Improved BS training by TDD reciprocity

IEEE 802.16 Presentation Submission Template (Rev. 8.3)

Document Number:
IEEE S802.16e-04/319r1

Date Submitted:
2004-08-28

Source: Intel Corporation: Ilan Sutskover +972-3-9207358 ilan.sutskover@intel.com

Venue:
Seoul August-September 2004

Base Document:

Purpose:
This is a response to a call for contribution to 802.16e

Notice:
This document has been prepared to assist IEEE 802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.

Release:
The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE’s name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE’s sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.

IEEE 802.16 Patent Policy:
The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures <http://ieee802.org/16/ipr/patents/policy.html>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <mailto:chair@wirelessman.org> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.16 Working Group. The Chair will disclose this notification via the IEEE 802.16 web site <http://ieee802.org/16/ipr/patents/notices>.
CSIT into 802.16e
C80216e-04_319r1

Ilan Sutskover
A.R.T
Intel Corporation
Talk Outline

- Current support in the standard.
- Improved channel knowledge.
- Our proposal.
Support in the Standard

• If contribution C80216e-04_263r1 is adopted:
  – Uplink sounding symbols.
  – Containing pilot subcarriers of equal power.
  – Guarded by “safety zone” IEs.
  – Absolute reference point – average SINR reported in message in the uplink.
Improved TDD Reciprocity

\[ C = \log \left( 1 + \frac{P|h|^2}{\sigma^2} \right) \]

- Path loss is not the whole story.
- Set pilot power to be inversely proportional to interference level at mobile side.
- BS gets the SINR information along with channel knowledge.
Our Proposal

• Add 3 bits to the sounding IE:
  – 2 bits selecting power assignment method.
  – 1 bit flagging power boost of 3dB.

• Set subcarrier powers inversely proportional to interference level at mobile side.

• Power assignment methods:
  – Control max power per subcarrier, or
  – Control total power per symbol, or
  – Avoid using the interference dependent scheme.
At the BS

• Instead of receiving \( y_a = h_a x + n_a; \ n \sim N(0, \sigma_B^2) \)
  the BS receives \( y_a = p \frac{h_a}{\sigma_M} x + n_a; \ n \sim N(0, \sigma_B^2) \)
  where \( a \) is the antenna number at the BS, and \( \sigma_M^2 \)
  is the interference at the mobile, assuming a single antenna there.

• This is equivalent to the information-lossless operation at the mobile: \( \tilde{z} = \frac{z}{\sigma_M}; \ z = hs + w \)

• The value of \( \sqrt{\frac{|h_a|^2}{\sigma_M^2}} \) is known exactly by the aid of a feedback message (REP-RSP) that provides the normalization factor.