Sounding sequence proposal for 802.16m

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"Comments on AWD 15.3.9 (UL-CTRL)"

Base Contribution:

IEEE C80216m-09/0771

Purpose:

Discussion and approval

Introduction

- Sounding sequence definition is missing in the current AWD
- In this contribution we propose sounding sequence for 802.16m and details on the MSs multiplexing schemes

Sounding sequence proposal

- Binary Golay sequence of length 2048 bits from 802.16e standard
- Common for all FFT sizes, multiplexing schemes and parameters of the corresponding multiplexing schemes
- Unique sequence for each cell and sector
- Guarantees low PAPR and cross correlation values

Support of FDM and CDM

- FDM subcarrier modulation

subcarrier symbol

sounding allocation

$$b_k = \begin{cases} 2 \cdot \left(\frac{1}{2} - G\left([k + u + offset_D(fft)] \bmod 2048 \right) \right), & k \in B, k \neq \frac{N_{used} - 1}{2}, k \bmod D = g \\ 0 & \text{otherwise} \end{cases}$$

baseline binary Golay sequence

subcarrier decimation

- CDM subcarrier modulation

multiplexing code

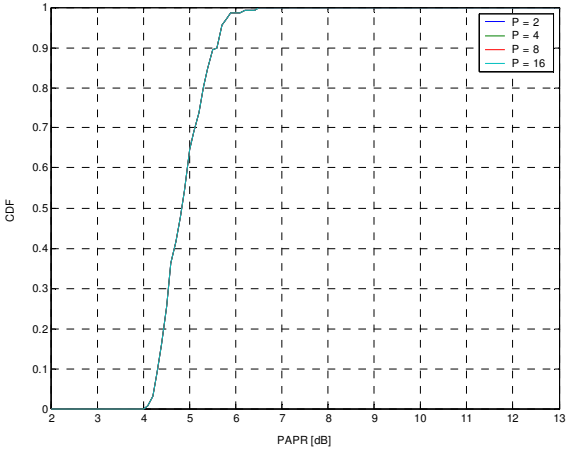
$$b_k = \begin{cases} 2 \cdot \left(\frac{1}{2} - G\left([k + u + offset_D(fft)] \bmod 2048 \right) \right) \cdot e^{-j2\pi \frac{k}{P} n}, & k \in B, k \neq \frac{N_{used} - 1}{2} \\ 0 & \text{otherwise} \end{cases}$$

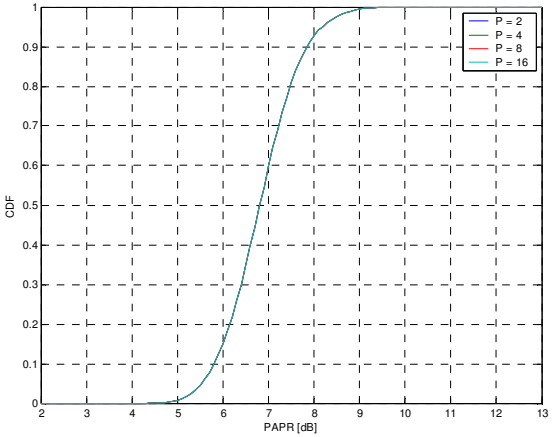
cell/sector specific offset

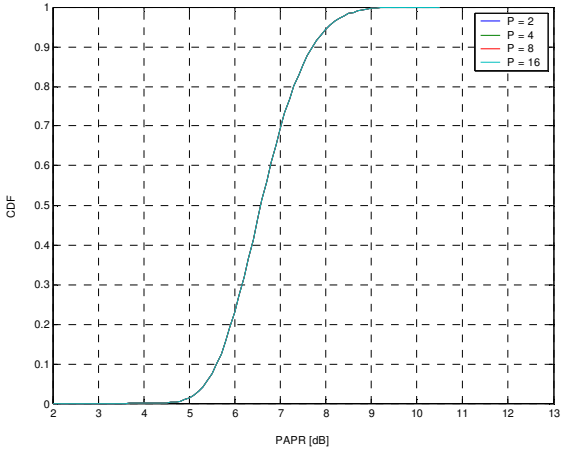
FFT dependent offset to min. PAPR

PAPR Performance

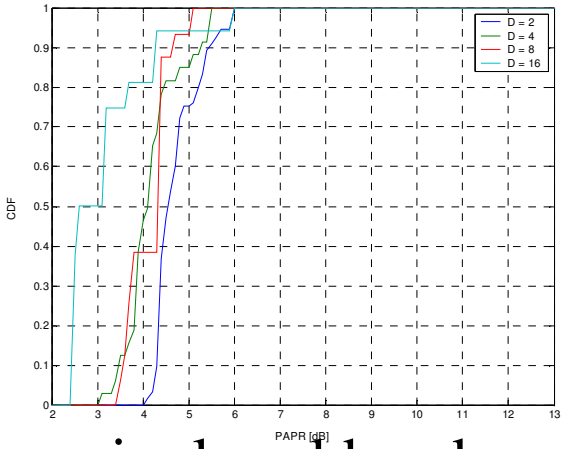
CDM



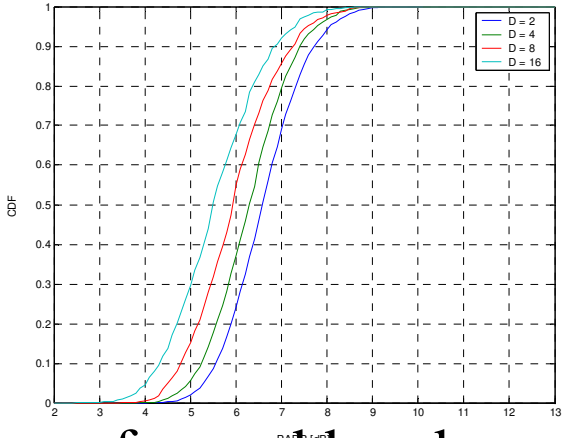




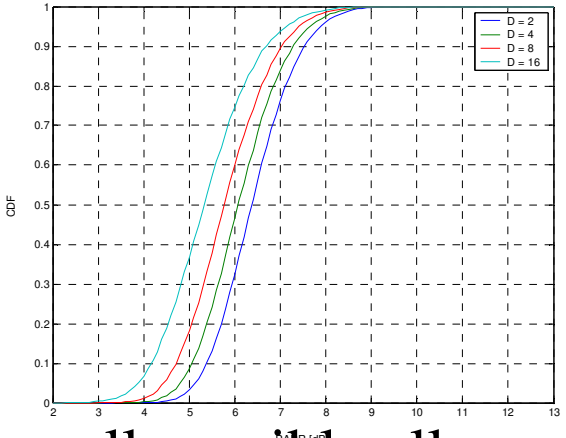
FDM



single subband

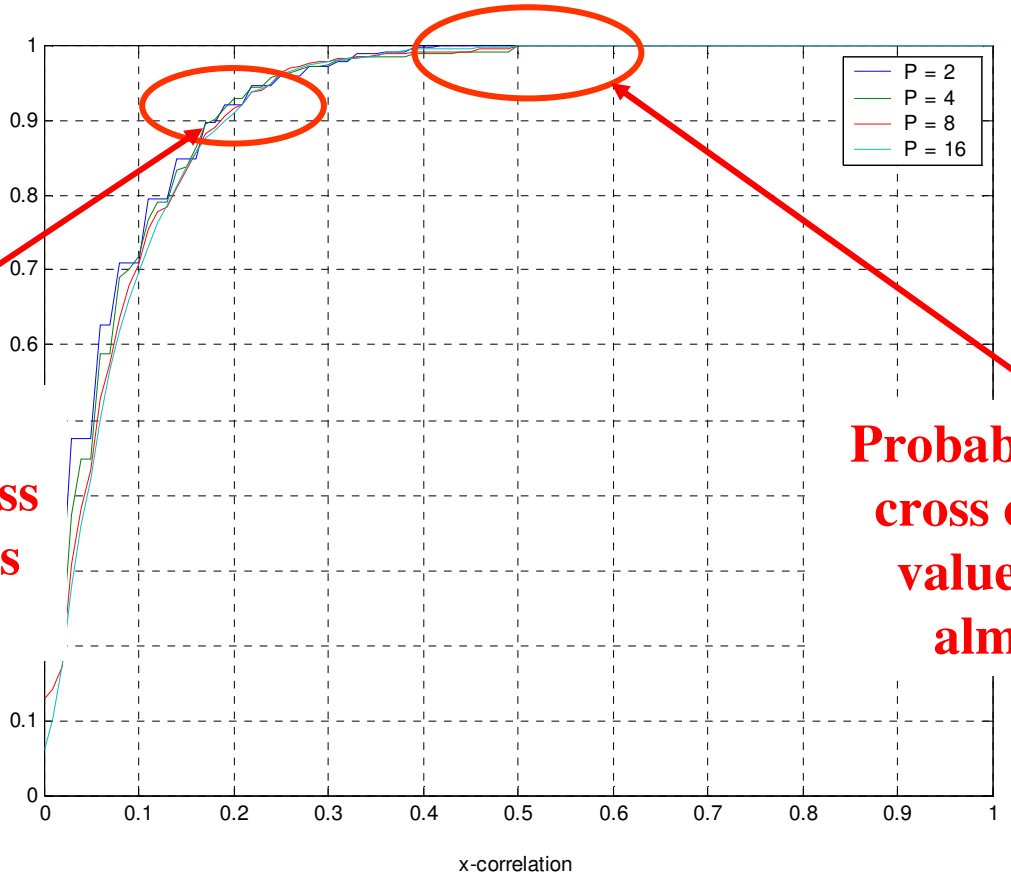


four subbands



all possible alloc.

Cross correlation performance



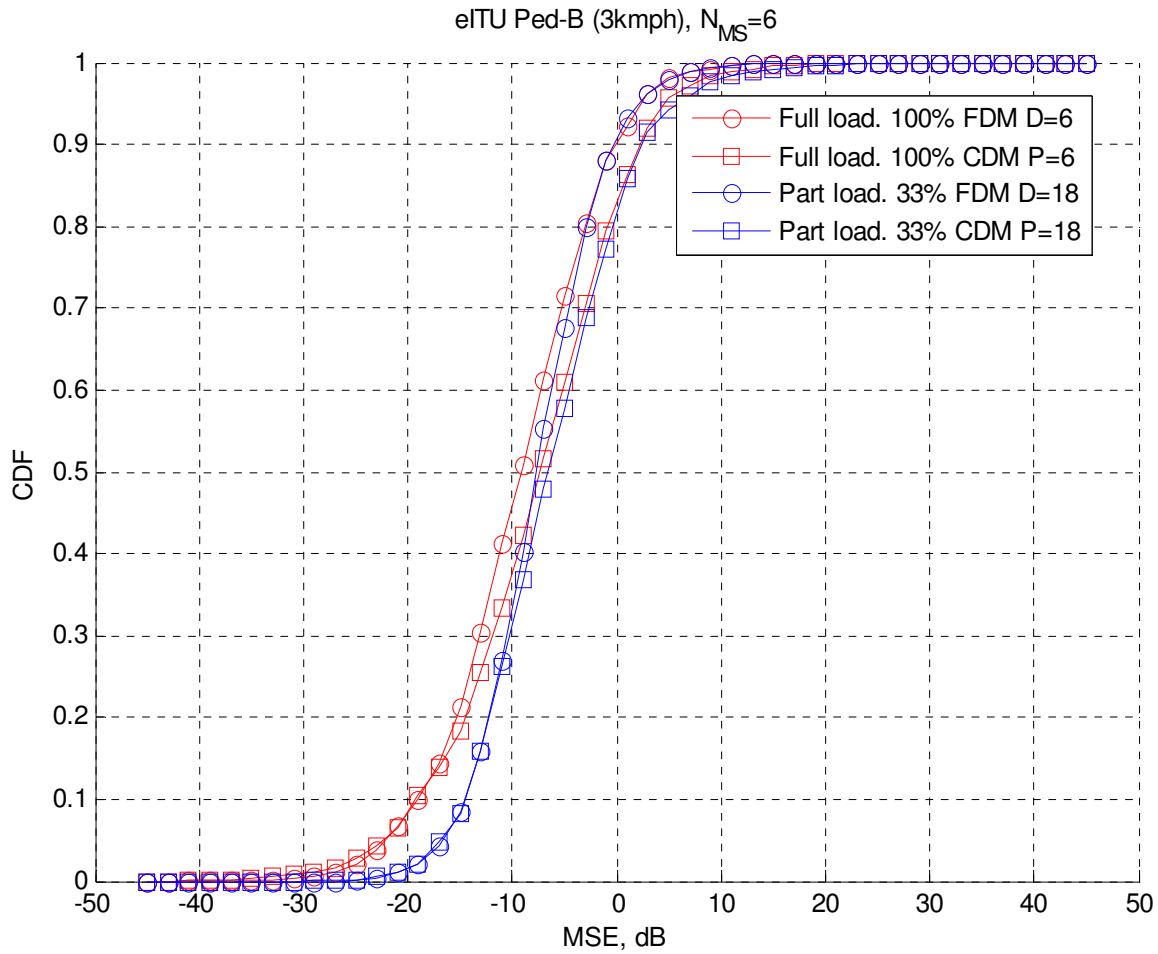
90% of the sequences has cross correlation values less than 0.2

Probability of high cross correlation values (>0.5) is almost zero

Simulation conditions

System Parameters	1024 FFT, 10 MHz, 2.4GHz
Sounding Sequence	Golay
Loading	Full Loading (100%): $N_{MS} = D = P = 6$
	Partial Loading (33%): $N_{MS} = 6$, $D = P = 18$
Multiplexing	FDM (D decimation), CDM (P max. cyclic shift)
Number of interfering sources	57 sectors
Target SINR	10 dB
Estimation	LS+MMSE

System level performance analysis



Conclusion

- The proposed sequence provides low PAPR and cross correlation characteristics
- The performance of CDM and FDM have been validated using system level simulations
- The proposed sequence is the same as 802.16e sequence which is preferable in terms of implementation complexity
- Recommendation is to adopt the text provided in IEEE C80216m-09/0771 contribution or it's latest revision