TSG-RAN Working Group 1 meeting #9 *TSGR1#9(99) j27*
Dresden, Germany
November 30 – December 3, 1999

Agenda item: 8
Source: Motorola
Title: Performance degradation for P-CCPCH without Block STTD encoding when Block STTD is assumed by the UE receiver.
Document for: Discussion

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1. Introduction

During last WG1 #8, AH06 recommended the adoption the possible use of block STTD encoding for TDD P-CCPCH.

It was noted that some complementary studies would be useful on the performance of Block STTD receivers detecting a non Block STTD encoded P-CCPCH. This contribution presents simulation results which quantify the performance degradation for three different reference channels.

2. Block STTD encoding for P-CCPCH

Block STTD is illustrated in Figure 1. Its performance has been quantified in previous contributions [1,2,3,4]. Its implementation is expected to be mandatory at the UE and optional in the Node B.

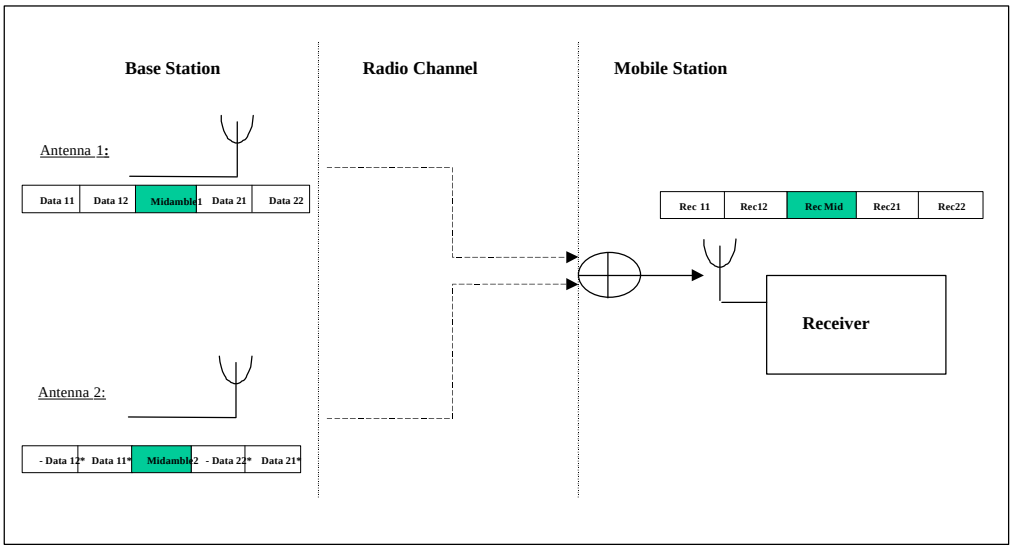

Figure 1: Block STTD scheme

In some situations the UE has to detect the P-CCPCH (for example, following UE switch on), and it may not know whether the P-CCPCH for the cell of interest is Block STTD encoded or not. If the UE assumes by default that the P-CCPCH is Block STTD encoded, it is able to decode both a Block STTD-encoded P-CCPCH and a P-CCPCH with no diversity antenna present. However, when no diversity is present some performance degradation appears with respect to detecting the P-CCPCH with a conventional JD-BLE receiver. The degradation is due to the noise-only channel estimation obtained for the diversity antenna, which is allocated no power.

3. Simulation results

Simulation results have been performed for the following conditions :

- 4 Data channels + BCCH
- ZF-BLE Joint Detector.
- 1 midamble per user
- 1 midamble used by P-CCPCH with no STTD encoding applied. The diversity antenna is allocated no power.
- Suboptimal STTD receiver using a first order approximation of the Cholesky decomposition (3% complexity increase) as described in [2].

Indoor A channel

Figure 2 illustrates the performance degradation for a non-Block STTD encoded P-CCPCH when Block STTD is assumed by the receiver. At the reference BER=2 10^{-2} , the degradation is about 0.7 dB.

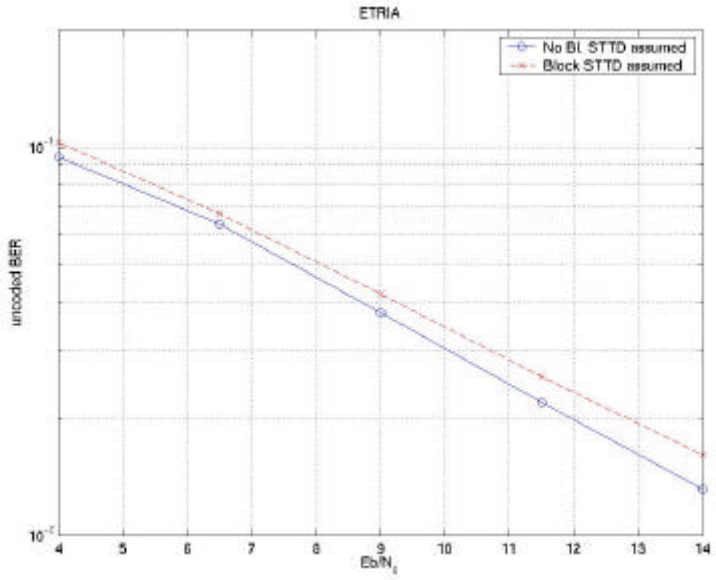

Figure 2: Performance degradation for an Indoor A channel.

Pedestrian B channel

Figure 3 illustrates the performance degradation for a non-STTD encoded P-CCPCH when Block STTD is assumed by the receiver. At the reference BER=10^{-2} , the degradation is about 0.4 dB.

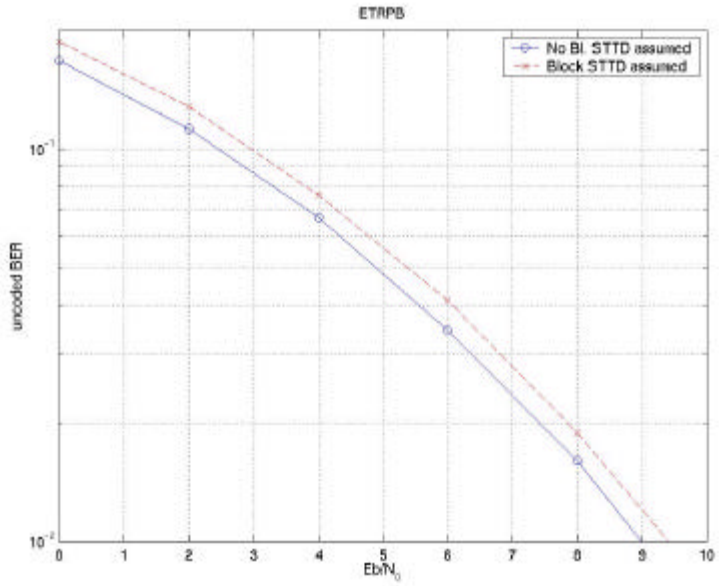

Figure 3: Performance degradation for a Pedestrian B channel.

Pedestrian B channel

Figure 4 illustrates the performance degradation for a non-STTD encoded P-CCPCH when Block STTD is assumed by the receiver. At the reference BER=7 10^{-2} , the degradation is about 0.7 dB.

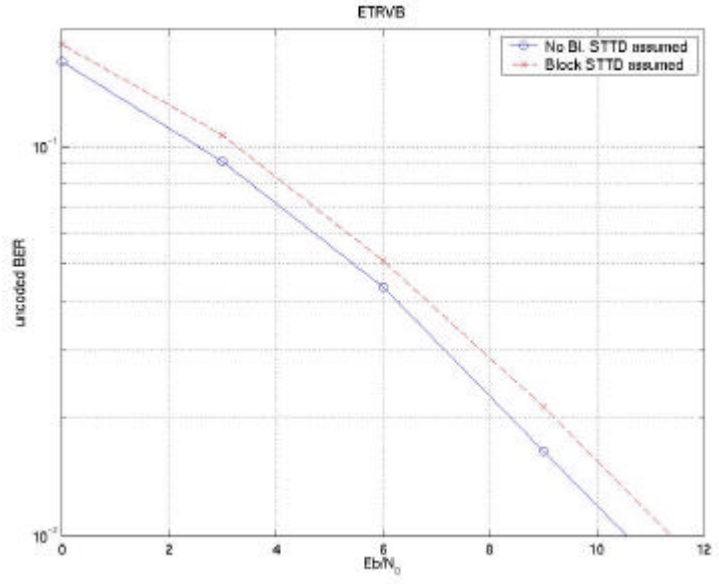

Figure 4: Performance degradation for a Vehicular B channel.

4. Conclusions

The simulation results obtained show a performance degradation within a fraction of dB for all the cases considered. Therefore, the impact of assuming Block STTD encoding when no diversity is present in the P-CCPCH will be small. P-CCPCH detection remains possible without knowledge of presence/absence of Block STTD encoding with a slight performance penalty.

5. References

[1] Motorola, TI, ‘STTD applied to broadcast …’, R1-99994, Espoo, WG1#6.
[2] Motorola, ‘Transmit Diversity schemes for Broadcast channels in the TDD mode’, R1-99c08, Hannover, WG1#7.
[3] Motorola, ‘Transmit Diversity schemes for Broadcast channels in the TDD mode (II)’, R1-99g38, New York, WG1#8.
[4] Interdigital, ‘Additional Results on STTD for Broadcast Channels of the TDD Mode’, R1-99g63, New York, WG1#8.