OFDM based 802.16.3 PHY Proposal

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802.16.3 PHY proposal for presentation, discussion and decision
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OFDM based PHY

- Transmit & Receive chain
DFT sizes

- Channel bandwidth support from 1.5 through 28 MHz

- Advantages of large DFT size:
  - Less overhead due to guard-interval
  - Steeper roll-off at band-edge, allowing higher occupied bandwidth

- Disadvantages of large DFT size:
  - Reduced carrier spacing means increased sensitivity to phase noise and carrier offset estimation errors, meaning tighter specifications and lower receiver sensitivity
  - Higher processing power means more expensive components

- 3 solutions for large bandwidth range support:
  - Constant DFT size with varying sub-carrier spacing
    - => Disadvantage: Wildly varying sub-carrier spacing, symbol and frame durations, varying performance in sensitivity
  - Constant DFT Constant sub-carrier spacing with sub-carrier nulling
    - => Disadvantage: Maximum sampling rate for low-bandwidth/performance devices
  - Varying DFT with with similar sub-carrier spacing
### DFT sizes

- **Varying DFT with with ANSI/ETSI sub-carrier spacing**

<table>
<thead>
<tr>
<th>MHz</th>
<th>FFT #</th>
<th>pilots</th>
<th>data carriers</th>
<th>subcarrier spacing (kHz)</th>
<th>symbol duration (us)</th>
<th>raw data rate (Mbps)</th>
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<td>4</td>
<td>48</td>
<td>23.44</td>
<td>42.67</td>
<td>0.51</td>
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<td>4</td>
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<td>27.34</td>
<td>36.57</td>
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<td>6</td>
<td>106</td>
<td>23.44</td>
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<td>27.34</td>
<td>36.57</td>
<td>10.75</td>
</tr>
</tbody>
</table>

- **Advantage:** Low-performance/bandwidth devices are not burdened by high-performance/high-bandwidth device requirements and have constant sensitivity performance.

- **Various guard intervals should be supported as a system configurable parameter.**
FDD mode

- **Frame size in the order of 10 ms (+/- 200 symbols).**

- **Downlink**
  - Map followed by data in increasing modulation order
  - Midambles are used to mitigate changes in the channel etc..

- **Uplink**
  - Single sub-carrier polling to see if device has data with threshold detection
  - Data sent with short and long preambles as needed
  - A number of adjacent symbols need to be left for random access system entry
• BS sends all data concatenated, as in FDD downstream
• CPEs use long and short preambles as required

• Concerns with broadcast standards in TDD mode
OFDMA Mode

- Using OFDMA requires tighter specification of frequency offset, AGC variation and sampling clock offset errors.

  => Increased cost and complexity?
  => Requires more investigation

- Possibility to assign all sub-carriers to each user allows OFDMA as optional mode.

![Diagram showing OFDMA Mode]

- All sub-carriers assigned to users
- Pure OFDMA
- Downlink: Long preamble, Data
- Uplink: Long preamble
- CPE 1, CPE 2, CPE 3, CPE 4
- Data