TSG-RAN Working Group1 meeting #7
Hanover, Germany, Aug.30-Sept.3, 1999

TSGR1#7(99)c29

Agenda Item : **ad-hoc 15**

Source : **Nortel Networks**

Title : **Optimized 2nd Interleaver for High Speed Fading**

Document for : **Decision**

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1. Introduction

In the WG1 meeting #6, 2nd channel interleaver proposed in TSGR1#6(99)929 was chosen as working assumption. However, the pattern of the proposed 2nd interleaver (Table 1) was adjusted on top of the MIL interleaving to prevent the performance loss. This result in an irregular permutation pattern (Figure 1). In this contribution, we propose an improved 2nd interleaver pattern (Table 2), with symmetrical permutation characteristic (Figure 2). This proposed pattern is obtained by simply following the MIL interleaver design under the symmetrical pattern constraint. It is shown such a pattern has better performance in the presence of high speed Fading channel, when the entire system depends on the 2nd interleaver to combat channel fading.

2. 2nd Interleaver Patterns for 15-Slot Frame

In TSGR1#6(99)929, 2nd interleaver was designed for the 15-slot frame. It is based on the MIL [3x10[2x5[2x3]]] interleaving to perform the column permutation. In addition, a further permutation between 9<->19, 2<->12 and 22<->7 was introduced to avoid performance loss.

Table 1 Modified 2nd Interleaver Pattern

Column number C_2	Inter-column permutation pattern
30	{0, 20, 10, 5, 15, 25, 3, 13, 23, 8, 18, 28, 1, 11, 21, 6, 16, 26, 4, 14, 24, 19, 9, 29, 12, 2, 7, 22, 27, 17}

Figure 1 Modified 2nd Interleaver Pattern

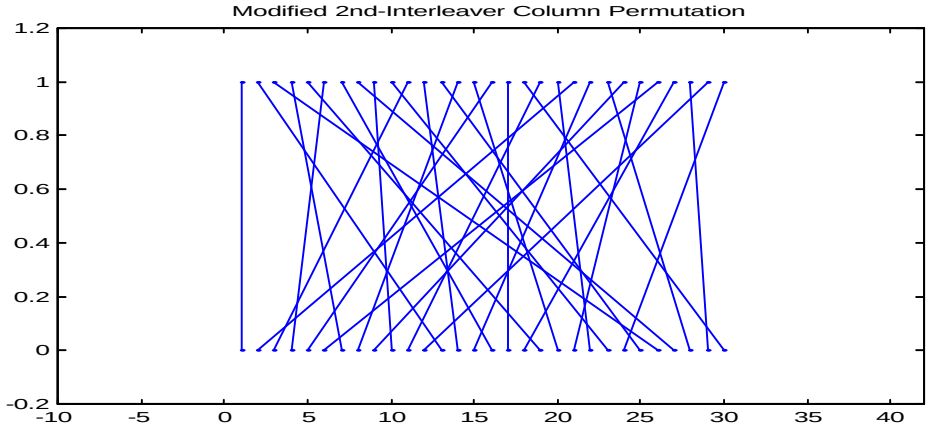
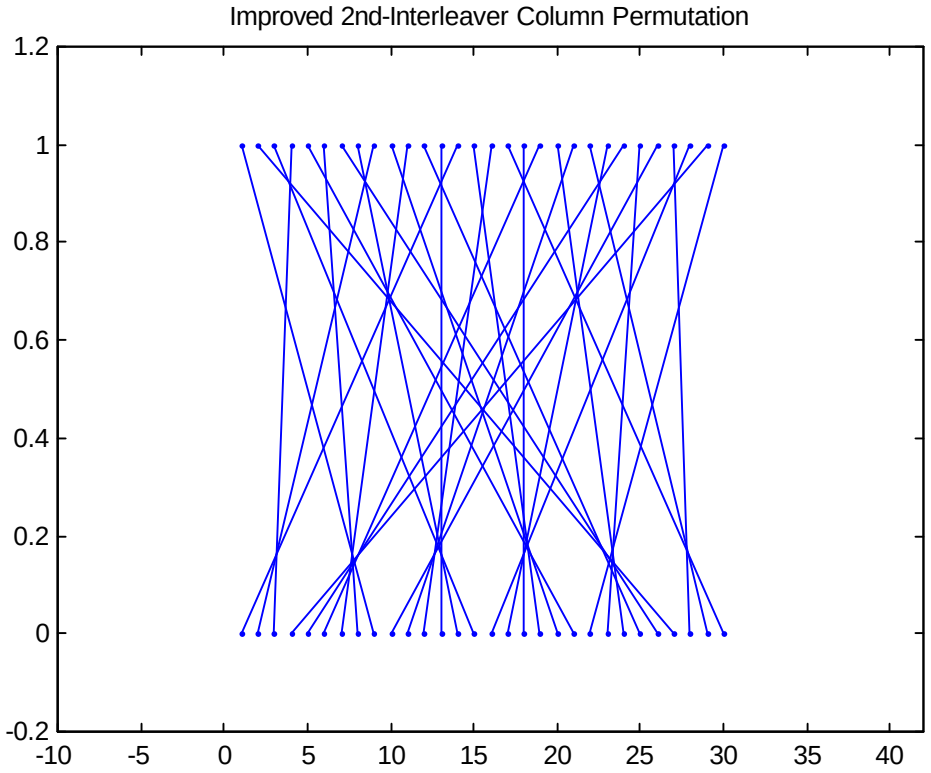


Table 2 Improved 2nd Interleaver Pattern

Column number C_2	Inter-column permutation pattern
30	{13,8,3,28,23,18,10,5,0,25,20,15,12,7,2, 27,22,17,14,9,4,29,24,19,11,6,1,26,21,16}

Figure 2 Improved 2nd Interleaver Pattern



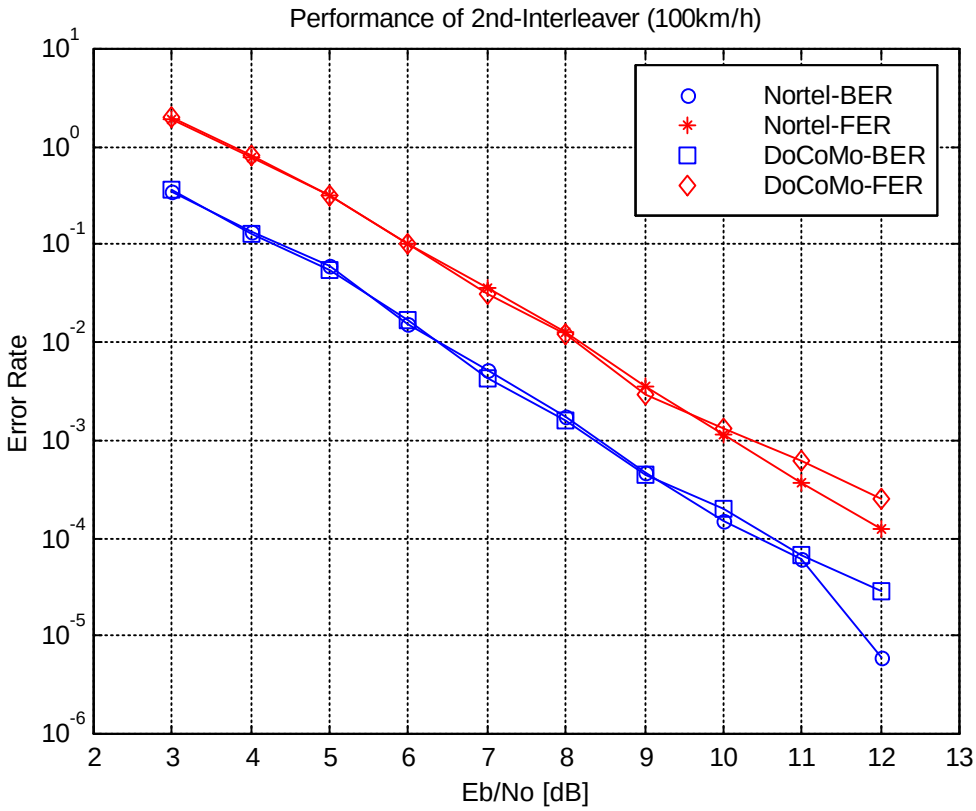
In this contribution, following the same MIL principle in TSGR1#6(99)929, instead of additional irregular permutations, we introduce the symmetrical constraint as shown in Table 2 and Figure 2. Simulation results show that the improved 2nd interleaver out-performs the modified 2nd interleaver in high speed fading channel.

3. Simulation Results

3.1 Simulation conditions:

Channel : Rayleigh Fading
Coding : Convolutional coding (R=1/3, K=9)
Decoder: Viterbi
Simulation termination : 100 frames errors or 800 000 frames
Demodulation : Rake

3.4 Results 100kmph:



4. Complexity Impact

The proposed improved 2nd interleaver has zero complexity increase compared to the modified the 2nd interleaver.

5. Conclusions

The an improved 2nd interleaver is proposed to enhance the performance of high speed fading channel. Such an enhancement is critical especially for the DL performance for high speed UE, where the entire system depends solely on the 2nd interleaver to combat the Rayleigh fading.

----------Text proposal for section 4.2.10 in TS 25.212

Table 4

Column number C	Inter-column permutation patterns
30	{27,22,17,14,9,4,29,24,19,11,6,1,26,21,16} ~~{20, 10, 15, 25, 13, 23, 18, 28, 11, 21,~~ ~~16, 26, 14, 24, 9, 29, 2, 7, 27, 17}~~

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