Recommendation of Downlink Subframe Control Channel Structure

IEEE 802.16 Presentation Submission Template (Rev. 9)

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[If this slide set is intended to illustrate the content of a base (".doc") contribution, use the serial number of the base contribution, with "S" replacing "C". If there is no base contribution, then use "C" instead of "S" on the slide set.]

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Venue:

TGm Call for comments on SDD, IEEE 802.16m-08/005, in the area of "Downlink Control Structures"

Base Contribution:

[If this presentation accompanies a base 802.16 contribution, cite its contribution number (e.g., IEEE C802.16x-07/NNN).]

Purpose:

Description of what specific action is requested of the 802.16 Working Group or subgroup.]

Notice:

Release:

Patent Policy:

DL Subframe Control Channel Design Proposal

- DL subframe control channel used for
  - ➡ DL allocation and UL grant
  - ➡ Conveying MIMO, redundancy version for HARQ etc.
  - ➡ Indicating pilot format for data resource blocks

- DL subframe control channel transmission supports
  - ➡ Beamforming
    - ➡ **Dedicated pilots which are used to beam-form the control channel**
  - ➡ SFBC and Precoder Based Beamforming
    - ➡ **Common pilots are used for this purpose**
  - ➡ Subframe Bundling
    - ➡ **Multiple subframes share one control channel**
      - ➡ **Reduces overhead**
      - ➡ **Increases coverage**
  - ➡ Microsleep
    - ➡ **Control channel is TDM'd thus saving battery life**

- DL subframe control channel structure
  - ➡ Control channel is per-user based
    - ➡ **Can be power controlled and Beam-formed**
    - ➡ **Connection ID is implicit by exclusively OR'ing it with the CRC**
  - ➡ Control channel is organized into time-frequency resource quanta called control mini-tile (CMT)
  - ➡ Each CMT may contain either dedicated or common pilots
  - ➡ One or multiple CMTs are concatenated to send control information to a user
    - ➡ **Concatenation of multiple CMTs to reduce coding rate and thus increasing coverage**
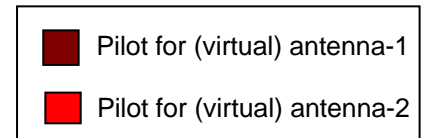
Subframe Control Message
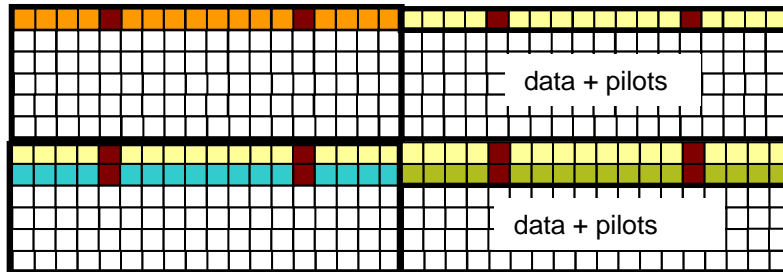
Ex: 1 or 2 baud control for 1 subframe, supporting 1 virtual antenna

Ex: 2 baud control for 2 subframes, supporting 2 virtual antennas
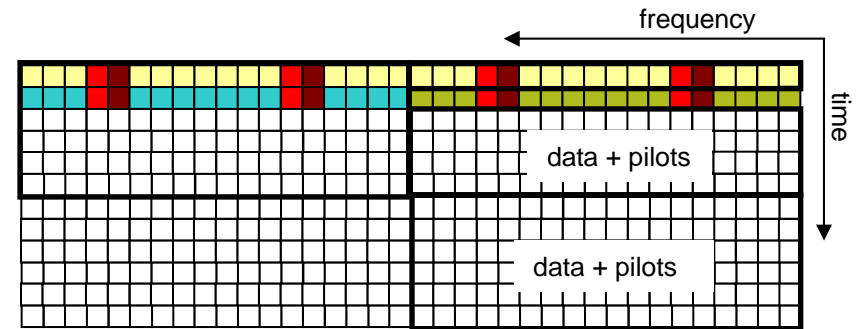
| | Pilot for (virtual) antenna-1 |
| | Pilot for (virtual) antenna-2 |

- **TDM control and data regions**

  ➡ Control Mini-Tiles (CMT) as building block for control channel
  - ➡ **Dedicated pilots used to beam-form subframe control channel**
  - ➡ **Common pilots used for SFBC, Pre-coding or measurement purposes**

  ➡ Flexible # of OFDM symbols for control varied based on system load, MS location etc.
  - ➡ **Lower overhead compared to fixed size control**
  - ➡ **Allow multiple OFDM symbols for control to improve cell coverage**

  ➡ Enable Microsleep to save MS power
  - ➡ **After reading control information on the DL, turning off RF functions until the next control channel**
  - ➡ **Enhanced micro sleep with subframe grouping [Motorola, C80216m-08_008.pdf]**

  ➡ Small buffer requirements and minimum data decoding lag

  ➡ Subframe grouping [Motorola, **C80216m-08_008.pdf**]
  - ➡ **Reduced control overhead**
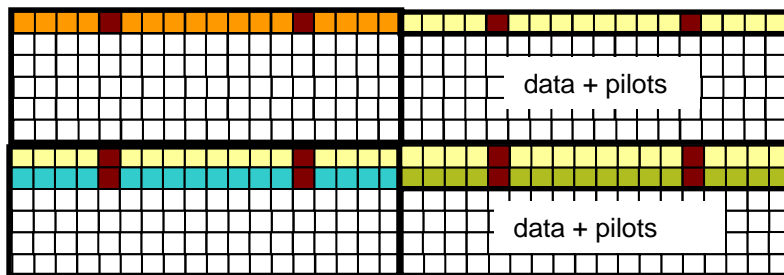 - ➡ **Enhanced micro sleep**

Subframe Control Channel and CMT

• CMT is the minimum building block of subframe control channel

• CMT size is same as two bins of WiMAX AMC: 18 subcarriers x 1 symbol

• Multiple CMT forms one control channel
  ➡ **distributed in frequency**

• Support user-specific beamforming, power control, FFR, MCS

• Enable blind decoding of control information by the MS with limited complexity

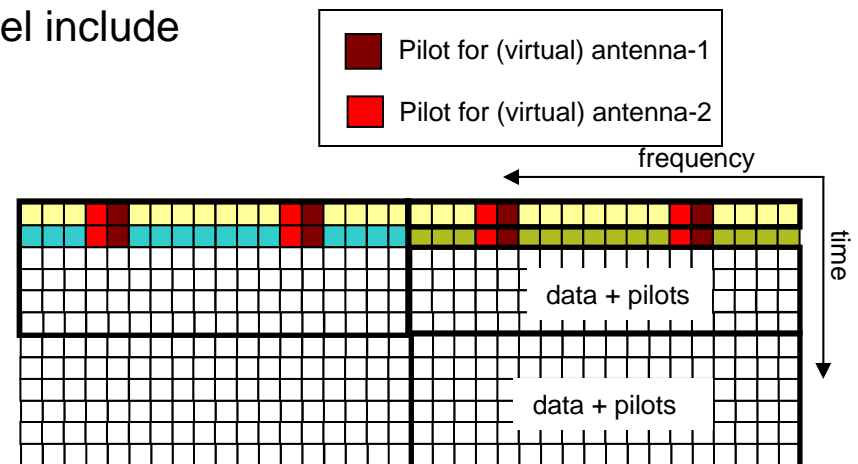• Support multiple virtual antennas (to enable SFBC, beamforming)

time

frequency

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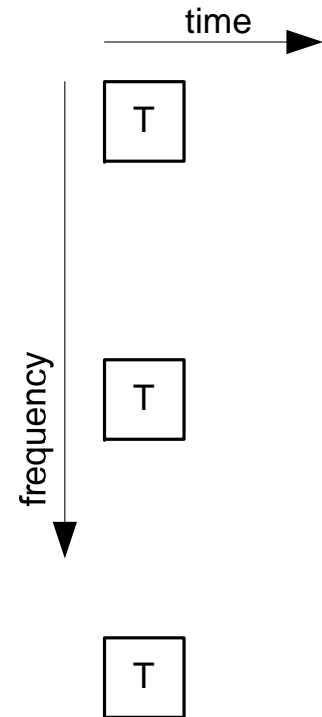
Proposed Text to 16m SDD (Section 11 --- PHY)

- ## 11.x Downlink subframe control channel

  ➡ Subframe control channel conveys DL Allocation, UL Grant, Pilot Format for data region

  ➡ DL subframe control channel is TDM'd with DL data within a subframe

  ➡ Subframe control channel is made up of multiple control channel mini tile (CMT)

  ➡ One CMT contains 18 subcarriers by 1 OFDM symbol

  ➡ Transmission schemes for subframe control channel include

  ➡ Beamforming, SFBC, CDD, Precoding etc

  ➡ CMT permutation

  ➡ Distributed

  ➡ Pilot format for subframe control channel include

  ➡ Common pilot

  ➡ Dedicated pilot

■ Pilot for (virtual) antenna-1
■ Pilot for (virtual) antenna-2

frequency

time

data + pilots

data + pilots

data + pilots

data + pilots

Ex: 1 or 2 baud control for 1 subframe, supporting 1 virtual antenna

Ex: 2 baud control for 2 subframes, supporting 2 virtual antennas