

Uplink Multiple Access and Design Considerations

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Purpose:

Input to 802.16m SDD.

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Summary

Overview of UL Design Principles

Precoded CDMA for PHY Signaling

Outer-cell Interference Control

Overview of Uplink 802.16m Radio Interface Design Principles

Baseline Design Principles

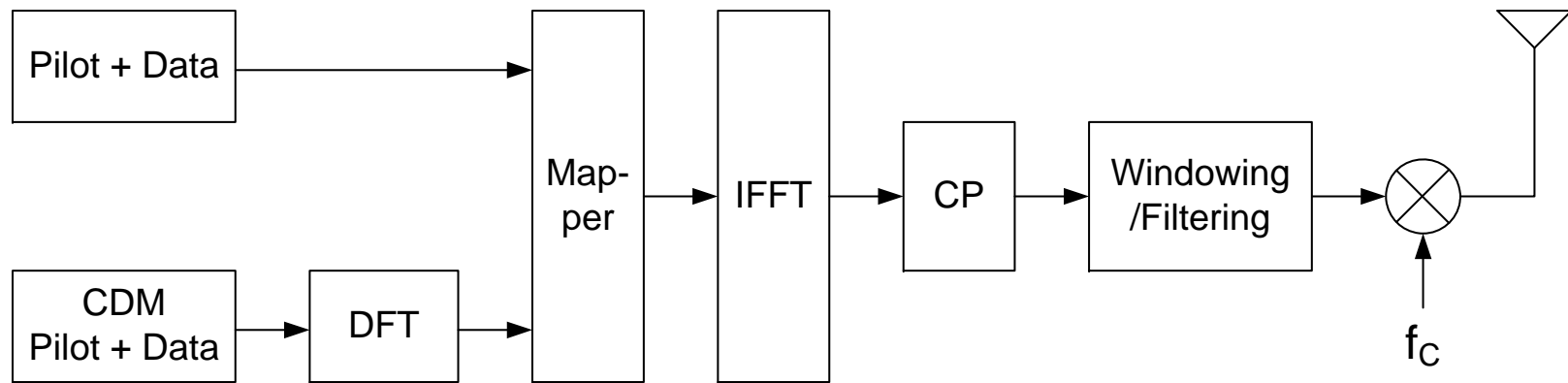
1. Regular PHY signaling (CQI, ACK, etc.) via **Localized Precoded-OFDMA**. Resources are persistently allocated.
 2. Event-based PHY signaling via frequency multiplexed **Localized Precoded-CDMA**. Dedicated resource allocation.
 3. Tight control of the other cell interference via transmit PSD control.
 - Special consideration of elastic to inelastic traffic interference at the cell edge
 - Rapid interference fluctuations at urban canyon environments (slow speeds but small decorrelation lengths).
 4. Trade Fractional Frequency Reuse (FFR) and Tx PSD update rate depending on the load in the RAN.
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Overview of Uplink 802.16m Radio Interface Design Principles

Enhancements Design Principles

1. Overload (Superpose) resources using MU-MIMO.
 - Keep channel estimates clean of interference for superposition order of 2/4
2. Overload (Superpose) resources using codeword dimensions *per antenna* (*Layered Superposed OFDMA*).

Precoded-CDMA Waveform for PHY Signaling Multiplexing with OFDMA Traffic



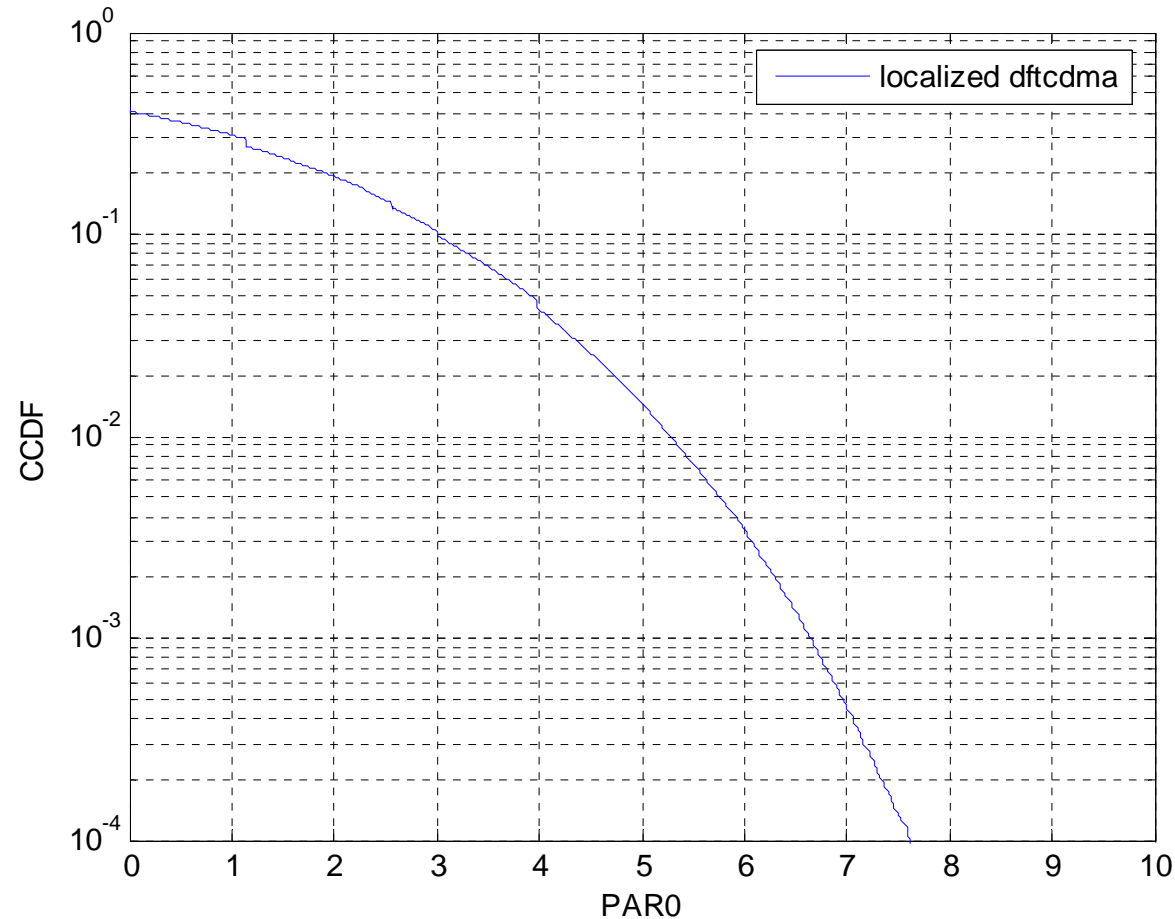
Introduction of **Frequency Zones** (in addition to Time Zones in 802.16e):

- OFDMA traffic tiles and Precoded CDMA signaling are frequency multiplexed. The Precoded CDMA occupies one or more frequency zones.
- The frequency resources allocated to CDMA are localized and hopped across the carrier bandwidth in subsequent interlaces.

Precoded CDMA signaling is periodically transmitted in a subset of the UL subframes.

PAPR of Localized Precoded CDMA

Zone of 64 localized sub-carriers in 512 FFT size



Single DFT precoder with one localized zone exhibits low PAPR as compared to multiple DFT precoders and distributed zones (at the expense of more elaborate receiver algorithms at the BS).

Power Control for Precoded-CDMA

CDMA pilot is always transmitted by all active users

- DTX Pilot when there is no signaling transmission, therefore,
- DTX of the complete transmission chain is possible benefiting battery life if no OFDMA data are present in that interlace.

Estimate CDMA pilot E_c/N_t and compare it to target E_c/N_t and send up down commands via the DL power control signaling channel.

Target E_c/N_t updates (outer loop) can run based on erasures of the block coded PHY signaling

Maintenance of fixed Precoded CDMA SIR target at the base station, allows to control the OFDMA Tx PSD depending on the relationship between the SIR of CDMA and required SIR of OFDMA traffic for the specific MCS.

Tight Interference Control in the OFDMA UL

