

5G Waveform Techniques

Module 1: PHY Enhancements

Ljiljana Marijanovic

ljiljana.marijanovic@nt.tuwien.ac.at

November 15, 2016



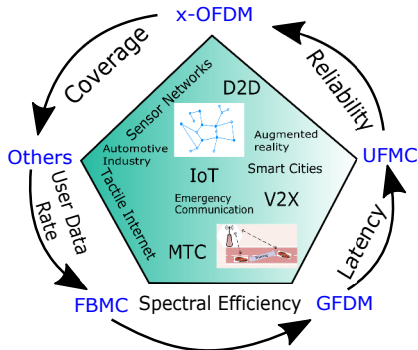
NOKIA

bmwfw
Bundesministerium für
Wissenschaft, Forschung und Wirtschaft



KATHREIN
Antennen · Electronic

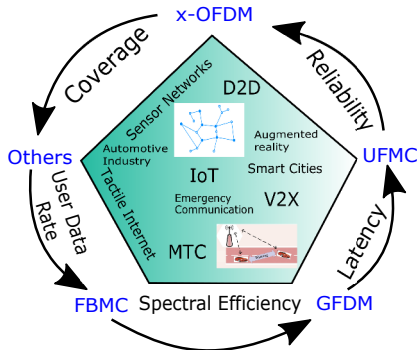




Requirements

- ▶ <1ms latency
- ▶ Mobility
- ▶ 100 Mbps
- ▶ 10-100x more devices
- ▶ Energy efficiency
- ▶ Low cost

Investigating the **most flexible** technique!



Requirements

- ▶ <1ms latency
- ▶ Mobility
- ▶ 100 Mbps
- ▶ 10-100x more devices
- ▶ Energy efficiency
- ▶ Low cost

Investigating the **most flexible** technique!



Filter Bank Multicarrier - FBMC

Universal Filtered Multicarrier - UFMC

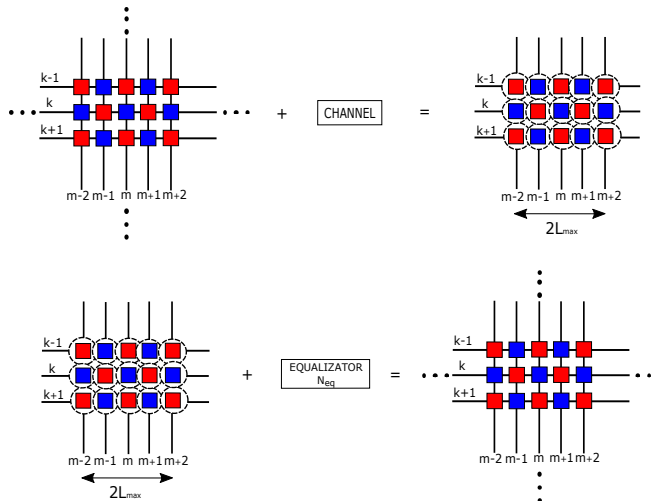
Outlook



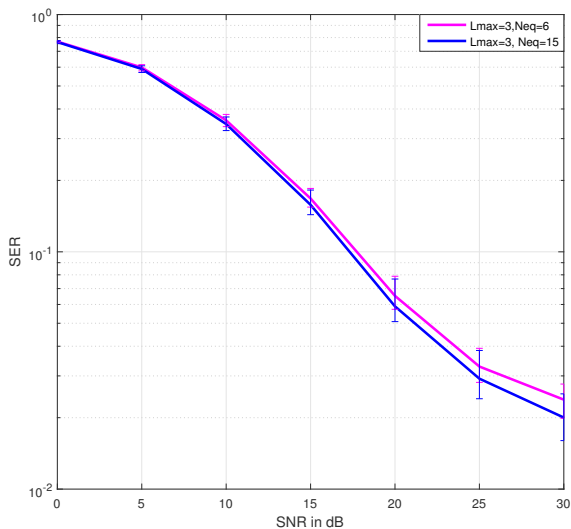
Filter Bank Multicarrier - FBMC

Universal Filtered Multicarrier - UFMC

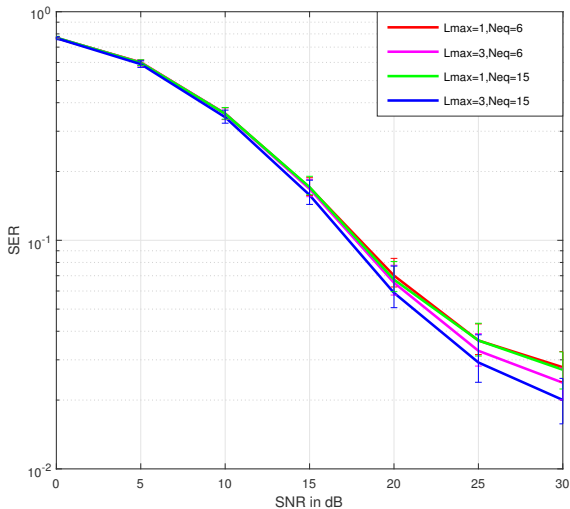
Outlook

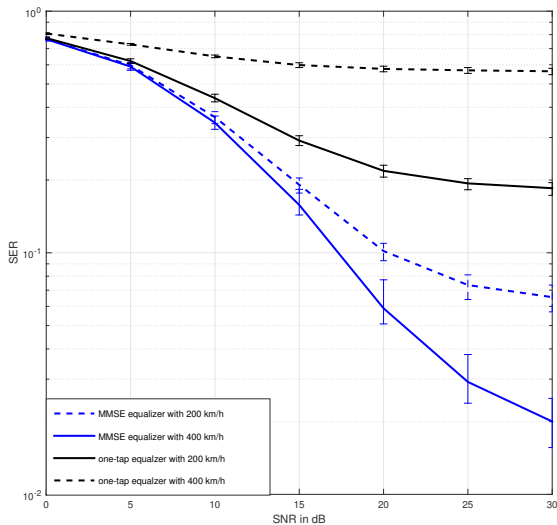


Results - Impact of Different Lengths of Equalizer



Results - Impact of Different Lengths of Impulse Response



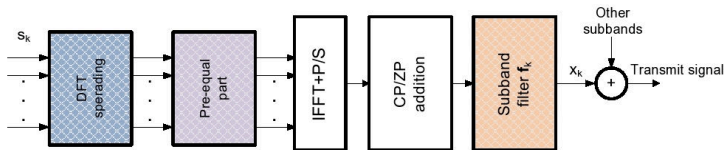




Filter Bank Multicarrier - FBMC

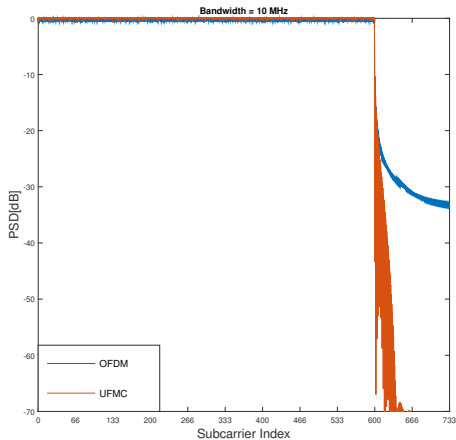
Universal Filtered Multicarrier - UFMC

Outlook

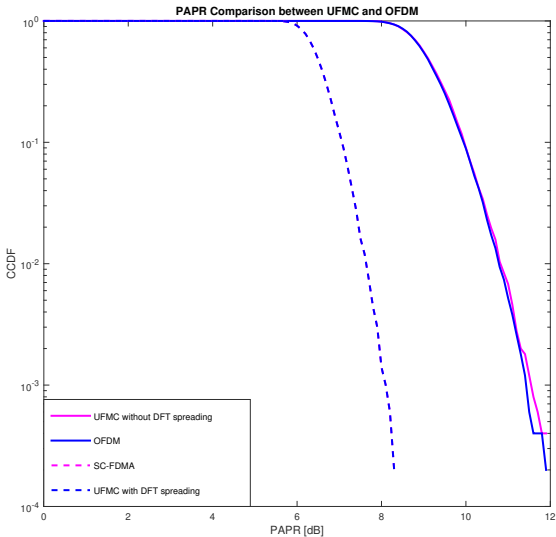


- ▶ Preserved orthogonality between subcarriers
- ▶ Zero Postfix or Cyclic Prefix avoid ISI
- ▶ Similar complexity as in CP-OFDM
- ▶ Possible DFT spreading for PAPR reduction

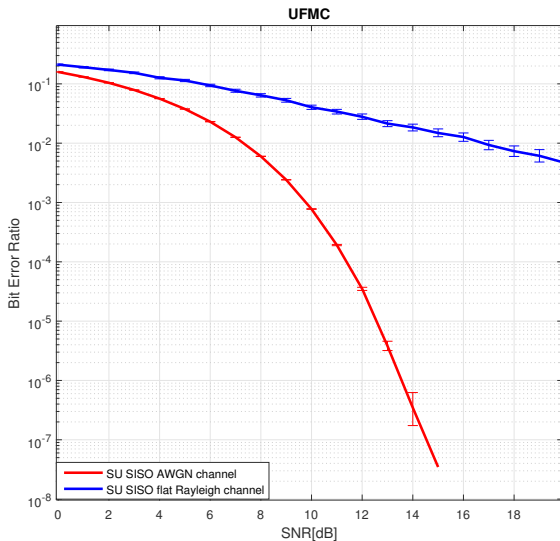
¹ R1-165014 "Subband-wise filtered OFDM for New Radio below 6GHz" Nokia, Alcatel-Lucent Shanghai Bell, May 2016



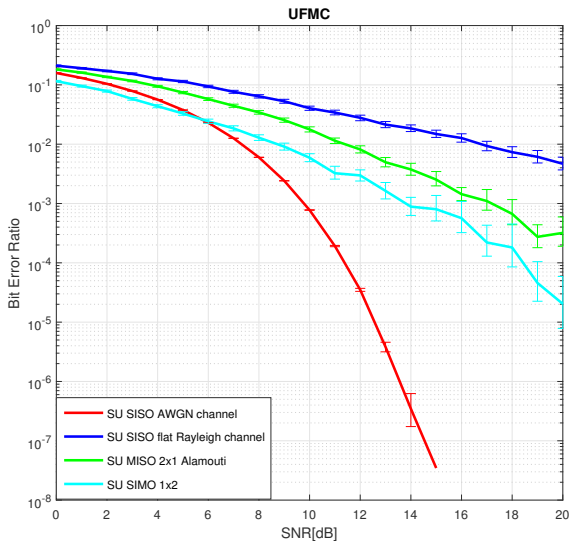
- ▶ Improved out-of-subband radiation
- ▶ Better support of fragmented spectrum



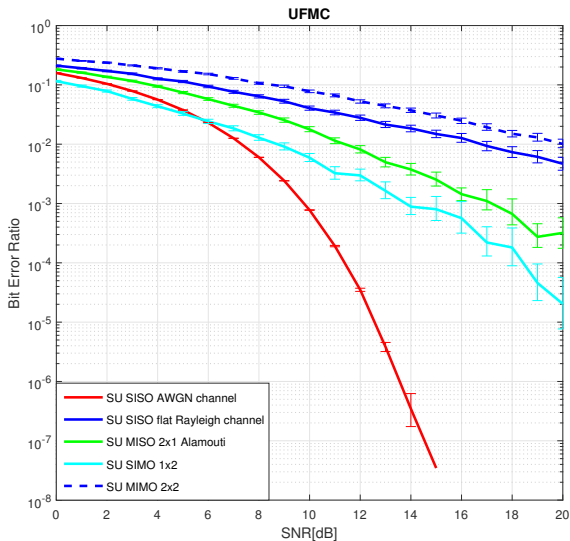
BER Performance for Different Transmission Modes



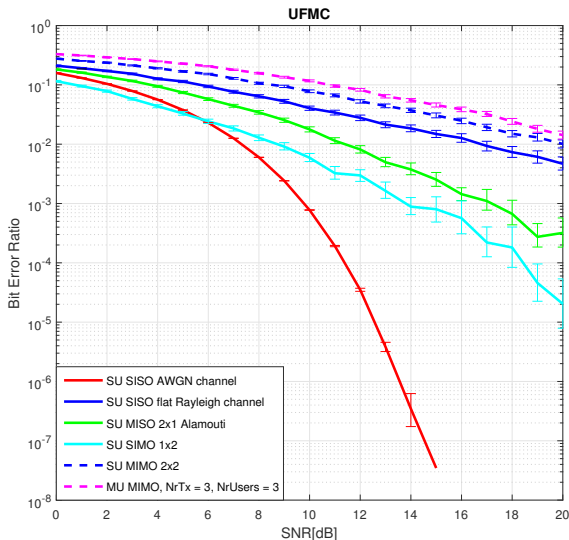
BER Performance for Different Transmission Modes



BER Performance for Different Transmission Modes



BER Performance for Different Transmission Modes



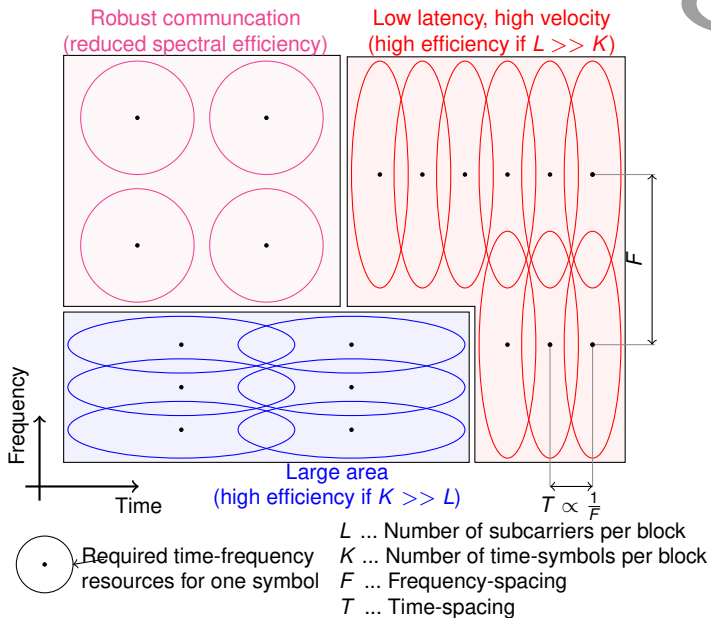


Filter Bank Multicarrier - FBMC

Universal Filtered Multicarrier - UFMC

Outlook

Multi-user parameters optimization





- ▶ Presence of ICI even for AWGN channel!
- ▶ Smaller overhead than in OFDM \Rightarrow Time-frequency efficiency is better!
- ▶ Tradeoff between time-frequency efficiency and ICI \Rightarrow optimal length of the filter and number of guard subcarriers?

Thank you for your attention!
ljiljana.marijanovic@nt.tuwien.ac.at



- ▶ Presence of ICI even for AWGN channel!
- ▶ Smaller overhead than in OFDM \Rightarrow Time-frequency efficiency is better!
- ▶ Tradeoff between time-frequency efficiency and ICI \Rightarrow optimal length of the filter and number of guard subcarriers?

Thank you for your attention!

ljiljana.marijanovic@nt.tuwien.ac.at

