OFDM based 802.16.3 PHY Proposal

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Purpose:

802.16.3 PHY proposal for presentation, discussion and decision

- Deployment issues
  - Low installation cost and good coverage required
    - Aiming on BS much more difficult than aiming on satellite
  - Residential installations require unobtrusive antennas
    - No large masts possible to gain LOS
  - Short ranges (due to propagation and capacity limitations) limit choice of BS sites
    - Huge BS structures won't be tolerated

=> Standard should not aim at high directivity antennas

=> Multipath unavoidably severe from deployment constraints

- Robust in adverse channel conditions.
- Allows NLOS operation while maintaining a high level of spectral efficiency.
- It effectively mitigates performance degradations due to multipath and is capable of combating deep fades in part of the spectrum.
- Waveform can be easily modified to adjust to the delay spread of the channel.
- OFDM allows efficient operation in both FDD and TDD mode
  - Only short pre-ambles needed.
  - No need to load channel coefficients for equalizer => No transmitter knowledge required by polling or scheduling

  => MAC flexibility
- More but independent taps in equalizer (one per carrier) => significant simplified equalizer

- **Frequency offset estimation in OFDM and baud timing accuracy in single carrier approaches are equally difficult.**
- **Relatively large Peak-to-average Power Ratio (~ 10 dB) is a drawback**
  - **Various methods are available to reduce this ratio.**

- DFT size
  - Powers of 4 preferred due to Radix-4 algorithm efficiency
  - 64 DFT
    - Legacy technology => Provides fast market entry
    - Comparatively high overhead due to delay spread driven guard intervals
  - 256
    - Higher phase noise requirements
    - Lower overhead due to guard interval
    - Longer training required (frequency offset estimation etc..)
  - 1024 and higher
    - High phase noise requirements (oscillators may get expensive)
    - Low overhead due to guard interval
    - Long training required
    - Traffic burst granularity becomes a big issue

  => Flexibility needed. Also advantageous for longterm relevance of PHY.
    - Scheme as in Breezecom presentation considered.

- Guard interval size
  - Large variation in cell-sizes creates large range in delay spread numbers
  - Selecting guard-interval to fit worst-case scenario causes severe throughput penalty, hence make no sense.

  => Flexibility needed.
  - Granularity of 1 or 2 μs, might make sense.
- Windowing (Roll-off factor or band-pass filtering)
  - Needs to be carefully designed to allow usage of adjacent channels on closely spaced sector-antennas
    - Causes slight reduction in effective guard time.

- Adaptive per-CPE modulation and Power Control required
  - Necessary to optimize capacity
- FEC
  - Convolutional codes and block turbo codes both make sense.
    - For large DFT sizes, turbo codes might be more efficient, for small DFT sizes, convolutional codes might be more practical.
    - Various coding rates needed to facilitate trade-off between throughput and robustness.
- ARQ will be mandated to achieve reliability.
- Modulation:
  - up:BPSK to 16 QAM / down: BPSK to 64 QAM, 64 up and 256 optional
- Antenna diversity support (MIMO, Vector etc..)
  - Should be included as optional.
    - Boosts system performance.
    - Leads to more expensive equipment.