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Title: On the complexity of the Block STTD joint Detection Receiver

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1 Introduction

Block STTD (BSTTD) for P-CCPCH was adopted by WG1 specification based on Motorola performance/complexity results indicating that BSTTD gains can be achieved with only a slight increase in the complexity of the joint detection (JD) receiver [1,2]. Recent results indicate however that the JD complexity required to achieve the STTD gain is significantly higher than originally reported. This paper presents our recent performance/complexity results. Based on these results we recommend to reconsider the option of BSTTD encoded P-CCPCH.

2 Performance and Complexity Results

The complexity results reported in [1] are based on the first order approximation of the Cholesky decomposition described in [2]. According to our results however, the first order approximation causes a significant degradation relative to the exact BSTTD-JD receiver, to the extent that no gain is observed relative to the case of no STTD. To achieve the STTD gain a more refined approximation is needed. The complexity of the resulting JD receiver is significantly higher than that reported in [1]. Table 1 presents the relative increase in complexity compared to the standard (no STTD) JD receiver.

Table 1: Increase in complexity as a function of the number of DCHs

No. of DCHs	Relative increase in complexity
0	91.6 %
1	44.3 %
2	28.4 %
3	20.4 %
4	15.6 %
5	12.4 %
6	10.1 %
7	8.4 %

Since the increase in complexity is quite moderate for 7 DCHs and because the receiver has to be designed for the maximum numbers of DCHs, the increased complexity will only have a moderate impact on the hardware complexity (assuming that increase in the number of operations translated to the same increase in the number of gates). However, the increased complexity for the case of a few DCHs will have a significant impact on the UE power consumption.

In addition to the increase in complexity as expressed in the number of operations, the architecture of STTD-JD receiver is considerably more complex than that of the standard JD. It appears likely therefore that the required increase in the hardware complexity will be higher than that predicted by the number of operations.

Figure 1 shows performance results of the BSTTD-JD with the refined approximation whose complexity is presented in Table 1.

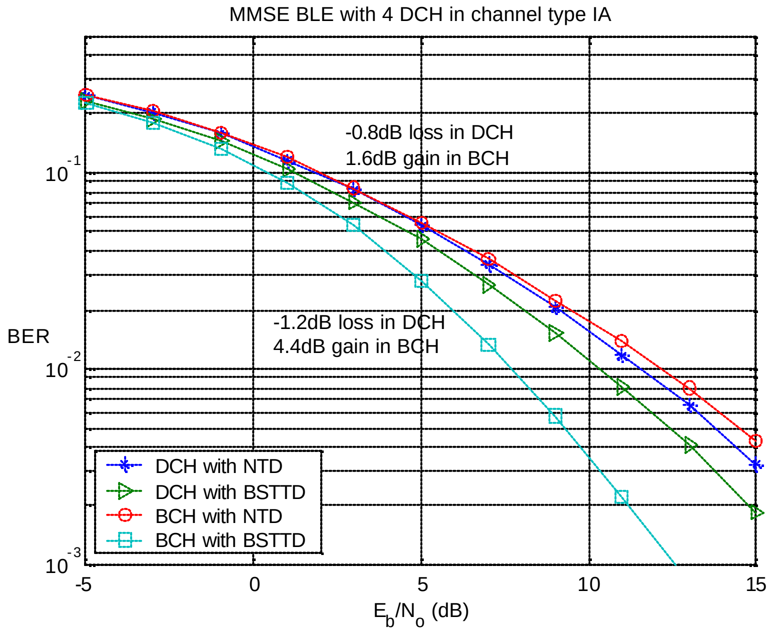

Figure 1: Performance of the BSTTD-JD receiver

The simulation assumptions for Figure 1 are:

?? MMSE BLE
?? BCH uses the channelisation code # 1.
?? 4 DCHs use the channelisation code #2, 3, 4, 5.
?? Scrambling code #0.
?? Perfect channel estimation.
?? ITU Indoor A channel

3 Discussion and Summary

Based on the results presented in this paper we propose to remove the option of BSTTD encoded P-CCPCH from the TDD specifications.

We recognize the importance of applying transmit diversity to the P-CCPCH and therefore encourage introducing other approaches that has a lower impact on the UE receiver complexity and power consumption.

4 References

[1] Motorola, TI, 'Transmit Diversity scheme for Broadcast channels of the TDD mode (II)', R199g38, New York, WG1#8.

[1] Motorola, 'Transmit Diversity schemes for Broadcast channels of the TDD mode', R199c08, Hanover, WG1#7.