

Proposal For Requirement that RS Transmit Preamble

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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.

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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

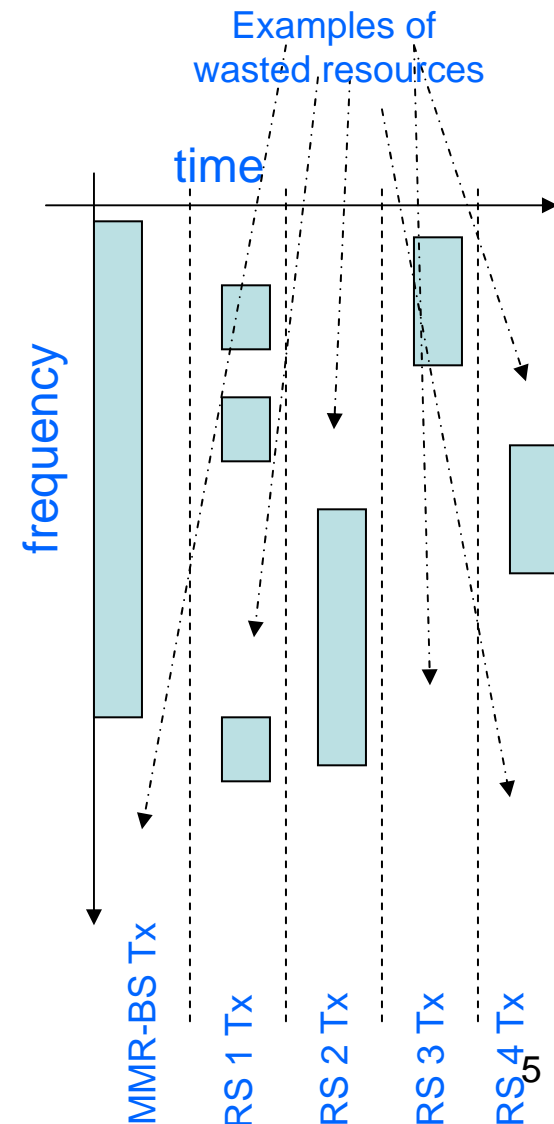
- The 802.16e-2005 spec does not specify that the preamble cannot be used for channel estimation.
- The 802.16e-2005 spec does not specify that MSs must support high speed mobility.
- Standards compliant implementations can use the preamble for:
 - Channel estimation mechanism;
 - Link adaptation mechanism;
- 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 $1/4$ 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.
 - ❖ In the case of macro-STC or macro-diversity handover, whether RS transmits preamble should be controlled by the MMR-BS