Proposal For Requirement that RS Transmit Preamble

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Jaroslaw Sydir, Wendy C. Wong, Hyunjeong Lee, Kerstin Johnsson

Intel Corporation — Voice: +1 408 765 2212

2200 Mission College Blvd. — E-mail: jerry.sydir@intel.com

Santa Clara, CA 95025

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Purpose:

This contribution is submitted in response to the call for contributions for technical requirements. The purpose of this contribution is to present the arguments for requiring that RSs transmit preambles.

Overview

- There have been contributions that propose the following scheme:
  - MMR-BS broadcasts preamble, FCH, DL-MAP,UL-MAP, UCD and DCD. (MS receives preamble from MMR-BS)
  - RS does not transmit preamble or broadcast data.
  - Unicast data is relayed by the RS (MS receives unicast data from RS)
- We have the following concerns regarding this scheme:
  - It is not strictly backwards compatible, i.e. it will not work with all 802.16e-2005 compliant MSs.
  - This usage will lead to decreased system capacity.

Backwards Compatibility

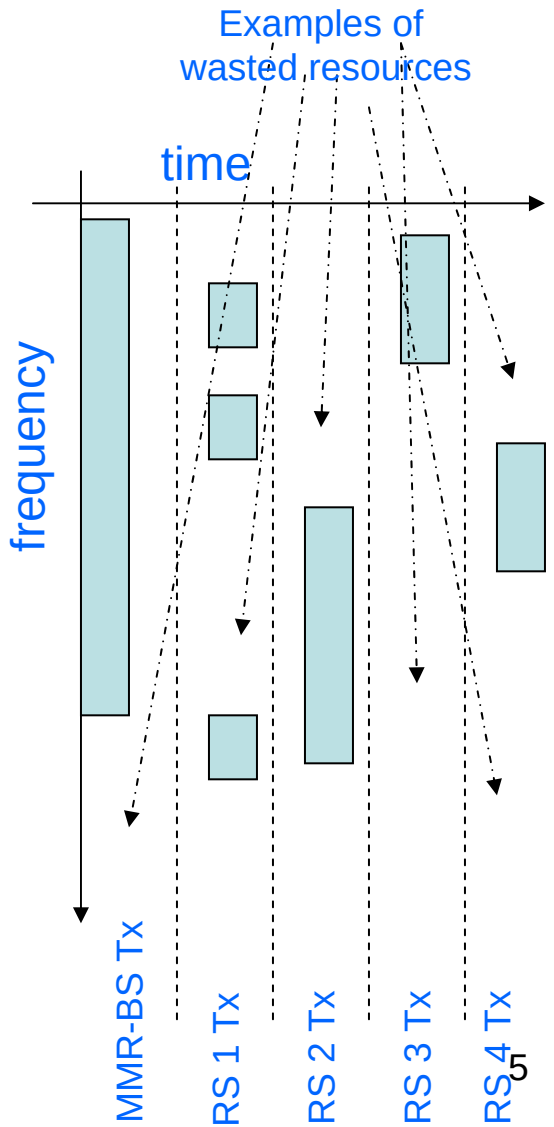
- The 802.16e-2005 spec does not specify that the preamble cannot be used for channel estimation.
- The 802.16e-2005 spec does not specify that MSs must support high speed mobility.
- Standards compliant implementations can use the preamble for:
  - Channel estimation mechanism;
  - Link adaptation mechanism;
- A standards compliant implementation that achieves a given level of performance in an 802.16e network (and uses the preamble for channel estimation) will perform significantly worse in an 802.16j network when the RS does not transmit a preamble.

System Capacity Limitations

- Pilot distribution in the downlink is not designed for multiple transmitters in a symbol.
- Larger cyclic prefix (CP) will need to be used to cover time synchronization errors.

Downlink Pilot distribution mechanism

- Downlink pilots are allocated before subchannels are allocated from remaining available subcarriers.
- No mechanism to separate pilots during simultaneous MMR-BS/RS transmissions so that
  - MMR-BS transmits some pilots;
  - RS transmits other pilots.
- No mechanism to associate pilots with subchannels.
- One option is to have all MMR-BSs and RSs transmit in complete symbols at different times in TDM fashion:
  - This is inefficient – system capacity will decrease
- Another option is to have multiple RSs transmit pilots simultaneously:
  - This will create interference depending how far apart the RSs are!
  - MS/SS cannot be changed and won't be able to distinguish one set of pilots from the other.



Cyclic Prefix Length

- In current systems CP is designed to cover maximum multi-path delay spread.
- When RS does not transmit preamble, the MS synchronizes with the MMR-BS and is unaware of the RS.
- Distance to the RS is different, so a timing error is introduced.
- This error is in addition to the multi-path delay spread, so the length of the CP will have to be increased to cover both delay spread and the additional timing error
- CP length of 1/8 is commonly used. Going to ¼ results in a large drop in capacity.

Recommendation

- We recommend that the RS be required to transmit a preamble when it participates in downlink data transmissions.