Improved BS training by TDD reciprocity

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Purpose:

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

CSIT into 802.16e C80216e-04_319r1

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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 $y_a = h_a x + n_a;\ \ n \sim N\left(0, \sigma_B^2\right)$ the BS receives $y_a = p\frac{h_a}{\sigma_M} x + n_a;\ \ n \sim N\left(0, \sigma_B^2\right)$ where a is the antenna number at the BS, and σ_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.