HARQ ACK Channel and Retransmission Dummy Pattern Performance Comparison

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Wen Tong, Hang Zhang, Peiying Zhu, Mohan Fong Voice: 613-763-1315

Gamini Senarath, David Steer, Israfil Bahceci, G.Q. Wang Email: wentong@nortel.com

Mark Naden, Derek Yu

Nortel

3500 Carling Avenue

Ottawa, Ontario

CANADA

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Purpose:

Performance comparison of HARQ ACK/NAK channels and re-transmission dummy pattern

Background

- Several ACK/NCK channels schemes are proposed for MR system.
  - Performance and overhead tradeoff should be compared
- Several re-transmission dummy patterns are proposed for MR system
  - Performance should be compared and optimized
- This draft severs a placeholder for reporting the simulation results to the HARQ ad-hoc
  - Simulations working is running

CQICH Coding

- Assume x_{ij} as the transmit symbol at data tone *j* of the tile *i,* where $i = 0, 1, \ldots, 5$, and $j = 0, 1, \ldots, 7$.
- $X=[x_{ij}]$ is selected form the codebook *P*.
  - **p**$=[p_{ij}]$ is a codeword of the codebook *P* containing 64 different codewords.
  - p_{ij} is selected from a QPSK constellation.
  - Each codeword represents a 6-bit binary number.
- Assume y_{ijk} as the received symbol at the receive antenna number *k*.

Coherent Detector

- $\hat{h}_{ijk}$ represents estimated channel between transmit antenna and the kth receive antenna for the data tone j and tile i.
  - Channel is estimated based on the received pilots per each tile.
  - The best channel estimation method is to average the 4 pilots over a uplink tile.
- Coherent detection is defined as follows:

$$\hat{p} = \arg \max_{p=[p_{ij}] \in P} \mathrm{Re}\left\{ \sum_{i,j,k} \hat{h}_{ijk}^{¿} \, p_{ij}^{¿} \, y_{ijk} \right\}$$

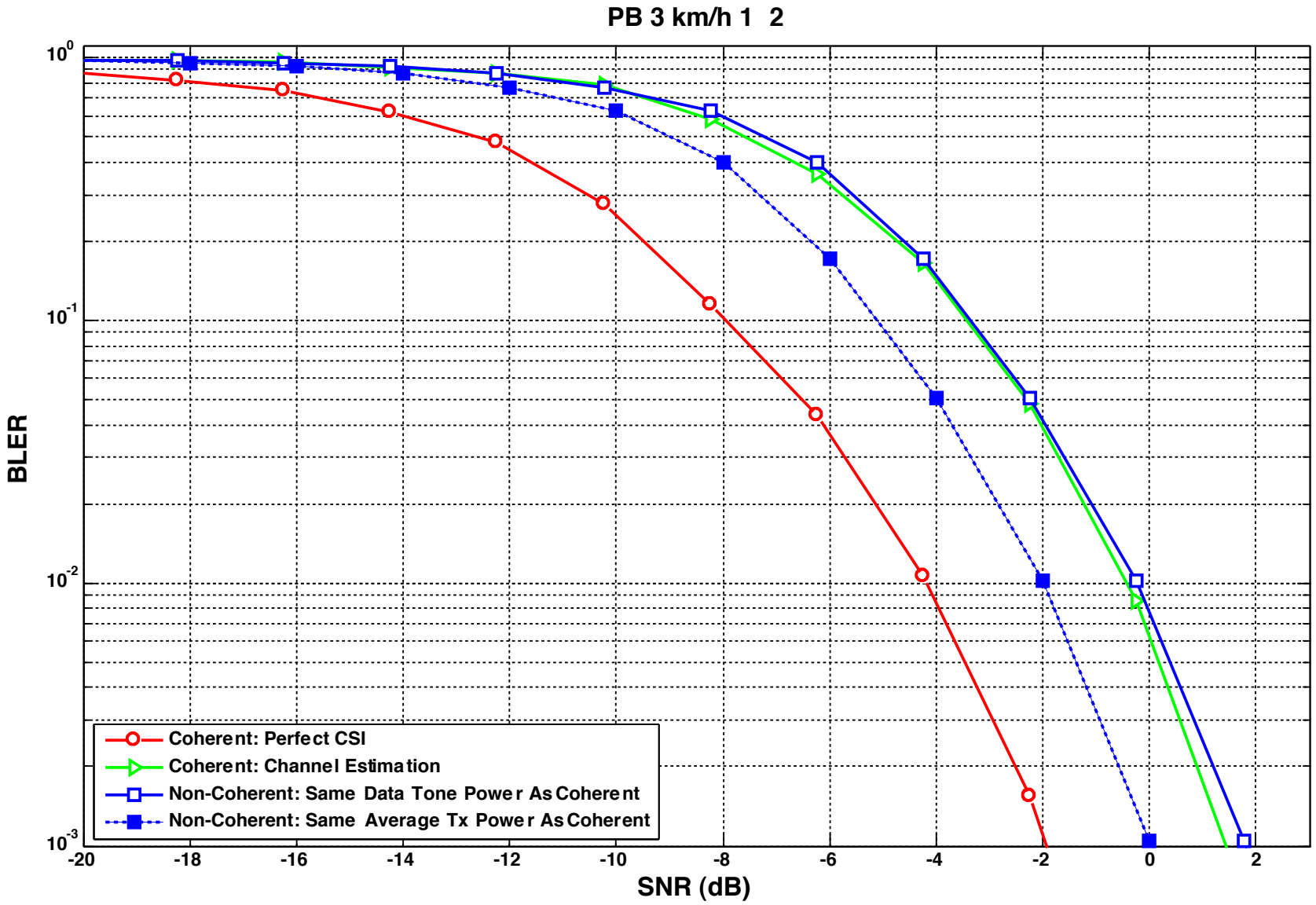
Non-coherent Detector

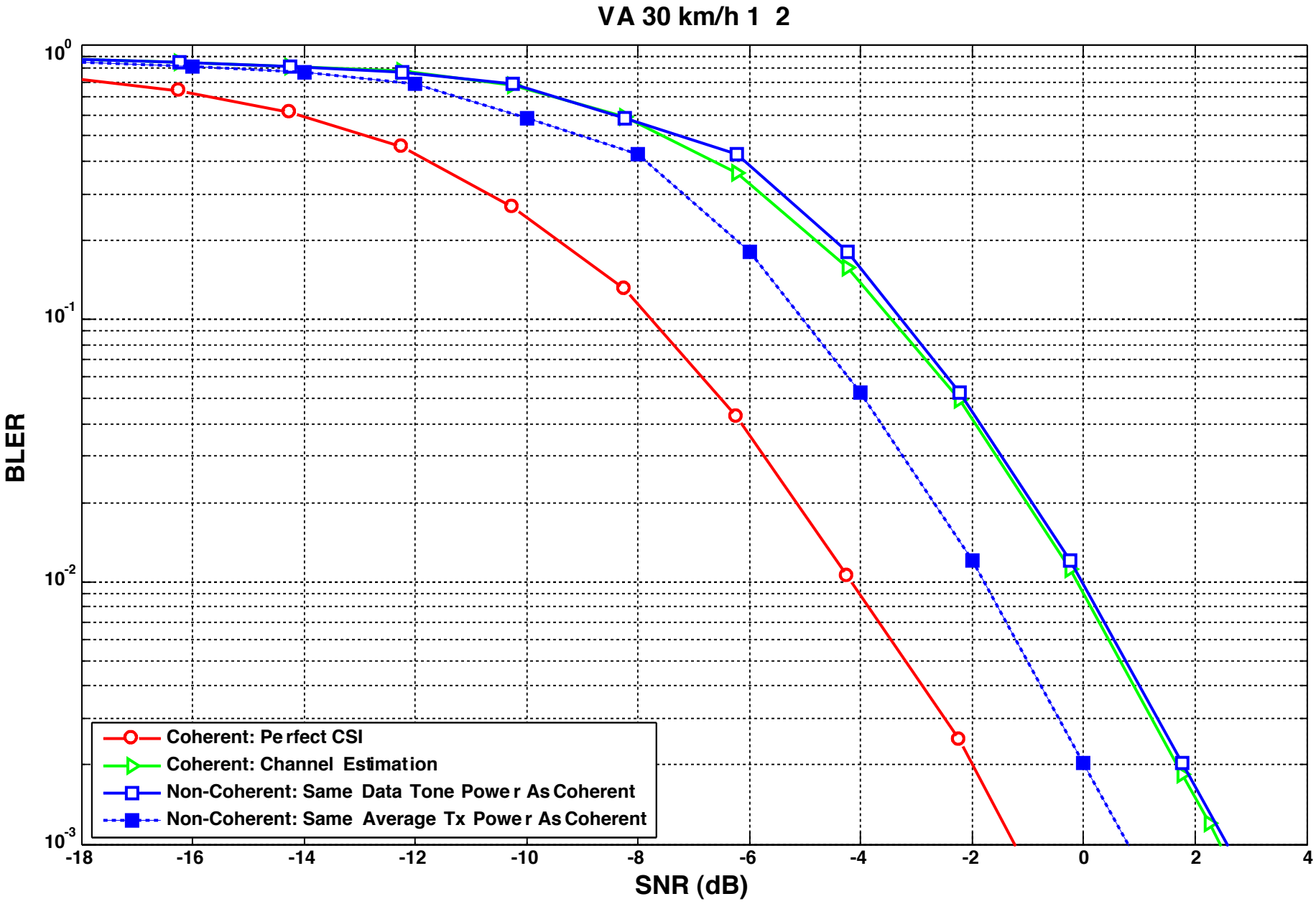
- No channel estimation
- Non-coherent detection is defined as follows:

$$\hat{p} = \arg \max_{p=[p_{ij}] \in P} \sum_{i,k} \left| \sum_{j} \overset{¿}{p_{ij}} y_{ijk} \right|^2$$

Pilot Overhead

- Coherent detection needs pilot for channel estimation.
- Pilot overhead for uplink tile is $10\log_{10}(12/8) \sim 1.7$ dB assuming no pilot power boost.
- Benefit of non-coherent detection is that there is no need to transmit pilots.
  - Null pilot tones
  - 1.7 dB power saving in comparison to coherent detection


PB 3 km/h 1 2
BLER
SNR (dB)
10^0
10^{-1}
10^{-2}
10^{-3}
-20
-18
-16
-14
-12
-10
-8
-6
-4
-2
0
2
Coherent: Perfect CSI
Coherent: Channel Estimation
Non-Coherent: Same Data Tone Power As Coherent
Non-Coherent: Same Average Tx Power As Coherent


VA 30 km/h 1 2
BLER
SNR (dB)
10^0
10^-1
10^-2
10^-3
-18
-16
-14
-12
-10
-8
-6
-4
-2
0
2
4
Coherent: Perfect CSI
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Non-Coherent: Same Data Tone Power As Coherent
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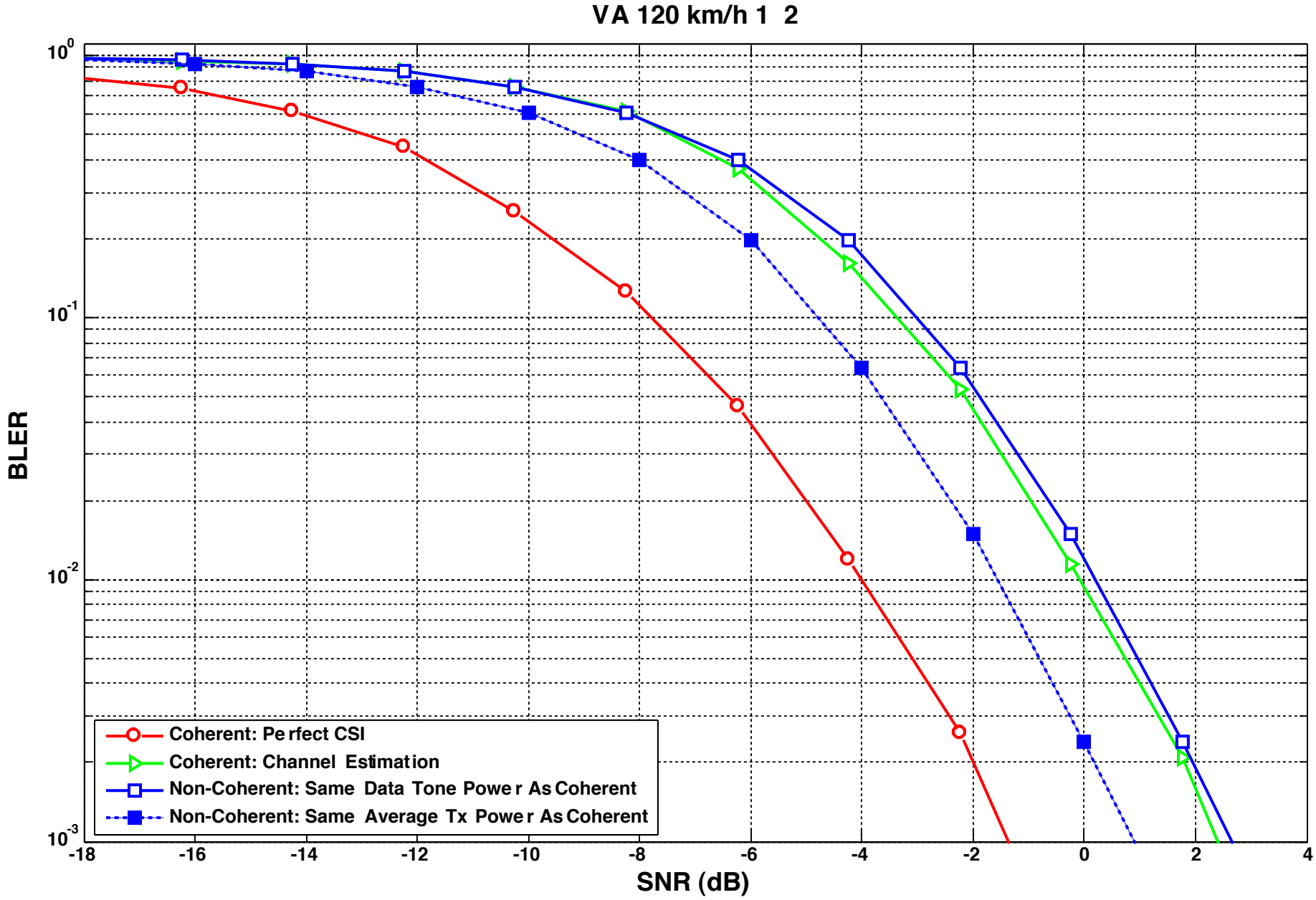
VA 120 km/h 1 2
BLER
SNR (dB)
10^0
10^-1
10^-2
10^-3
-18
-16
-14
-12
-10
-8
-6
-4
-2
0
2
4
Coherent: Perfect CSI
Coherent: Channel Estimation
Non-Coherent: Same Data Tone Power As Coherent
Non-Coherent: Same Average Tx Power As Coherent