DL subchannelization extension for OFDM mode

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DL subchannelization extension for OFDM mode

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Scope

• To Introduce an extension to 802.16e for providing DL subchannelization.
• An extension to OFDM 256FFT mode.
• Backward compatible to 802.16d
Key features

- Improved frequency reuse factor:
  - DL Subchannelization
  - Robust Low rate codes to support users at very low CINR.

- 16 subchannels DL subchannelization
  - Same subcarrier allocation as 16d UL.

- Midamble based channel estimation
  - All training info is contained within the sub channel
  - Facilitates AAS, Boosting.

- Designed in support for AAS.
Why DL subchannelization?

- Provides link budget improvement:
  - Far away subscribers are assigned subchannel with high power.
  - Near by subscribers are assigned subchannel with low power.
  - Transmit power is limited by average power.
  - Thus some get more than average.
  - ~3-4 dB depending on path loss decay.
Why DL subchannelization? (2)

• Improved frequency reuse factor
  – Partial usage of channel.
  – Same techniques as in OFDMA mode.
  – Sectors/cells are assigned non-overlapping sets of sub-carriers.
  – Reduced probability of two sectors colliding on same set.
Why DL subchannelization (3)

- Low overheads of DL preambles
- Important for AAS.
Design considerations

• Maximize element re-use from 802.16d
  – Carrier allocation
  – Subchannelization format
  – Midambles
• No drastic redesign for 802.16d SSs.
• Simple SS design
  – No concurrent reception
  – SS needs to receive a single burst (control or data) at a time.
  – Simple training structure.
Frame structure

- Frame is divided between OFDM 802.16d and sub-channelized section.
- Subch. section pointed to in 16d map
- Subch. Section is composed of
  - A dedicated preamble.
  - An FCH burst which carries the Down link frames.
  - Subchannelized traffic.
FCH and Downlink Frame Prefix

- FCH is transmitted on the entire BW
- QPSK using rate 1/8
- => Very robust to interference.
- Contains DLFP
  - BSID, frame number, DCD count
  - Pointer to Control Subchannel
  - Rate and length of first burst in CCH
The CCH

• Composed of short PHY bursts, of known length and modulation.
• Each burst contains several MAP-IE, which points to an allocation in the next frame.
• The pointed allocation may contain additional embedded map elements.
• A chain of maps is created.
The CCH (2)

- Map elements may be echoed in the CCH, for recovery in case that one of the embedded map elements was lost.

- BST shall **not** assume that a SS is capable of listening simultaneously to the CCH and to the payload channel.
  - No requirement for concurrent reception of bursts.
CCH (3)

- CCH may be boosted relative to data sub-carriers
  - => provides improved CINR rejection.

- Location of CCH may depend on BSID.
  - => boosted CCHs of different cells do not collide with one another.
Robust low rate FEC codes

- Concatenated basic code (CC BTC CTC LDPC ?) with repetition codes.
- Similar to OFDMA mode.
- 2x and 4x repetitions.
  - 3dB and 6dB improvement in AWGN
  - More in selective fading conditions.
- Only for QPSK
- Repeated symbols are spread in frequency thus providing enhanced frequency diversity.
AAS support

• Proposed structure readily supports AAS
  – DL OFDMA minimizes overhead due to preambles
  – CCH may be used as primary control channel.
  – Preamble+FCH may be repeated to form beam-pattern diversity.

• CCH bursts can either be
  – Transmitted on a wide beam. Boosted relative to other subchannels.
  – Composed of bursts directed towards specific users or regions.
  – Composed of bursts using beam pattern diversity
Thank you !