for the calibration, or estimated, which implies more complications in the simulation setup.

3 Possibilities

The transmit power in both BS and MS can be assumed the maximum available power. This may serve to provide statistics about the geometry. Since, those numbers may be not realistic for the most technologies, we can choose to use the formla given above to determine the transmit power. By doing so the assumption is made that both base station and the mobile station transmitter knows its channel gain g and the interference on the receiving side. Moreover, it is necessary to determine the details of the interference. For instance, whether the interference contain intra-cell interference or not. In another word, whether the radio channels used by different users within a sector are orthogonal or or not.

4 Decision

We need decide which of the three approaches should be take to run the calibration

- Maximum transmit power for both up-link and down-link
- Maximum transmit power for the down-link only, the up-link use the above formula
- Both up-link and down-link use above formulae.
- Technolgy dependent approach: choose a technology, e.g. CDMA or TDMA

References

[1] IEEE802.20 Meeting Note, Monterey, CA, Feburary 2005