Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	Missing definitions for CINR in OFDMA PHY
Date Submitted	**2004-11-01**
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Re:	IEEE P802.16REVd/D5-2004
Abstract	Add missing definitions of CINR in OFDMA
Purpose	Adopt changes
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Missing definitions for CINR in OFDMA PHY

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1. Motivation

The definition of CINR in 8.4.11.3 is incomplete and doesn't allow correct operation (setting DL burst profile and other related parameters (boosting/repetition/permutation zone) by the BS.

2. Details

2.1. Problems in current definitions

It is not defined what the CINR value relates to. Does it relate to data carriers of a specific burst, to data carriers overall, or to the pilots or to the preamble ? different SS implementations may choose different sources to estimate CINR from resulting in large difference in the result. These differences will not enable the BS to correctly choose the burst profile, boosting, repetition, permutation and so on, or will result in high margins in the BS.

(1) Treatment of boosting: if the SS measures CINR directly on data subcarriers of specific DL bursts (directed to it) then boosting is taken into account. If it measures CINR overall then boosting (on average) is not included in the report.
(2) Weighting of interference versus noise: since pilots and preambles are boosted (in 7dB and 2.5dB accordingly), then CINR resulting from noise is weighted differently than CINR resulting from interference. The standard doesn't define should an SS estimating CINR from pilots/preambles scale the result according to the pilots/preamble boosting or not, and this may result in difference of 7dB between SS. Even if normalization is defined, the problem with different weighting of noise and interference exists.
(3) Taking partial collisions into account: The pilots/preamble and data subcarriers may suffer from interference from other BS, when there is a collision on that tone (=other BS uses same tone). This results in different C/I on pilots and data. For example, for BS that use the same RF channel and same PUSC segment, partial collisions occur on the data subcarriers (depending on the BS load), however all the pilots and the preamble tones are in collision (to will measure higher CINR). For BS with different PUSC segments, and different Cell-ID (in the permutation), there is no interference on preamble tones, partial interference on pilots and data tones. To conclude, different measurement methods will give completely different results, depending on the deployment.
(4) The standard doesn't define if CINR includes implementation losses (phase noise, quantization, channel estimation, etc). In our opinion it should include implementation losses as much as possible, so that BS can put SS with poor performance and SS with good performance on the same CINR scale when selecting downlink rates.
(5) The current definition of CINR relates to "CINR on a message". However it is not clear which message this relates to. It doesn't make sense to average on all messages since SS is not always capable of receiving all messages (and potentially not aware which messages were directed to it).
(6) The indication of the averaging factor (α) appears in REP-REQ (bits 3-6 of "Report type"), but there is no definition of this factor for FAST_FEEDBACK.

2.2. Proposed solution

We recommend to measure the CINR on the FCH or on the DL-map. The advantages are:

- Estimation on the map/FCH suffers from interference only from the relevant segment.
- CINR on the map/FCH weights interference and noise the same way they are weighted on other data tones.
- Since FCH and map are modulated by QPSK, it is relatively easy to compute CINR by hard-slicing.
- The SS may obtain better CINR results by using the repetitions on the FCH (i.e. combine repetitions, slice, then calculate CINR).

The drawbacks of this solution are:

- It doesn't take into account partial collisions between co-channels (due to the permutation).
- There is no mechanism to estimate CINR on other permutation zones (except PUSC).

In spite of the drawbacks since at least a basic definition of CINR is required, we suggest to adopt this solution.

3. Changes summary

8.4.11.3 CINR mean and standard deviation

[Add the following text at the end of the section]

The SS is required to estimate the CINR at the input to the decoder, so that implementation losses (due to non-idealities of the receiver) are included in the estimate. When repetition code is applied it is considered part of the coding, and the CINR value doesn't include the SNR improvement resulting from repetition.

Unless indicated otherwise, the CINR for REP-RSP and FAST_FEEDBACK reports shall be estimated on the data subcarriers of the FCH or the broadcast DL-map.

The averaging parameter (α_{avg}) is given in DCD for FAST_FEEDBACK and CQICH indications as well as for unsolicited REQ-RSP, and in REP-REQ for invited REP-RSP reports. If not transmitted in DCD, the default value of α_{avg} shall be 1/4.

11.4.1 DCD channel encodings

[Add the following line in Table 356, p. 665, line 20 after "H-ARQ ACK delay"]

Name	Type (1 byte)	Length	Value (variable length)	PHY scope
RSSI and CINR averaging parameter	XX	1	Averaging parameter α_{avg} for CINR and RSSI measurements not indicated by REP-REQ (e.g. FAST_FEEDBACK, CQICH), in multiples of 1/32 (range [1/32, 16/32])	OFDMA