

OFDM based 802.16.3 PHY Proposal

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Purpose:

802.16.3 PHY proposal for presentation, discussion and decision

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- **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.