Modifications to AAS Mode for OFDMA

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Purpose:

Discussion of new structure to consider for OFDMA AAS mode

Modifications to AAS Mode for OFDMA

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Motivation

- Propose changes to current AAS definition for OFDMA to:
  - work within OFDMA-1X scalable definition
  - resolve issues with current AAS Active DL scan
  - fit well within the existing map definitions in the standard

Current AAS Support in OFDMA

- Active AAS DL Scan
  - Fixed subchannel allocation
  - Iterates over up to 64 different TX strategies, indicating the following:
    - Private ranging allocation (subchannel, num symbols)
    - Private DL MAP allocation (subchannel, num symbols)
  - Concept:
    - SS detects a given “beam”
    - Performs ranging on an allocation using the same RX beam
    - Listens for DL MAP on an allocation using the same TX beam

Issues with Active AAS DL Scan

- Protocol specification includes specifics of implementation pertaining to DOA beamforming which should be removed
- Latency between scan and SS ranging or reception of DL MAP may be a serious problem for a mobility solution
- Vector channel response will vary over frequency, so private DL MAP may need a different TX strategy from the scan

Issues with Active AAS DL Scan

- Ranging solution is applicable only for TDD (assuming the BS actually does use a fixed uplink beam corresponding to the scanning downlink beam)
- Unclear if a transmit strategy has to be fixed with respect to the “beam index”. If so, the available transmit strategies are seriously limited.

Proposed Solution

- Redesign the existing AAS scan mode
- Design principles:
  - Range extension can be achieved only by matching the link budget of broadcast channel with that of directed unicast channel
  - Capacity enhancement can be achieved by supporting low reuse networks and SDMA
    - Mandates the need for unique preambles/training sequences in the uplink and downlink

Bridging Link Budget between Broadcast and Unicast

- Design Philosophy:
  - Minimize the information sent on the broadcast channel
  - Use beam-pattern diversity to obtain diversity gain and (partial) coherent combining gain
  - Use more coding on broadcast channel than the lowest modulation class on the traffic channel

Maps in AAS mode

- Maps in AAS mode should be transmitted as:
  - Broadcast maps (AAS-SICH)
  - Private maps
- AAS-SICH will carry information on:
  - Basic BS parameters (e.g. BSID, frame number)
  - Allocation for uplink network entry, uplink bandwidth request and uplink bandwidth.
- AAS-SICH needs a fixed subchannel allocation or an identifying preamble
- Maps are transmitted repeatedly with beam-pattern diversity

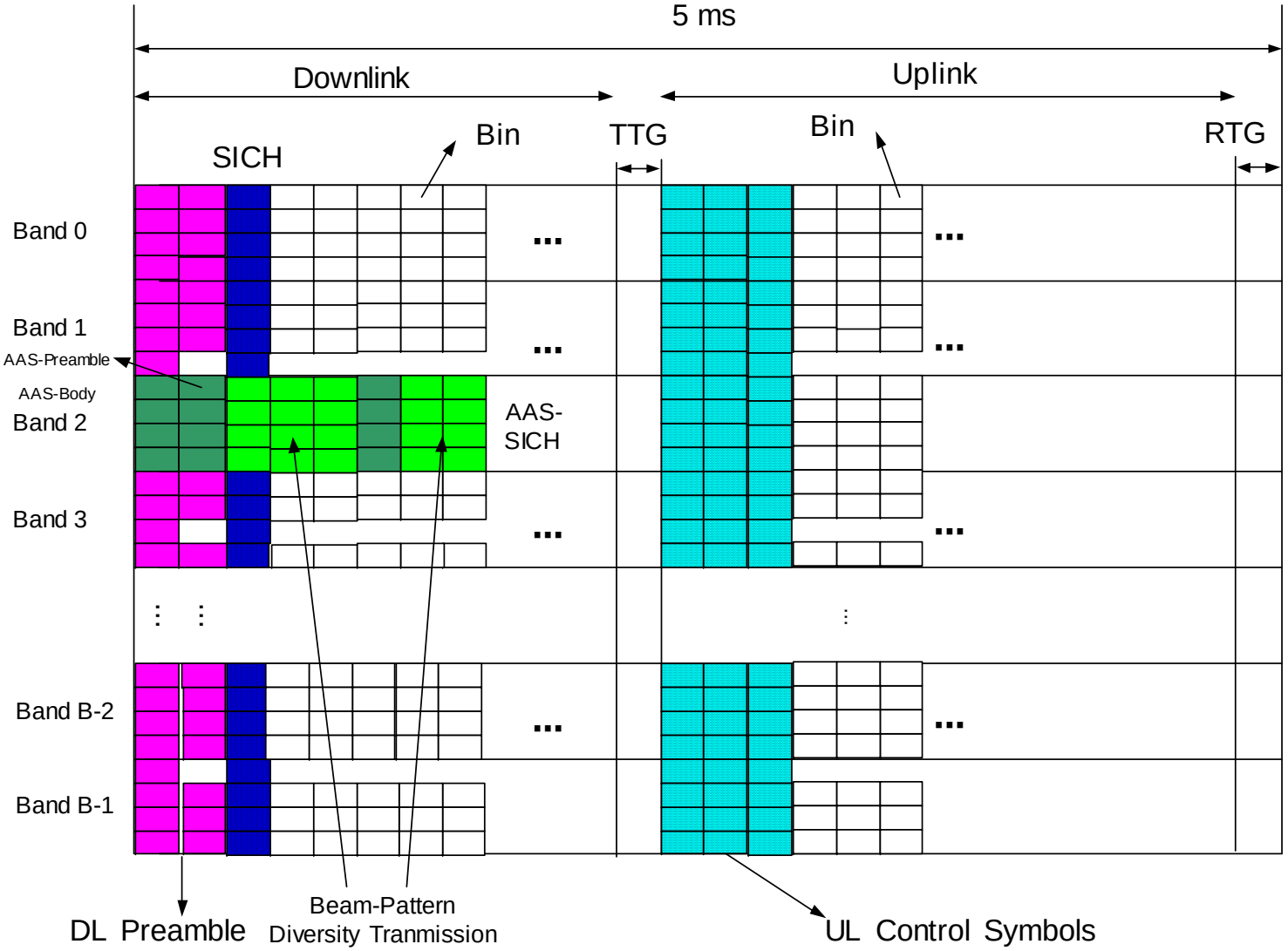
AAS Private Maps

- AAS private mode will carry all other information for the maintenance of further communication between the BS and SS.
- AAS private mode will be on directed unicast channels.
- Directed downlink maps are sent upon receiving an uplink transmission enabling the BS beamformer to estimate the propagation channel and interference environment

Dedicated AAS-SICH

- A dedicated AAS-SICH to carry broadcast maps is introduced.
- Use one or more AMC subchannels to form AAS-SICH carrying:
  - Basic BS parameters (e.g. BSID, frame number)
  - Allocation for uplink network entry, uplink bandwidth request and uplink bandwidth
- SS listens to AAS-SICH and then gains uplink access on the assigned subchannel

Example AAS-SICH Layout



Private Maps

- SS receives further DL maps in the private mode in the directed traffic channel
- Directed map in the current DL frame may be used for assignment either in the current frame or future frame.

Capacity Enhancement

- AAS should perform interference nulling both in the uplink and downlink
- To enable nulling, user signals need to be uniquely identified
- Unique preambles are required in the uplink and downlink

Preamble Design

- A small set of distinct preambles need to be designed to support reuse planning
- Preambles will be assigned as a function of BSID and CID

Specific Text Changes

- TBD

Summary

- Significant changes to the AAS mode in the 802.16 OFDMA PHY is needed
- A scheme using beam-pattern diversity, compressed broadcast map and private maps is required to bridge the gap in link budget between broadcast and unicast
- Distinct preambles need to be designed for uplink and downlink to operate in low reuse networks