Project	**IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**>**
Title	**Simulation Results for Common and Dedicated Pilots**
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Re:	Call for Comments and Contributions on Project 802.16m System Description Document (SDD). Target topic: “SDD Comments on DL Pilot Scheme”.
Abstract	This contribution provides the simulation results for various common and dedicated pilot schemes supporting downlink MIMO transmissions.
Purpose	For discussion and approval by TGm
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Objectives

- This contribution provides the performance comparison of various common pilot and dedicated pilot schemes for downlink MIMO transmission.
- The simulation results show that common pilot plus the on-demand dedicated pilot [1,2] is an efficient MIMO pilot structure for various MIMO configurations and channel scenarios.

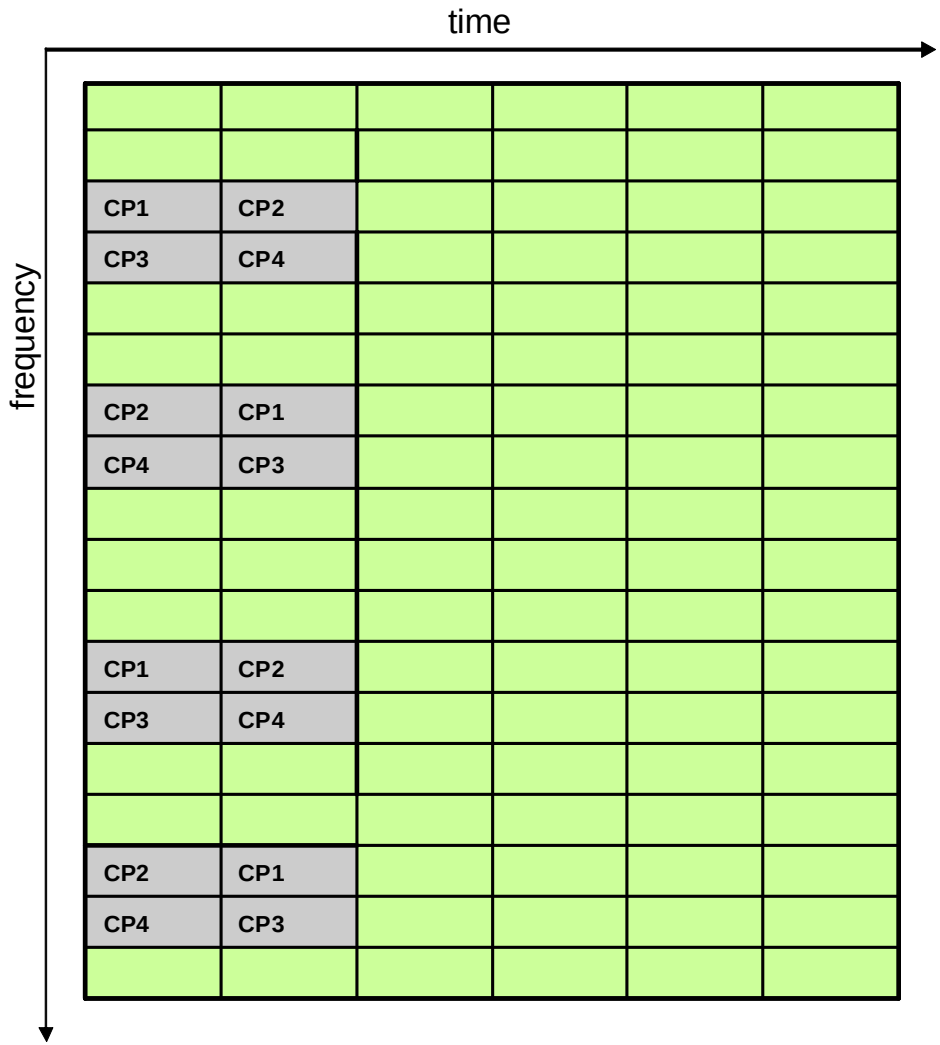
[1] C80216m-08_214r1, Zhigang Rong, et al, “16m Downlink Common Pilot Structure for TDM Control Structure”, March 10, 2008, IEEE 802.16m contribution

[2] C80216m-08_215r1, Young Hoon Kwon, et al, “16m Downlink Dedicated Pilot Structure for TDM Control Structure”, March 10, 2008, IEEE 802.16m contribution

Proposed Common Pilot Pattern

Grey: Common pilot

Green: Available for data and control. Dedicated pilot can be sent over the last four OFDM symbols based on needs.



Simulation Parameters

- Carrier frequency: 2 GHz
- System BW: 5 MHz
- Channel Model: Extended ITU Ped. B (3km/h) and Veh. A (120km/h,)
- Antenna Configuration: 2x2-1stream, 4x2-1stream, 4x2-2streams
- Correlated Tx antenna with 4 λ spacing and Uncorrelated Rx antennas
- Tile size = 18 subcarriers * 6 symbols
- Two PRUs are allocated
- Packet size and Modulation:
  - –QPSK: 192 for 1 stream and 384 for 2 stream
- Dedicated pilot pattern is summarized in C80216m-08_253 and C80216m-08_029 (Samsung's new pattern)
- SVD-based precoding vector is applied
- Throughput = (1-PER)*PacketSize/(Subframe duration)

Simulation Parameters

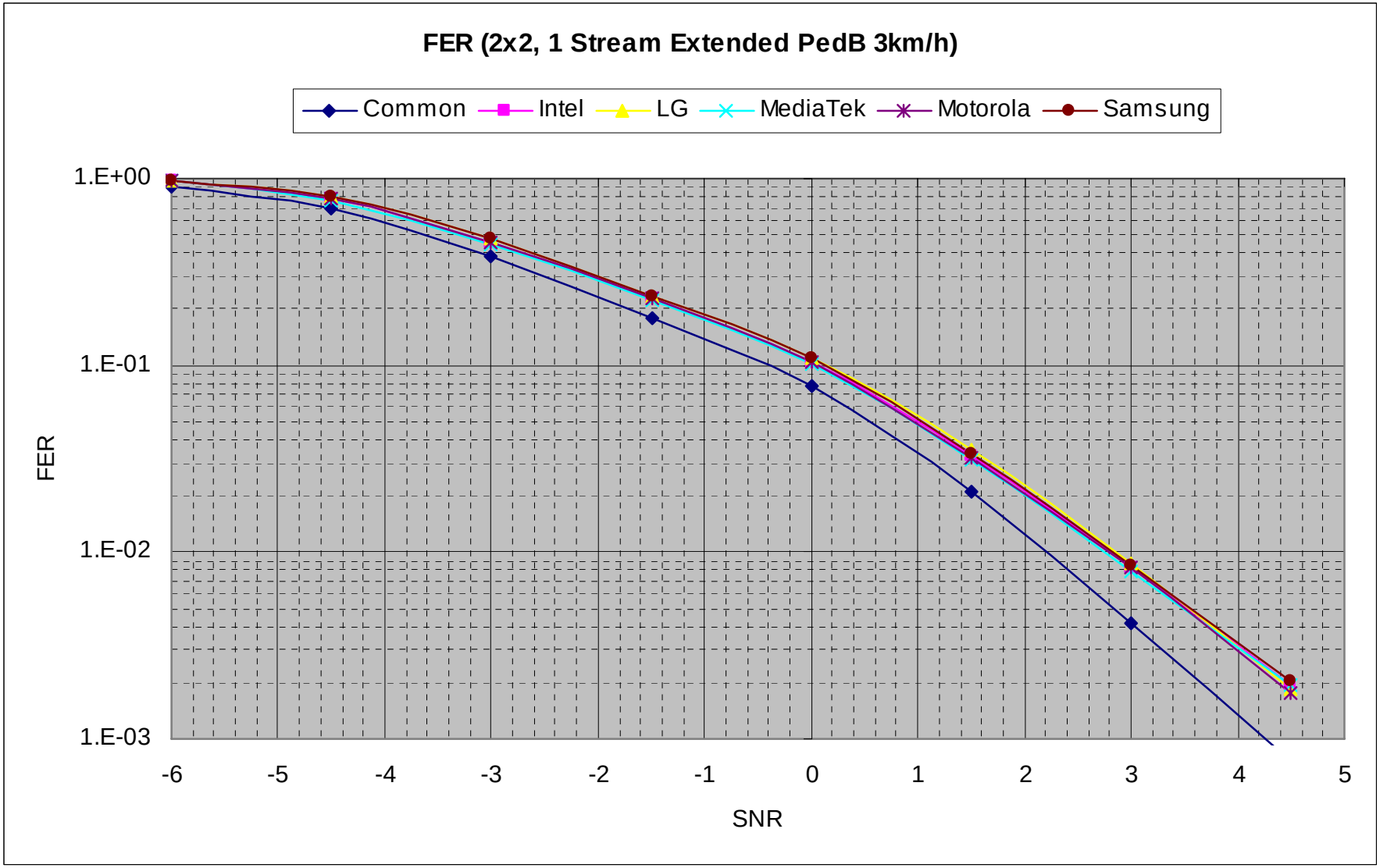
- Common pilot is boosted by 3dB
- Total power per tile is set to same among all schemes and power of data tone is set to 1
  - –Pilot overhead per tile and pilot boost

	Intel (B), Samsung	Motorola, LG	MediaTek
2 streams	12 (3.0dB)	12 (3.0dB)	12 (3.0dB)
4 streams	16 (4.8dB)	20 (3.8dB)	24 (3.0dB)

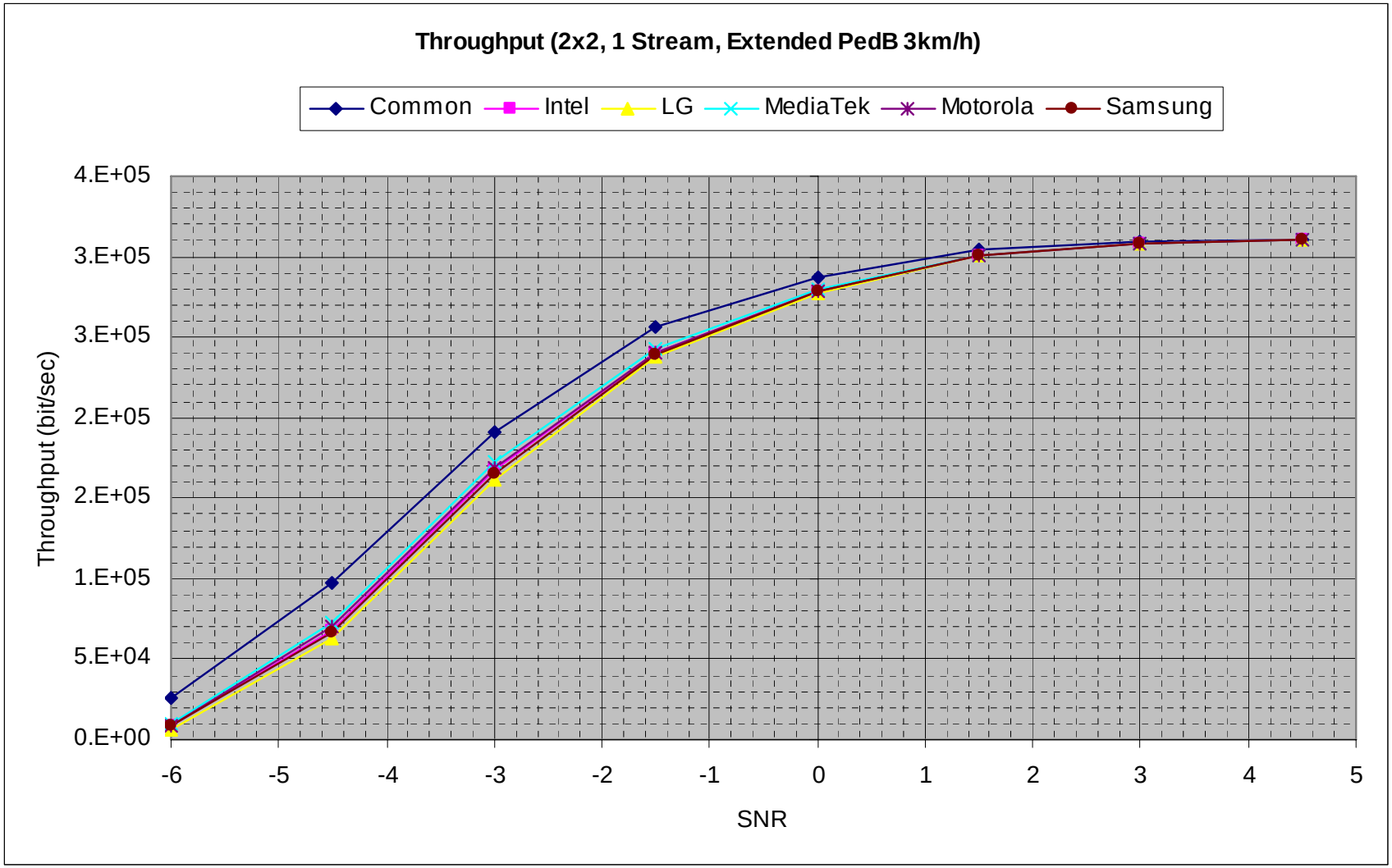
Channel estimation

- Dedicated pilot
  - –2D-MMSE CE with one PRU
  - –3.7 μsec delay spread with equal power and Doppler frequency corresponding to mobile speed
- Common pilot
  - –2 stage MMSE CE
  - –MMSE-based CE on frequency domain with filter length 6 (common pilots of next tile are used too)
  - –MMSE-based CE on time domain with 4 OFDM symbol (2 in current + 2 in next)
  - –3.7 μsec delay spread with equal power and Doppler frequency corresponding to mobile speed

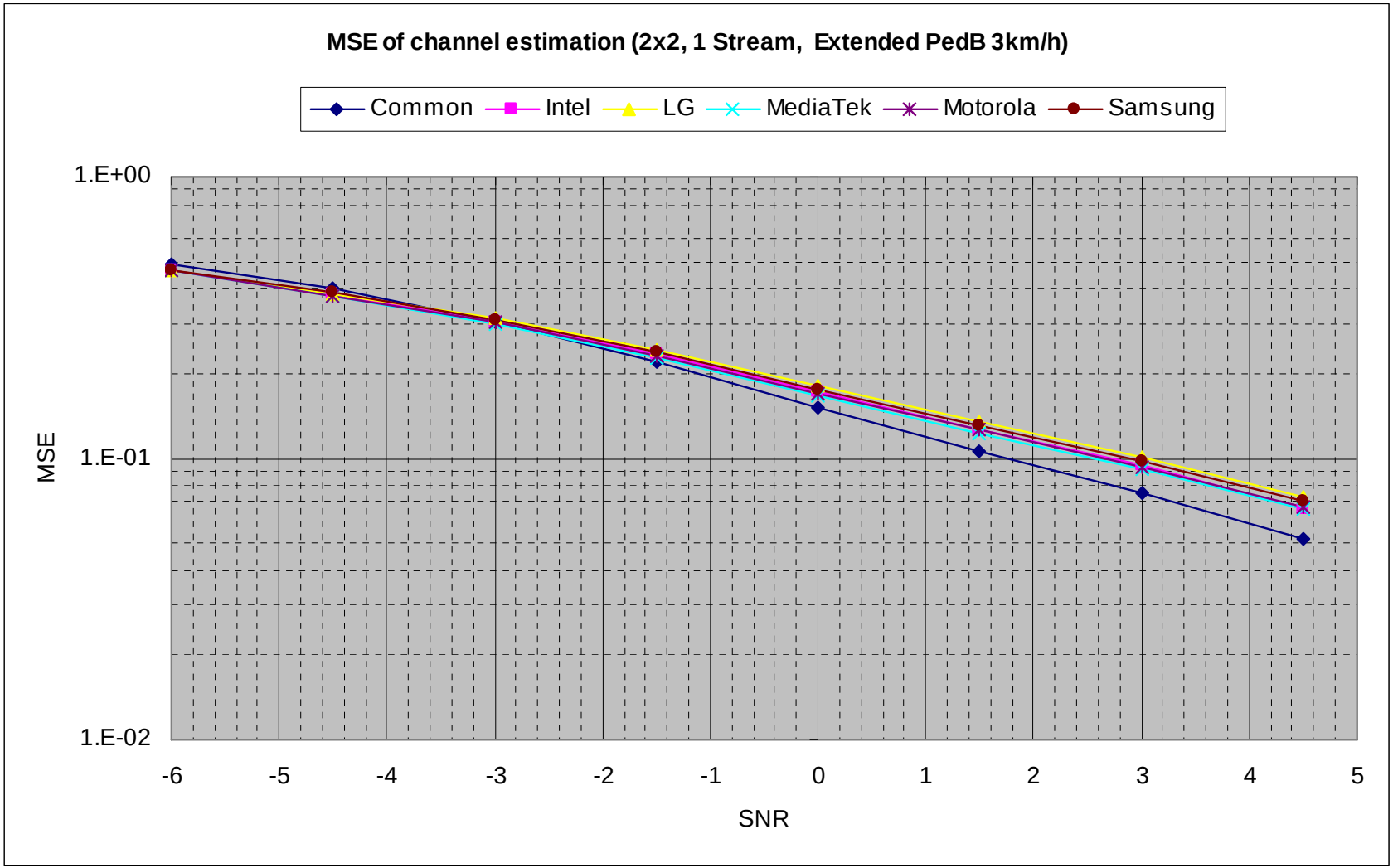
Simulation Results



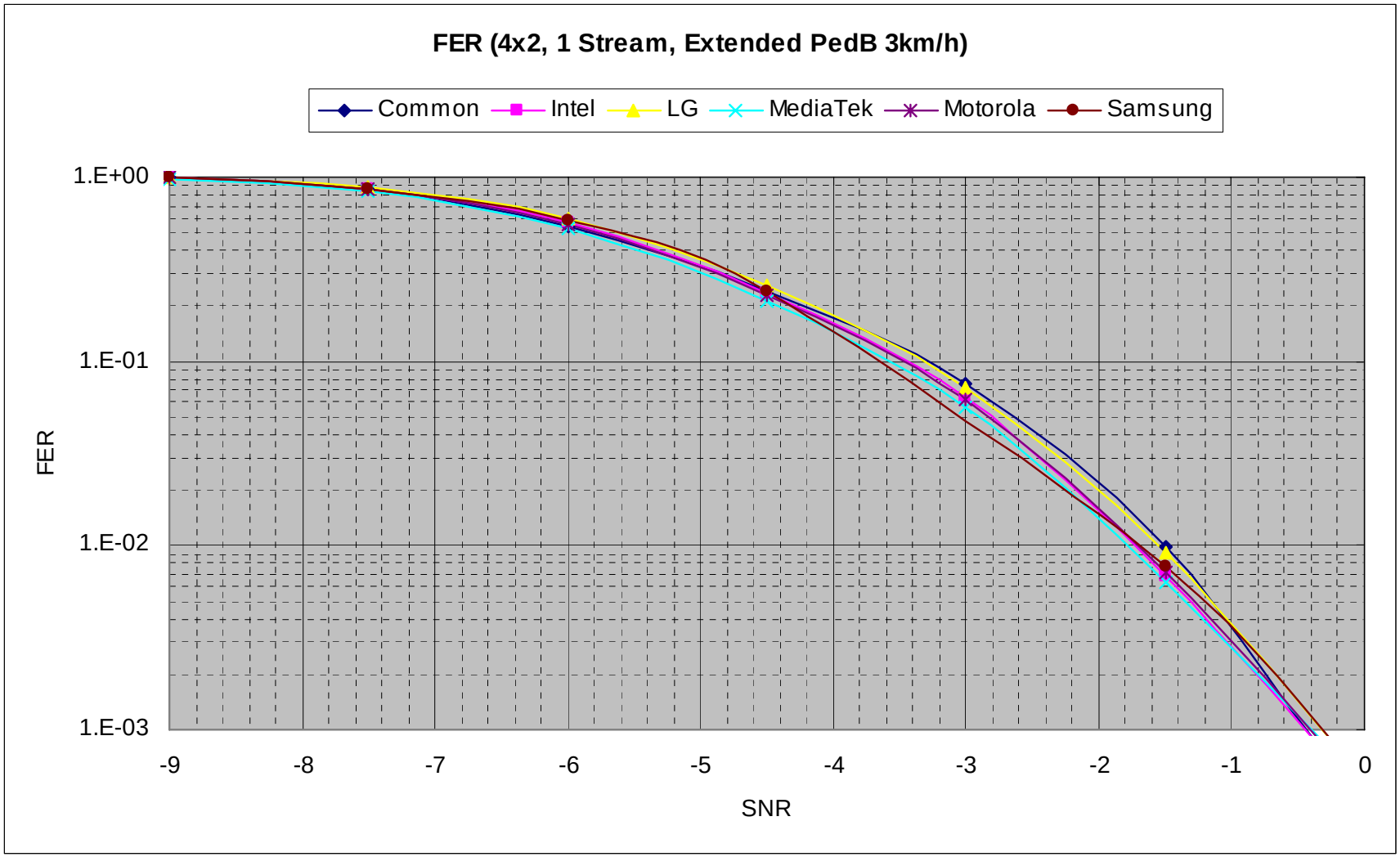
Simulation Results



Simulation Results



Simulation Results



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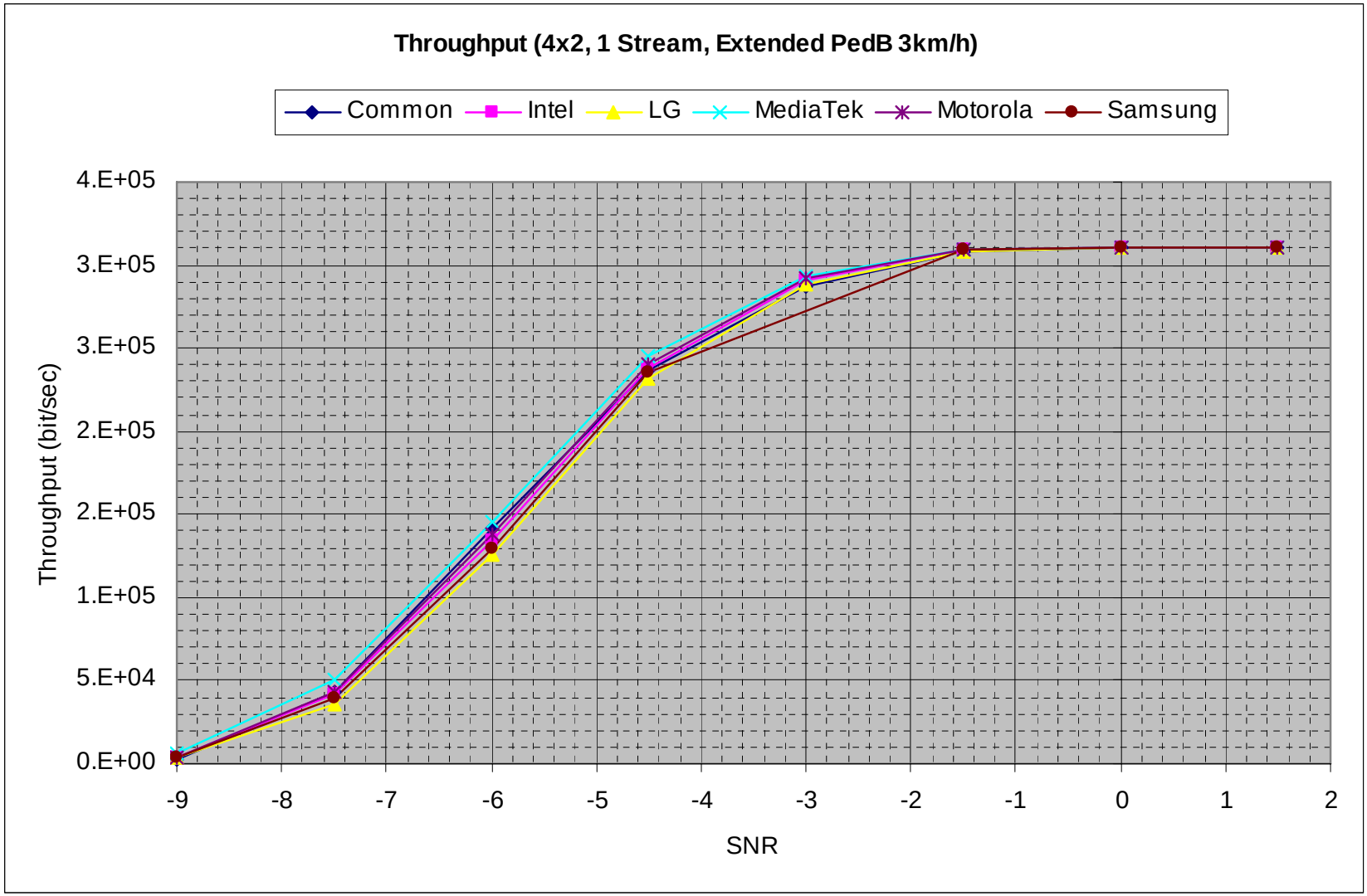

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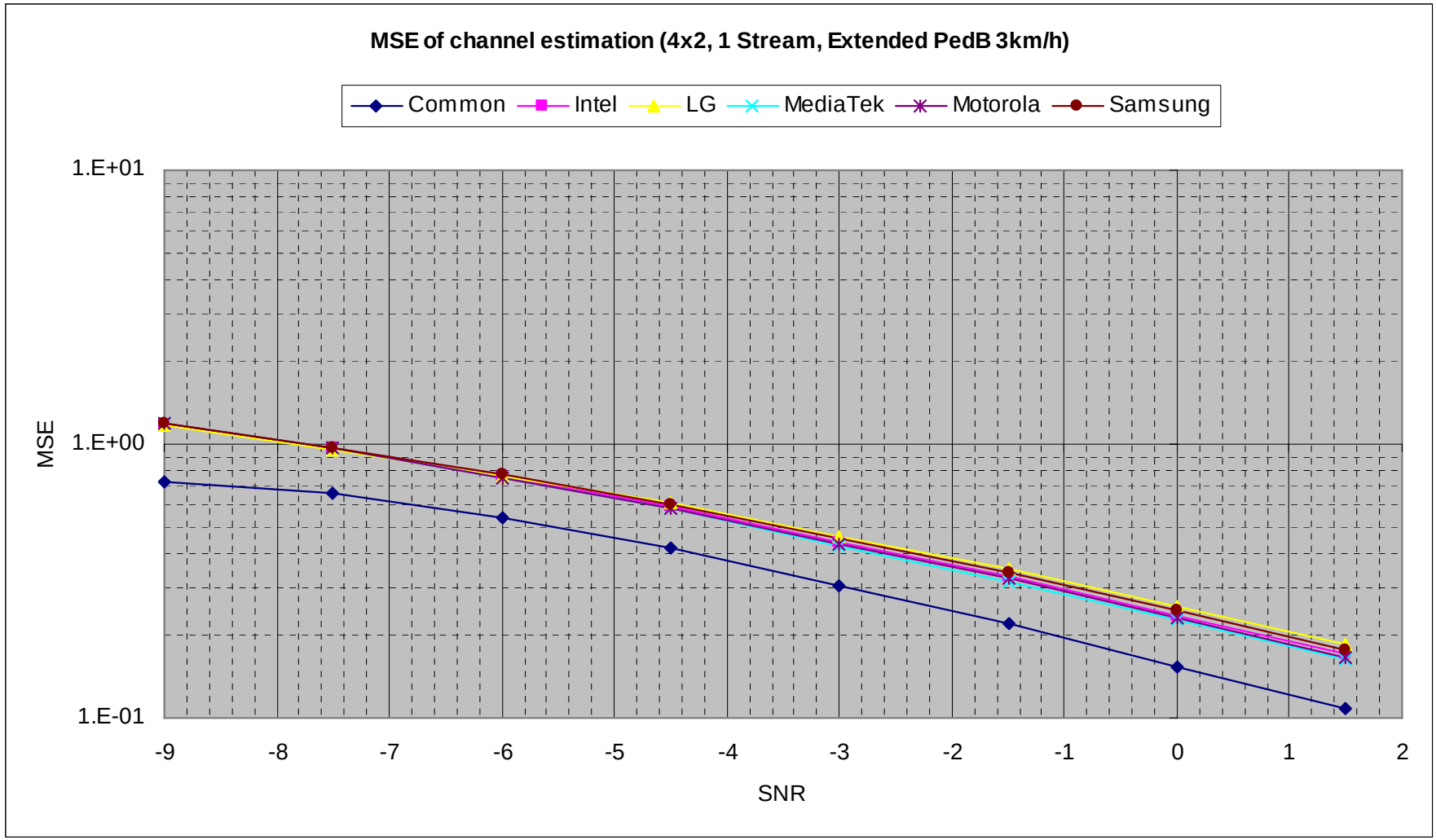

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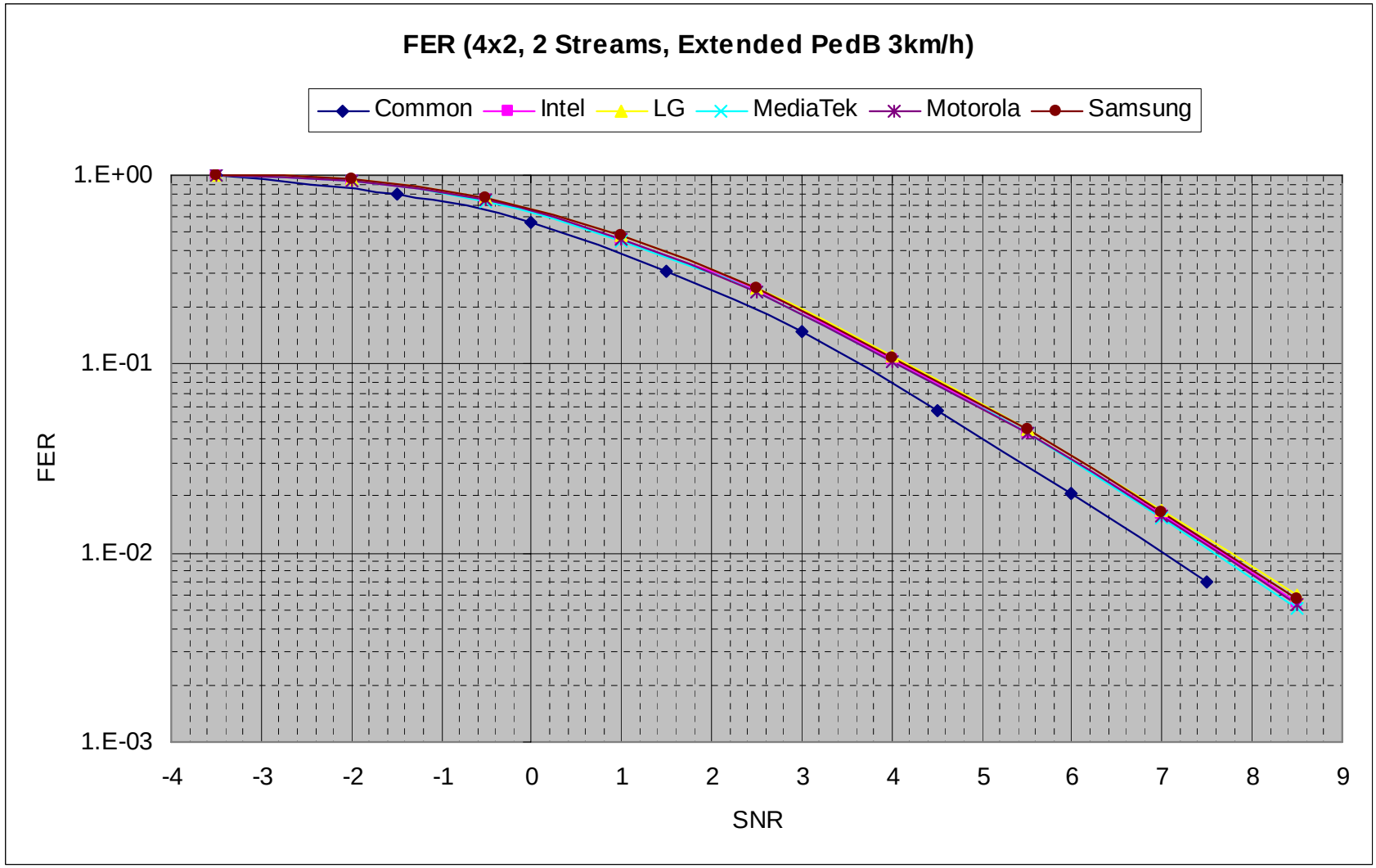

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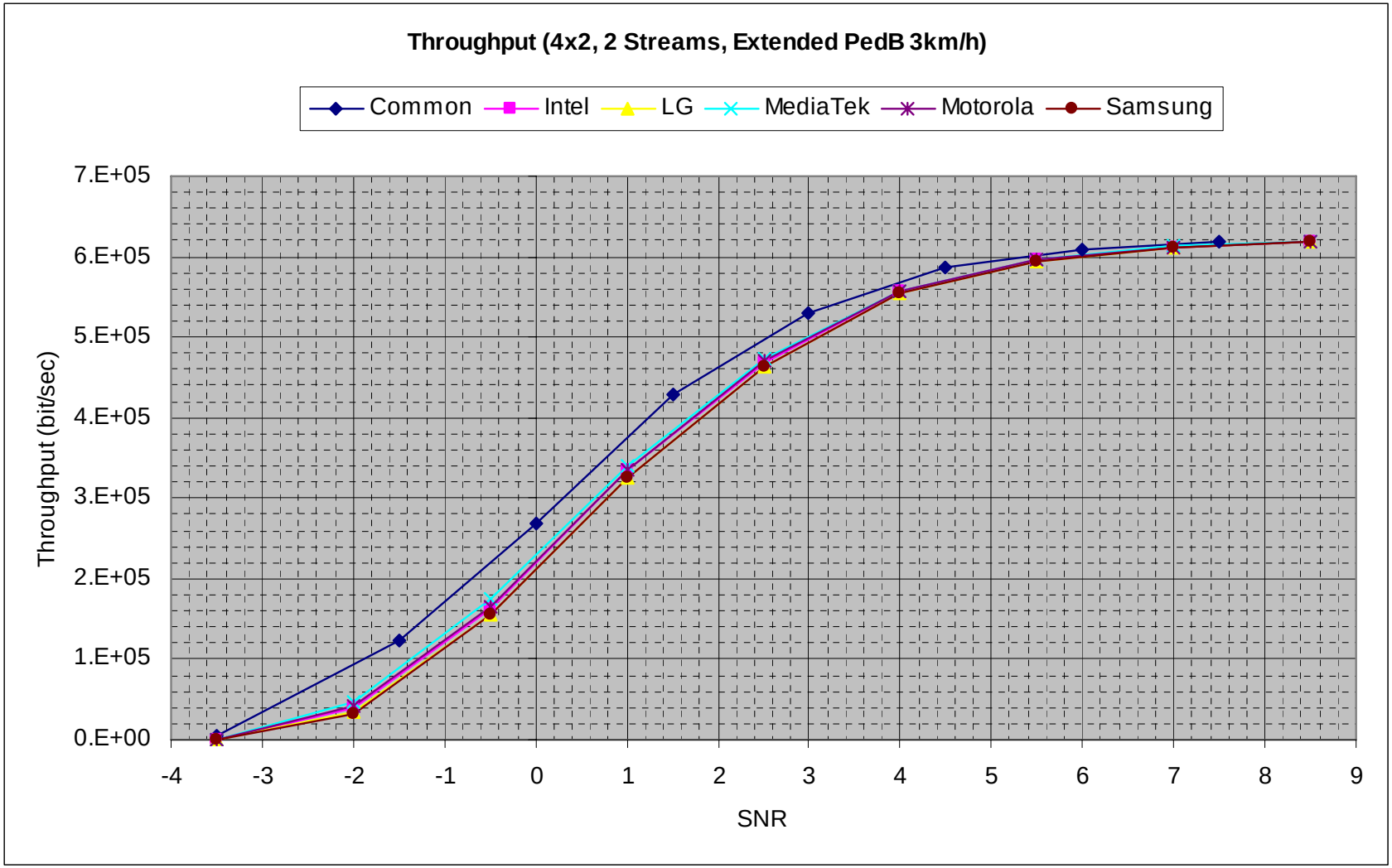
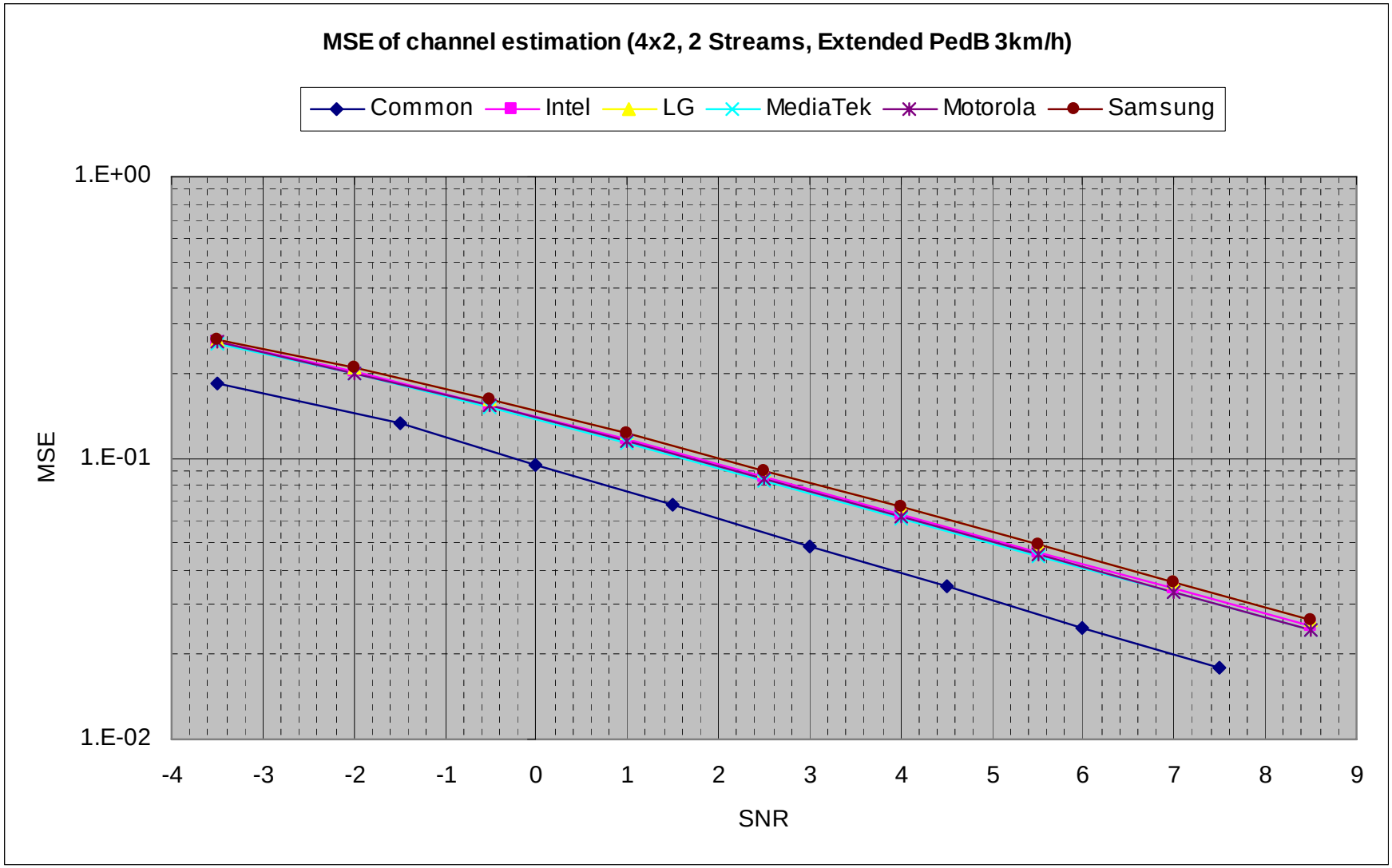
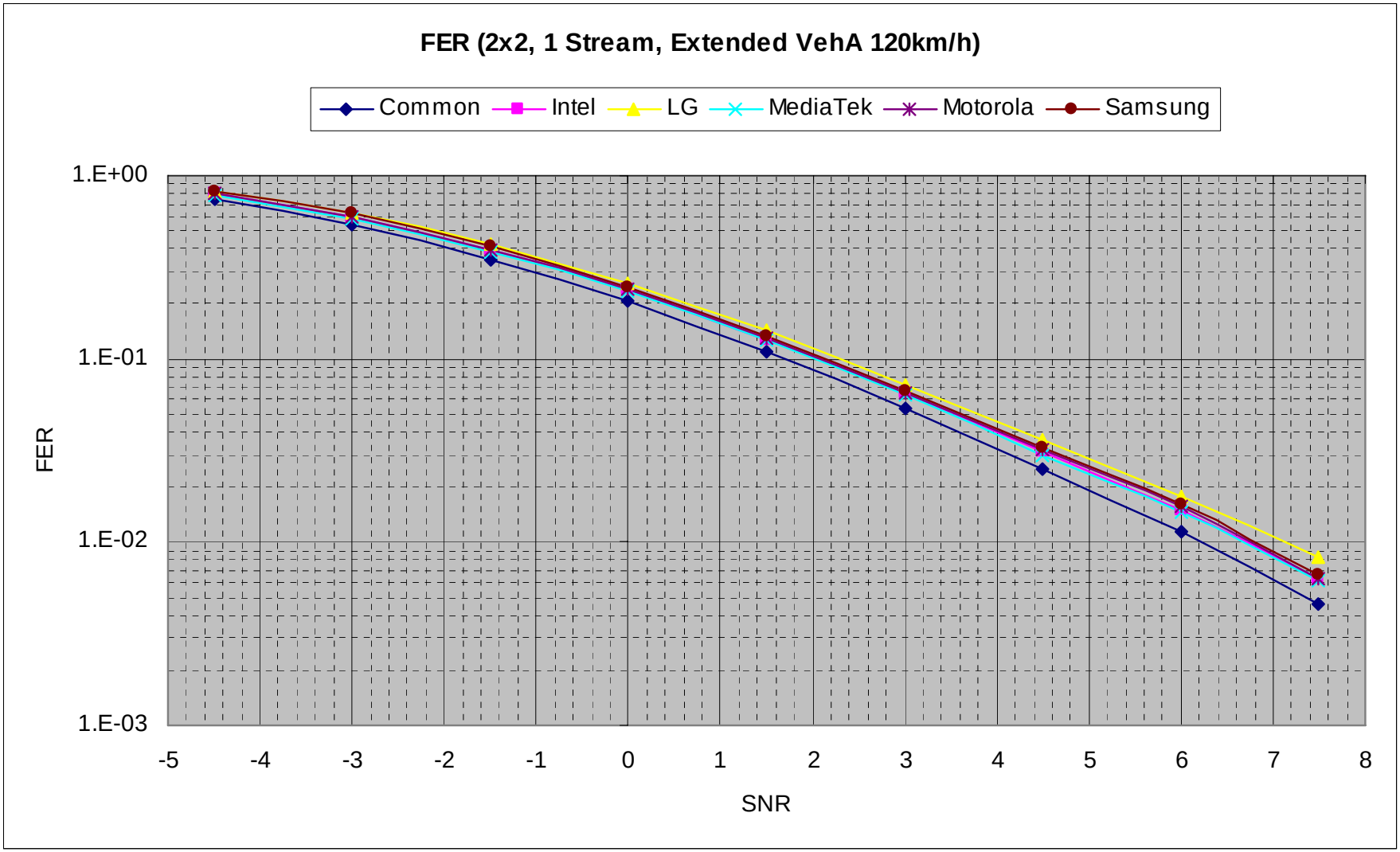


Simulation Results



Simulation Results



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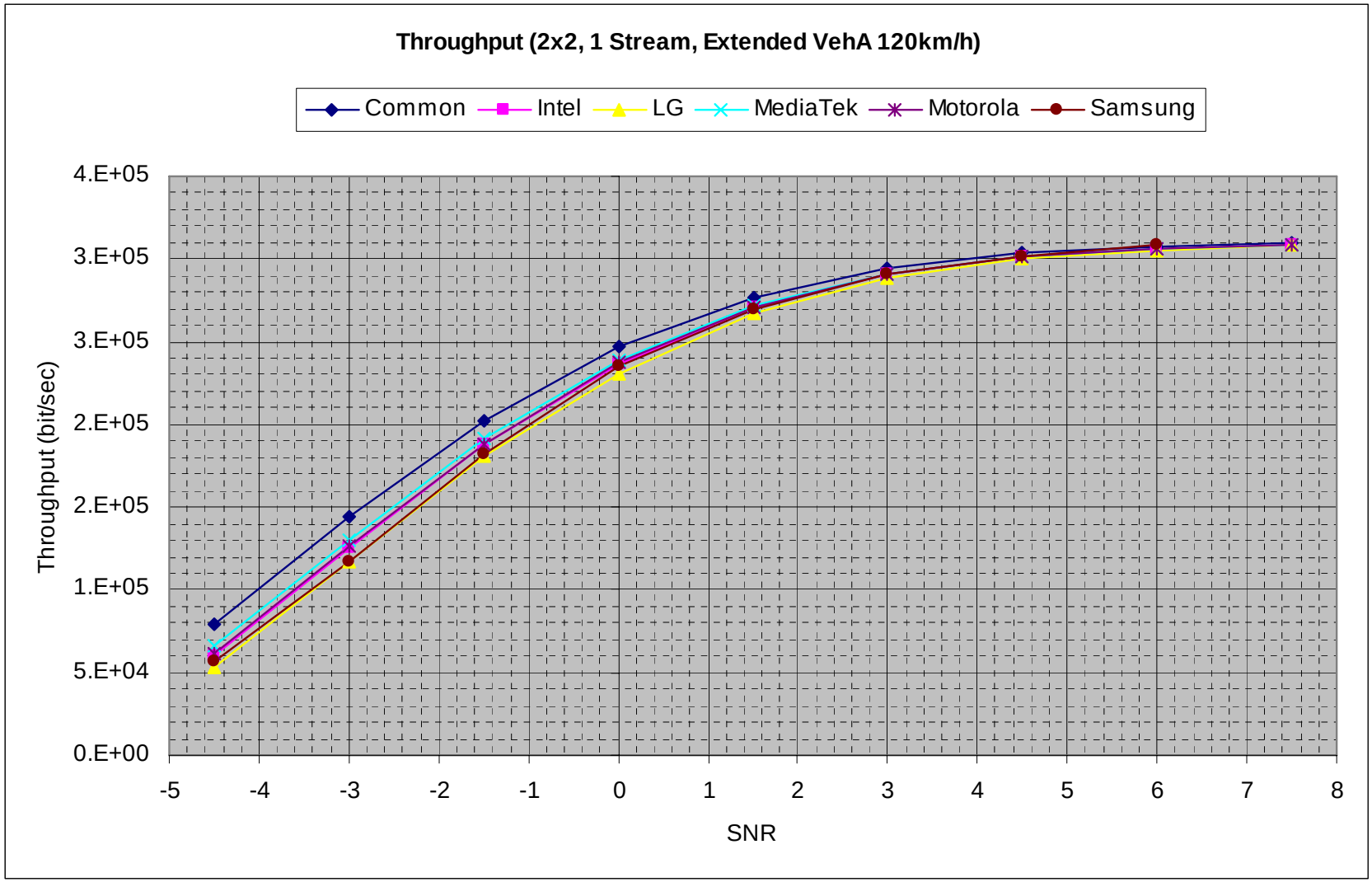
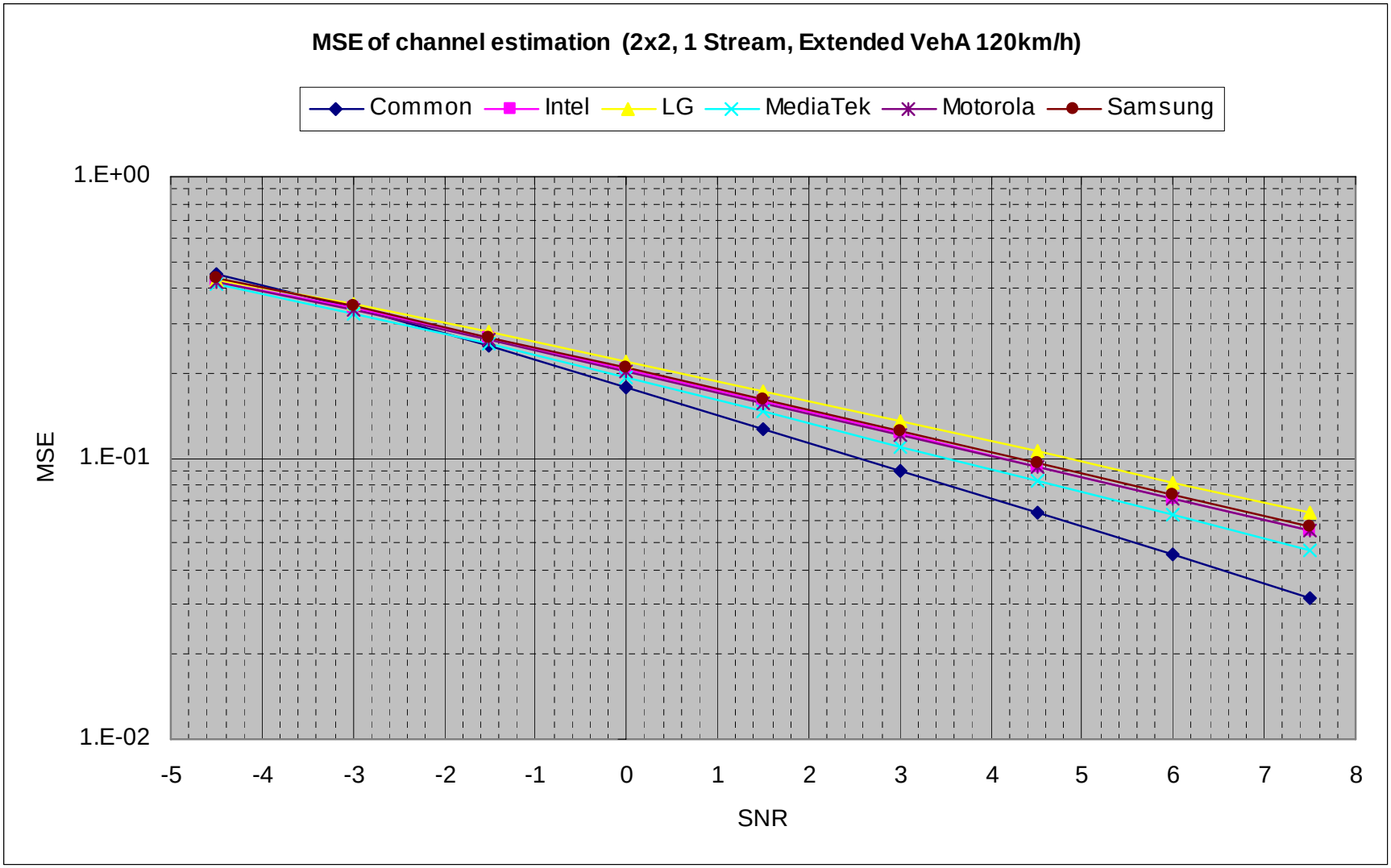
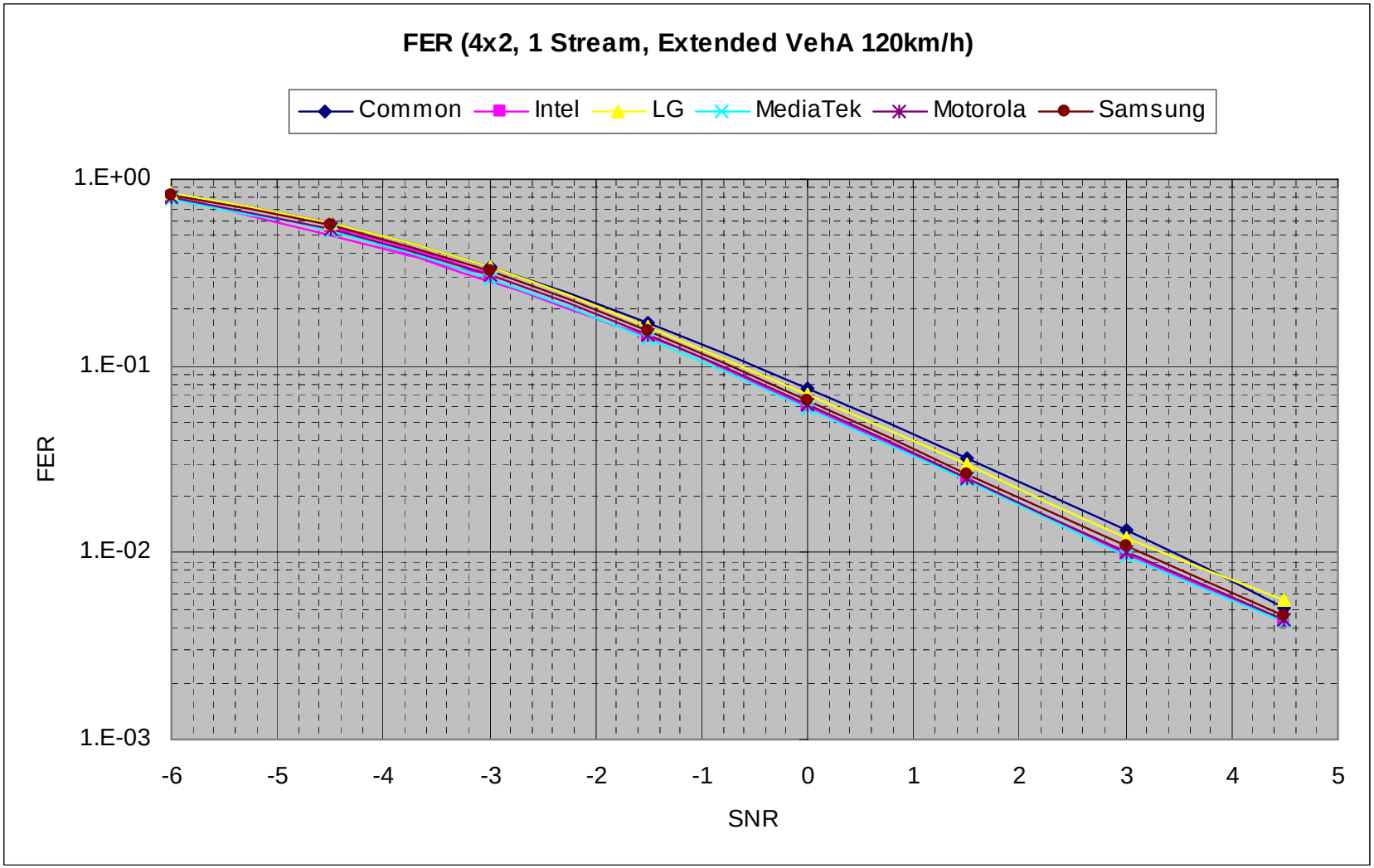


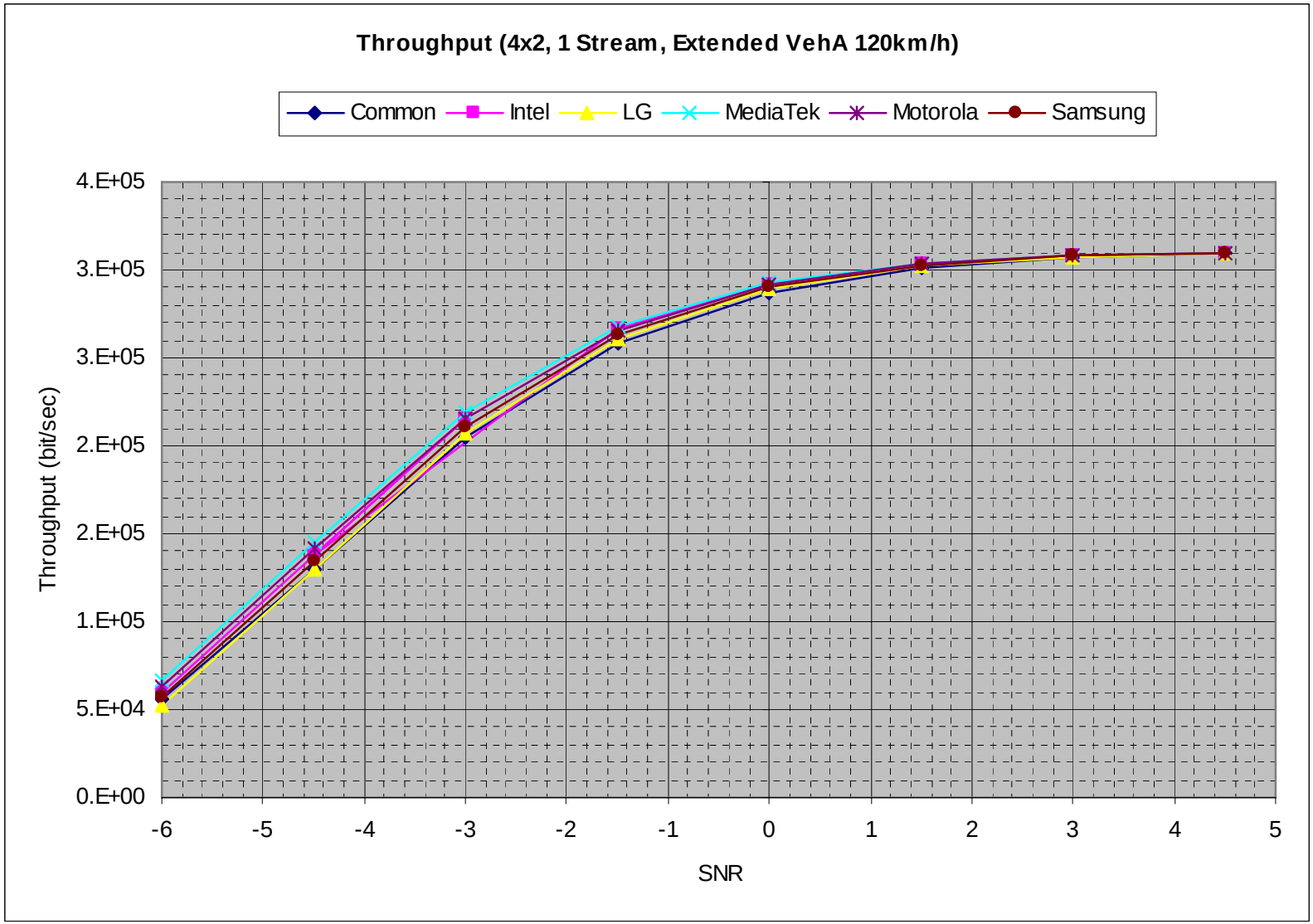
Simulation Results



Simulation Results



Simulation Results



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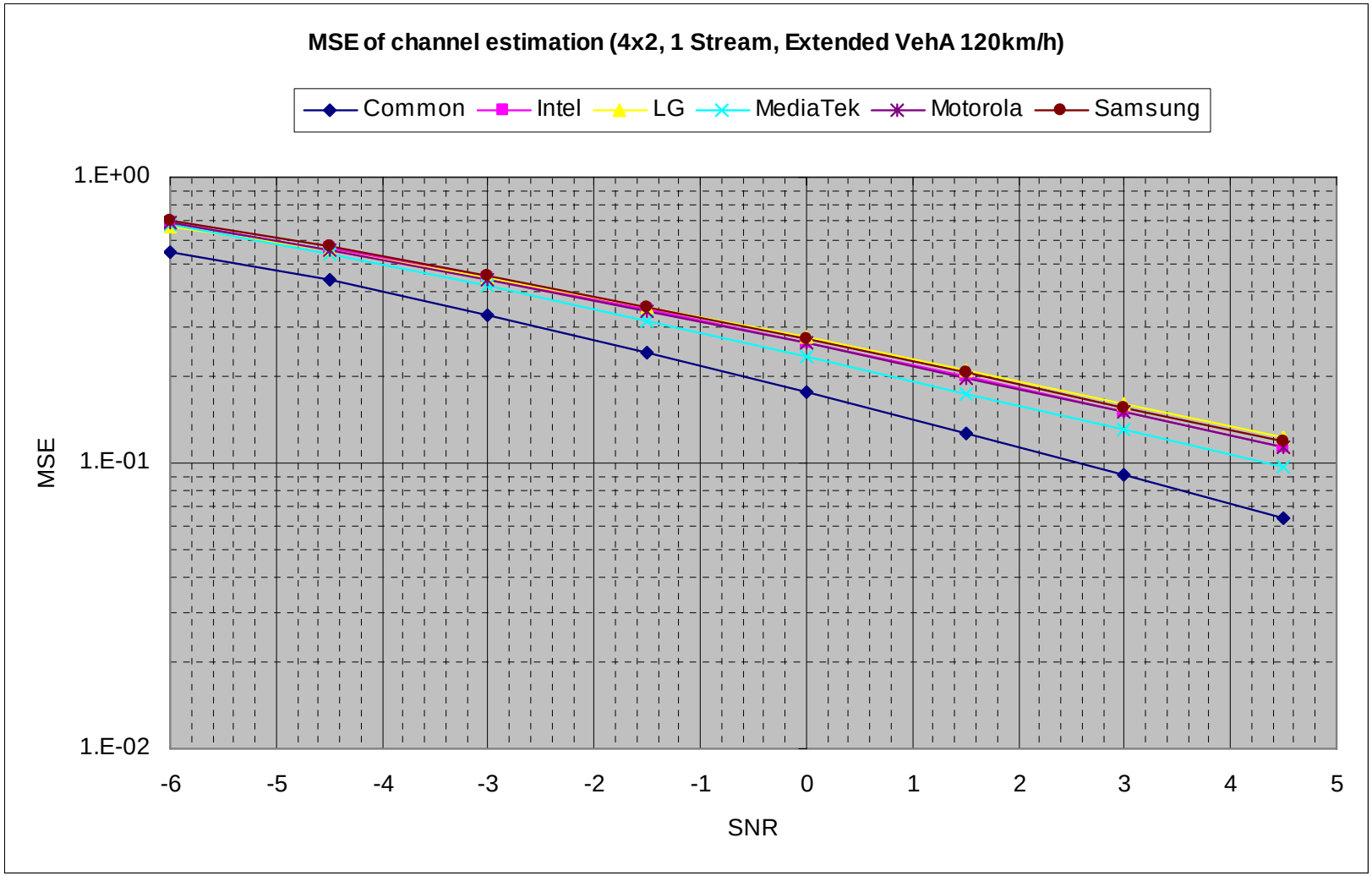


Conclusions

- Common pilot carried in the first two OFDM symbols has better or similar performance as the dedicated pilot pattern proposed in low and high mobile speed
- Our proposed “common pilot + on-demand dedicated pilot” [1,2] provides flexibility to serve a wide range of scenario without burdening average users with unnecessary MIMO pilot overhead
- Common pilot can also serve as reference signal for DL MIMO measurement
  - Save the overhead of reference signal such as mid-amble

[1] C80216m-08_214r1, Zhigang Rong, et al, “16m Downlink Common Pilot Structure for TDM Control Structure”, March 10, 2008, IEEE 802.16m contribution

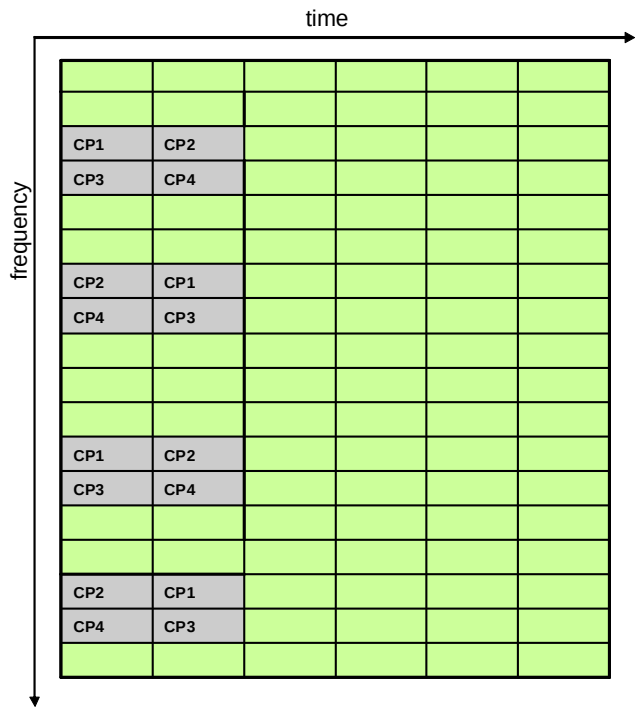
[2] C80216m-08_215r1, Young Hoon Kwon, et al, “16m Downlink Dedicated Pilot Structure for TDM Control Structure”, March 10, 2008, IEEE 802.16m contribution

Text Proposal

Insert the following text in Section 11.5.3.1:

11.5.3.1 Common pilot structure

The common pilots are transmitted in the first two OFDM symbols in a subframe as shown in the following figure.



Grey: Common pilot. CP*i*, *i = 1, 2, 3,* and *4*, indicates common pilot for the *i*th antenna when presented.

Green: Available for data and control. Dedicated pilot can be sent over the last four OFDM symbols based on needs.

There is no common pilots provided in the data zone. Instead, the dedicated pilots are provided based on needs in each specific resource allocation.

Text Proposal

Insert the following text in Section 11.5.3.2:

11.5.3.2 Dedicated pilot structure

The dedicated pilots are provided in data zone on per resource allocation base and only when they are needed. Some examples of such need can be high mobility, long delay spread, low SNR, various OL-MIMO or CL-MIMO/BF, and SFN transmissions. The dedicated pilots allocation can be per-antenna or per-stream. Several dedicated pilot patterns are pre-defined and indexed for optimized performance. The presence of dedicated pilots can be indicated by the scheduling grant messages or determined by the MIMO/SFN mode negotiated between the BS and MS. The MS may assist the BS to determine the need and pattern of dedicated pilots by providing feedback. The dedicated pilots do not occupy the first two OFDM Symbols.