R1-0501240

3GPP TSG-RAN1 Meeting #42bis

San Diego, USA, 10th-14th, Oct. 2005

Agenda Item:	**8.2**
Source:	**Nortel**
Title:	**UL OFDMA Performance with Real Channel Estimation**
Document for:	**Discussion**

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Uplink OFDMA Performance with Real Channel Estimation

Nortel
October, 2005

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- UL cluster structure and pilot allocation
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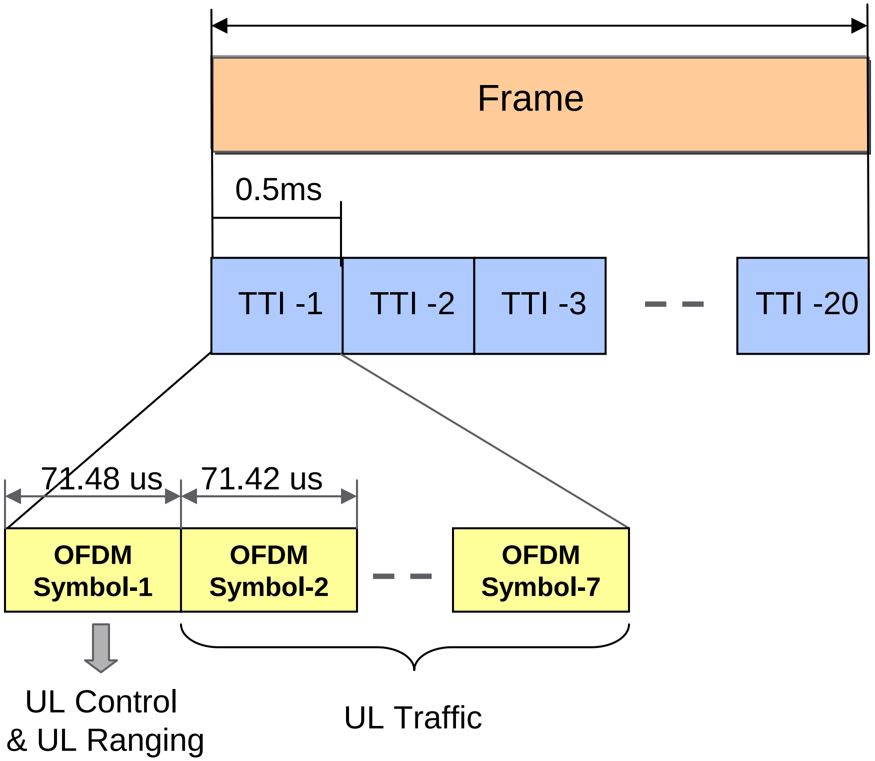
Introduction

> OFDMA has been proposed as a candidate UL transmission scheme.
  - The OFDMA UL detail design are given in Ref-1

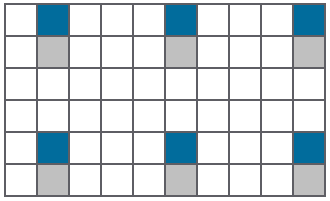
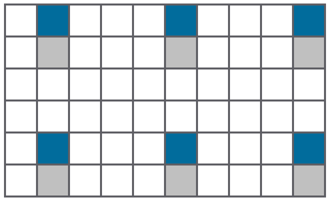
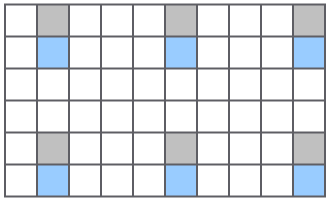
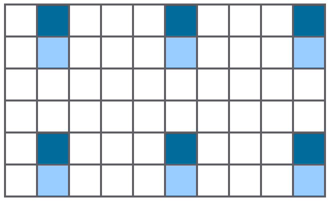
> To investigate the impact of the real channel estimation to UL OFDMA performance, simulations have been done under different scenarios:
  - Antenna configuration: 1x2 (non-MIMO) and 2x2 (MIMO)
  - Sub-channel types: diversity and sub-band
  - Channel: ITU-VA 30km/h.

Simulation Assumption: UL OFDMA Frame Structure



Simulation Assumption: UL Cluster and Pilot Allocation

- For Two Antennas

Non-MIMO UE		
Collaborative MIMO **with 2 non-MIMO UEs**	**UE-1 (pattern-A)** 	**UE-2 (pattern-B)** 
Two transmit antenna UE		

■ **Antenna #1 pilot** 🟦 **Antenna #2 pilot** □ **Data** ▨ **Null**

Simulation Assumption: OFDM Parameters

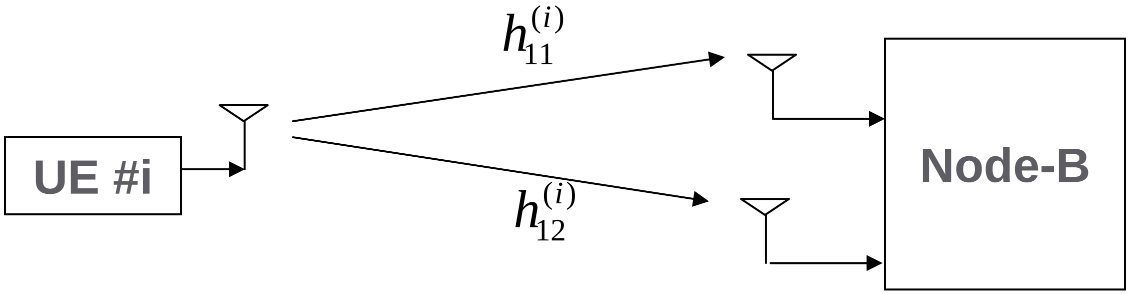
– *10 MHz Bandwidth*

> IFFT/FFT Block = 1024
> CP length = 73 samples
> Useful carriers: 600 carriers (not include DC)
> Each Channel contains 4 clusters (192 traffic tones)
> One turbo code block per TTI (TTI = 0.5 ms)
> Pilot modulation: QPSK
> Pilot power boost: 3 dB
> Channel scenario: VA, 30 km/hr
> Node-B receivers: ZF for 1x2, MLD for 2x2 SM

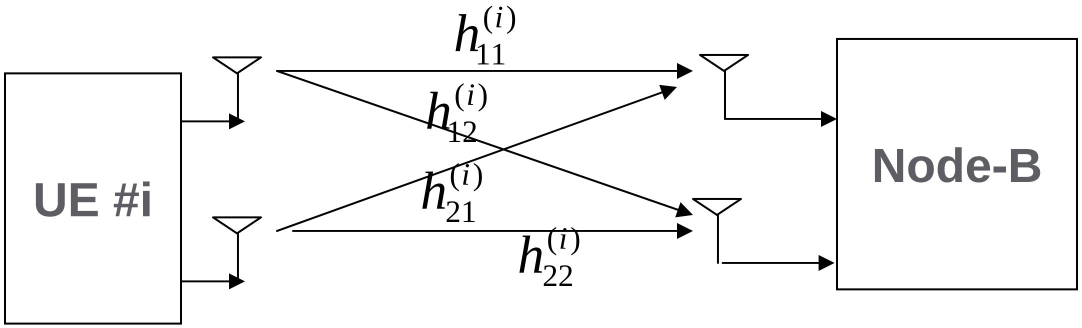
MCS	Modulation	Code Rate
1	QPSK	1/2
2	QPSK	2/3
3	QAM-16	1/2
4	QAM-16	2/3

Simulation Assumption: UL Transmission Scenarios

1. 1x2



2. 2x2 single user SM

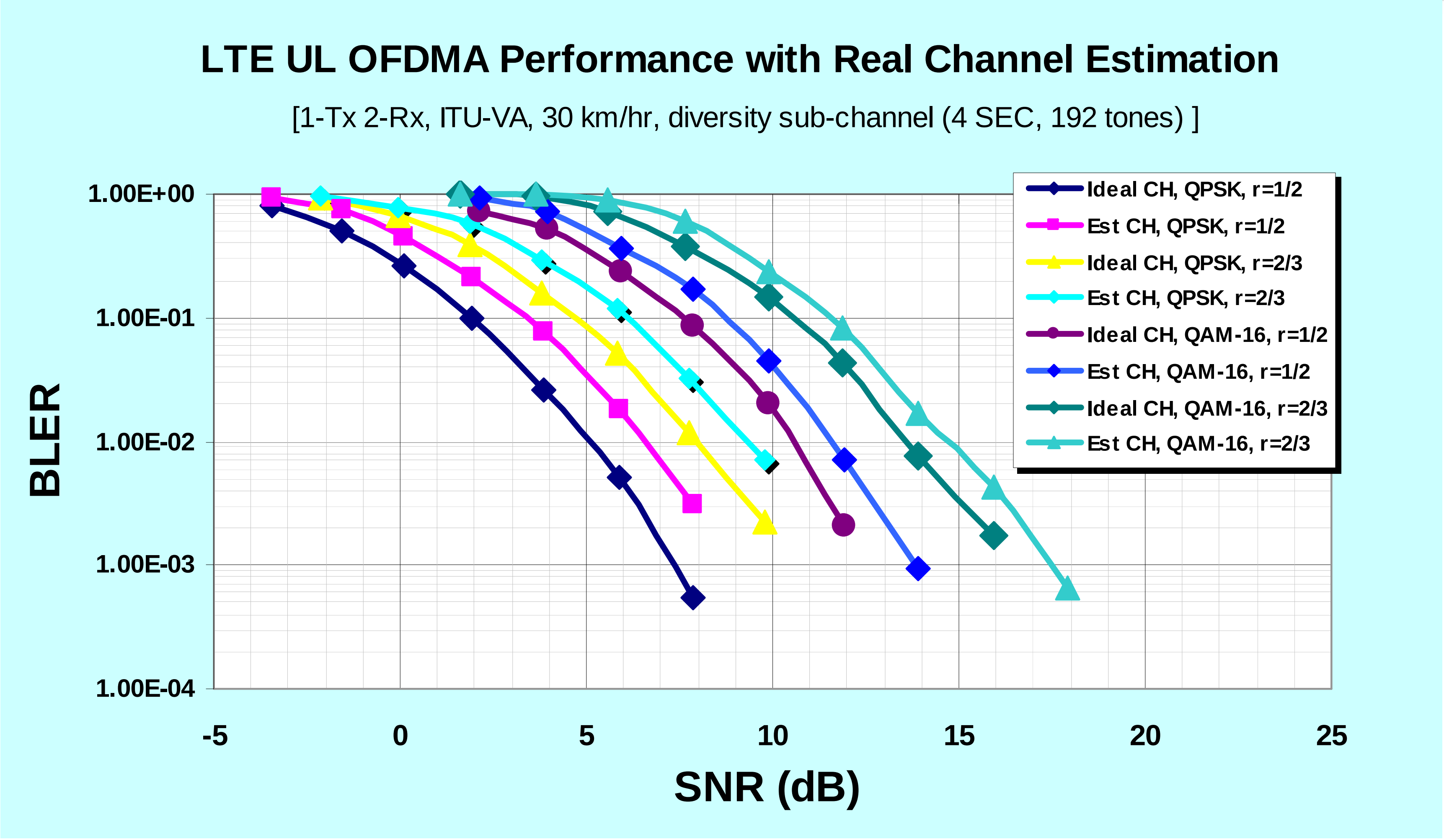


Node-B Channel Estimation Algorithms

- For QPSK, averaging along one dimension (time/freq) based on the outcome of an adaptive averaging direction determination method, followed by linear interpolation/extrapolation along the second direction
- For QAM-16, linear interpolation/extrapolation along time dimension followed by the Lagrange interpolation/extrapolation along frequency dimension

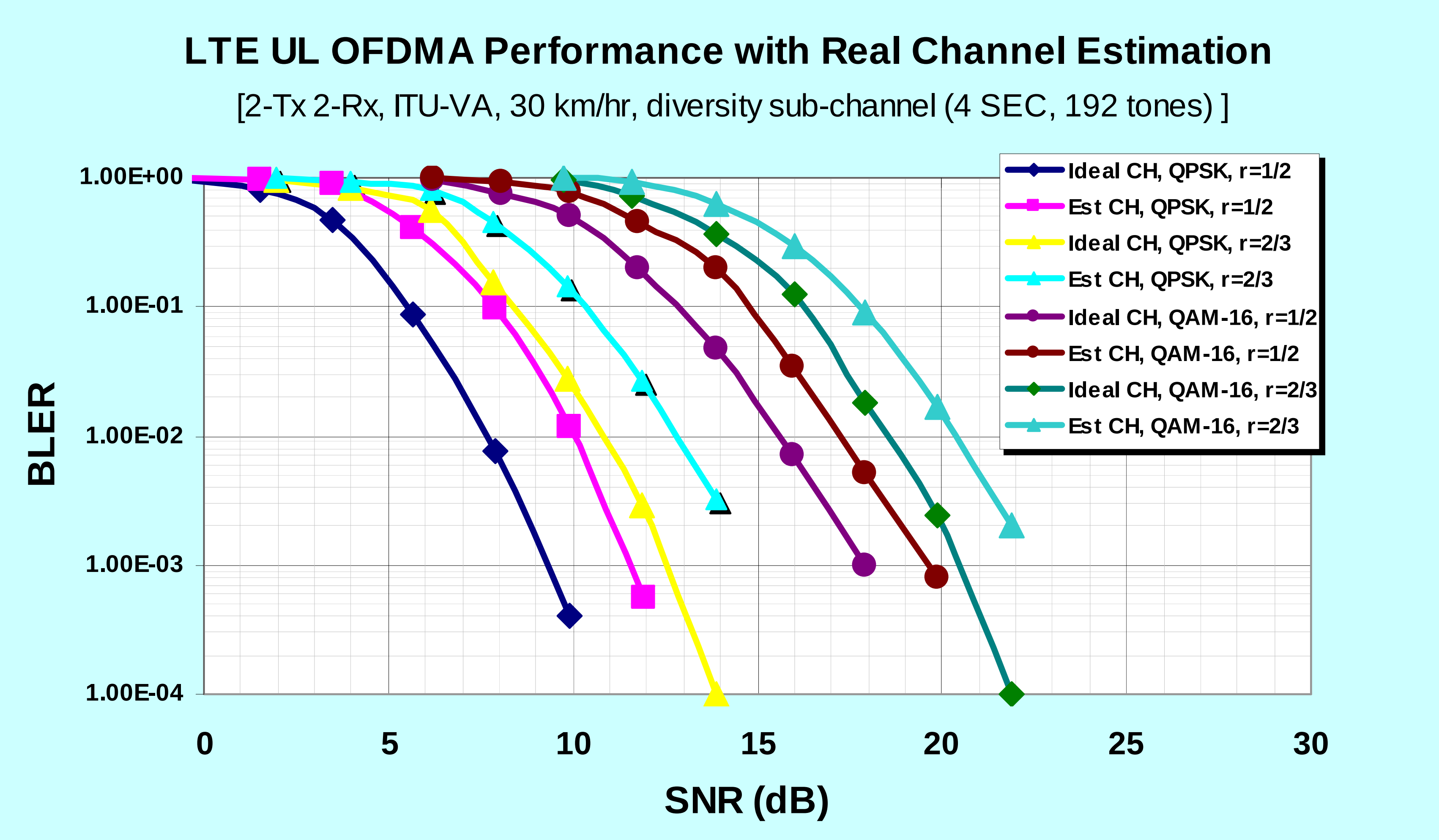
Simulation Results - Non MIMO

Diversity Sub-channel , (1x2)



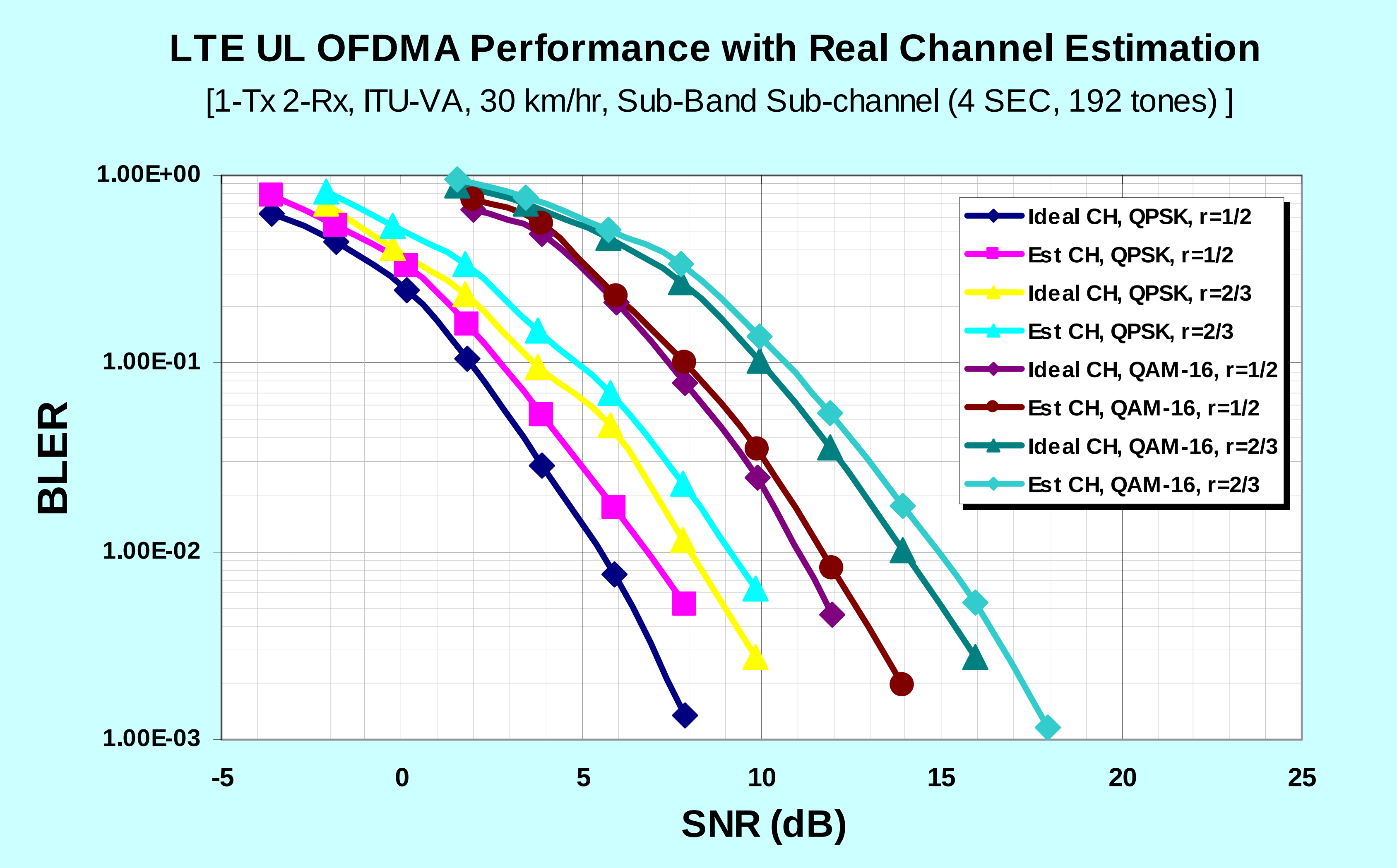
Simulation Results - MIMO

Diversity Sub-channel , (2x2)



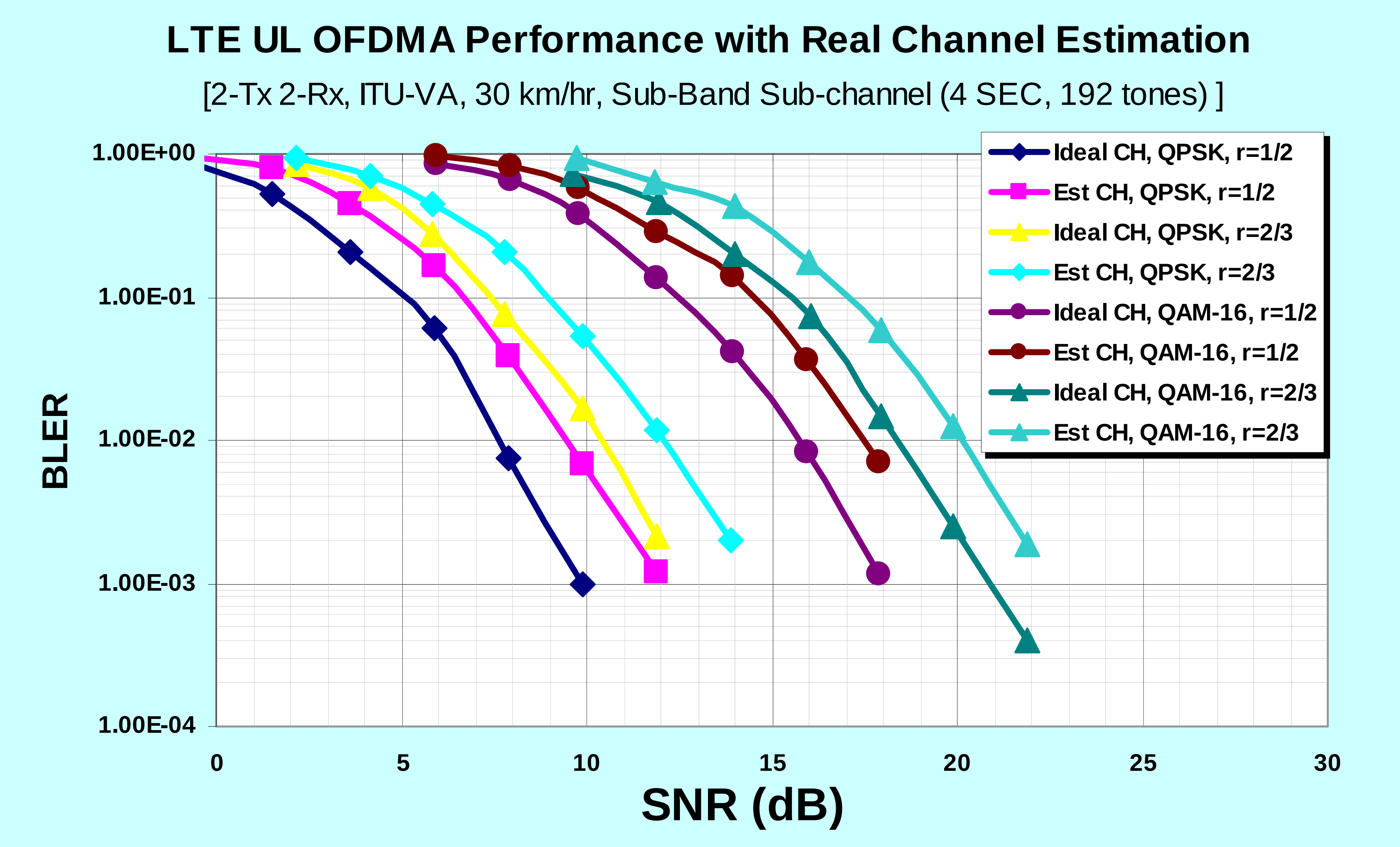
Simulation Results - Non MIMO

Sub-Band Sub-channel , (1x2)



Simulation Results - MIMO

Sub-Band Sub-channel , (2x2)



Observations and Summary

- In the presence of real channel estimation, OFDMA UL can achieve high link level performance
  - The performance degradation from real channel estimation is reasonable according to the pilot allocation scheme in Ref-1
    - For 1x2, the channel estimation degradations range from 1.5 dB for QPSK to 1 dB for QAM-16.
    - For 2x2 SM (single user) the channel estimation degradations range from 2 dB for QPSK to 1.5 dB at QAM-16
- UL OFDMA transmission scheme requires less pilot overhead compared to single carrier based UL, especially for MIMO transmission.

Reference

- Ref-1:R1-051165 (resubmission of R1-050926):” Proposal for the Uplink Multiple Access Scheme for E-UTRA (Update)” Oct, 2005