3GPP TSG-RAN WG1#7 TSGR1#7(99)a82

Hanover, Germany

30. August – 03. September 1999

Agenda Item: AdHoc 1 + AdHoc 6

Source: Bosch

TDD downlink performance in indoor environments

1. Introduction

Following the presentation of [1] at the last WG1 meeting #6, AdHoc 1 and AdHoc 6 delegates requested link level simulation results of the TDD downlink in indoor environments. The results should compare MMSE Joint Detection (JD) and Joint Predistortion (JP) performance with the performance of less complex detection algorithms like e.g. the RAKE detector. The single Tx antenna case as well as the dual Tx antenna (transmit diversity) case should be taken into account.

This paper presents the requested results. Single Tx antenna MMSE-JD, RAKE, Matched Filter (MF) and JP performance is shown as well as dual Tx antenna STD, TxAA and JP performance in IndoorA and IndoorB environments.

2. Simulation parameters

Simulations have been carried out to evaluate the raw bit error rate performance of the TDD downlink in a multi user scenario with 8 active users in a time slot. The following parameters have been used:

carrier frequency	2 GHz
duration of a time slot	10000/15 µs
data modulation	QPSK
chip pulse shaping	root raised cosine, α=0.22
chip pulse length	10 chip periods
number of chips per symbol	16
chip duration	1/3.840 µs
chip over sampling	2
burst type	traffic burst 1 (old midamble)
data detection	MMSE-BLE, RAKE, MF
channel estimation	correlation, four strongest taps selected
channel type	IndoorA, IndoorB at low mobile velocity

If required, ideal uplink channel estimation (no noise, no time difference between uplink reception and downlink transmission) is applied.

3. Simulation results

The following three figures present the obtained simulation results for the different transmission and detection schemes. Figure 1 shows the performance of the single Tx antenna schemes JD, RAKE, MF and JP. Figure 2 displays the comparison between dual Tx antenna TxAA (JD, RAKE and MF detection) and JP (MF detection). Finally Figure 3 shows the comparison between dual Tx antenna STD (JD, RAKE and MF detection) and JP (MF detection).

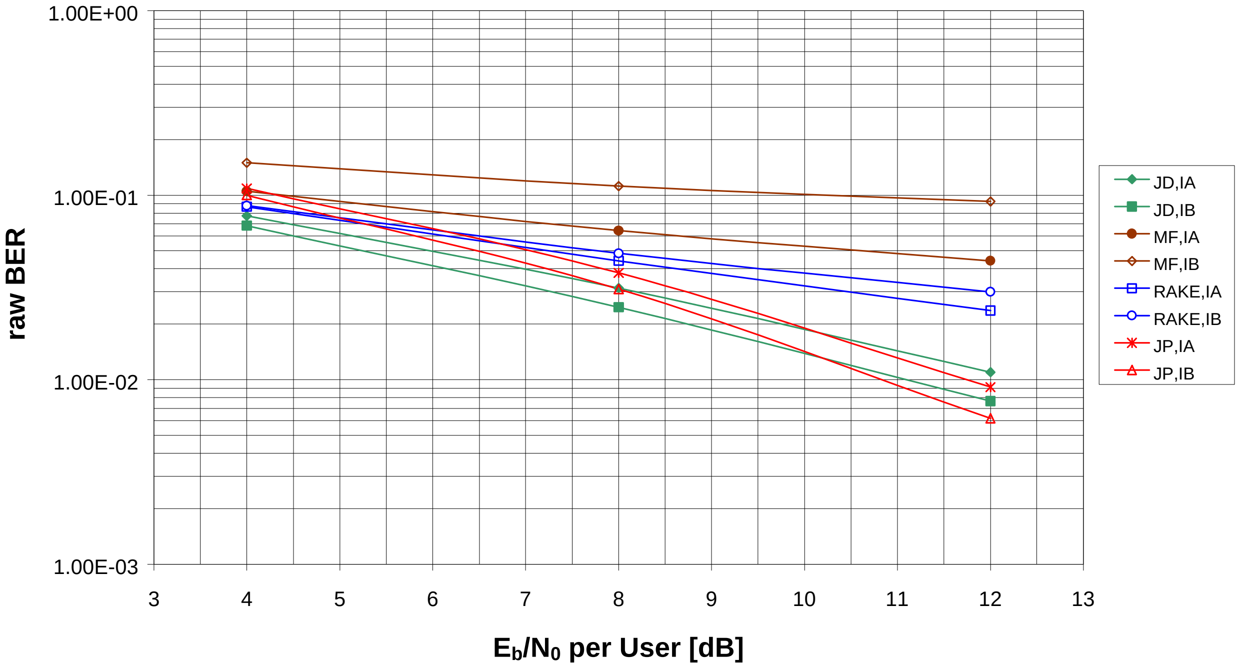

Figure 1: Raw BER performance of single Tx antenna JD, RAKE, MF and JP in IndoorA (IA) and IndoorB (IB) environments.

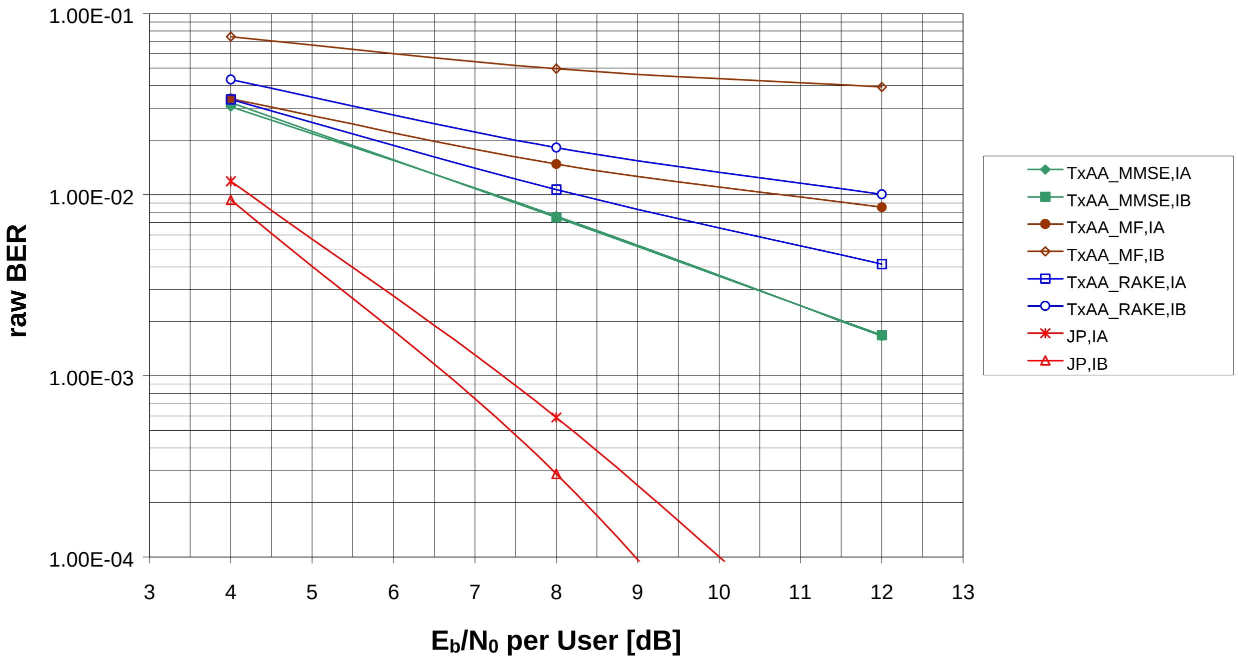

Figure 2: Raw BER performance of dual Tx antenna TxAA with JD, RAKE and MF detection compared to JP in IndoorA (IA) and IndoorB (IB) environments.

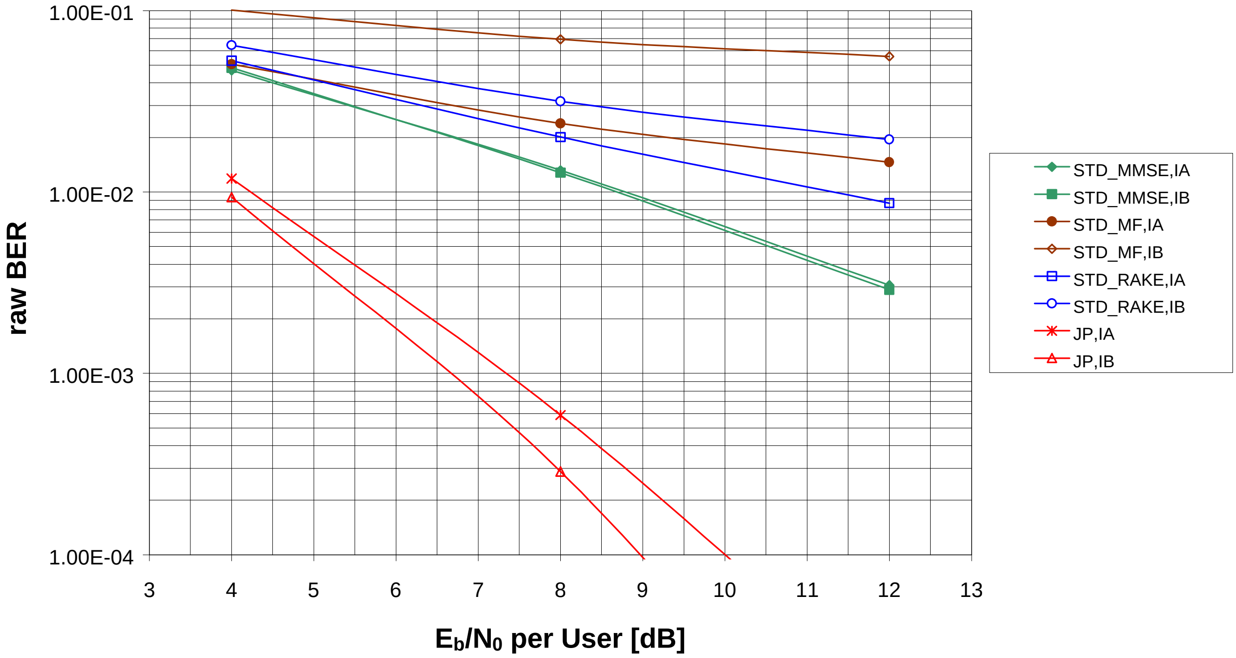

Figure 3: Raw BER performance of dual Tx antenna STD with JD, RAKE and MF detection compared to JP in IndoorA (IA) and IndoorB (IB) environments.

4. Conclusions

With the assumption given in [2] that the operating point of the TDD system in an indoor environment with data services is at raw BER≈1e-02 the following main observations can be made:

- Neither in the single Tx antenna nor in the dual Tx antenna modes (excluding JP) a detection algorithm less complex than JD like RAKE or MF can be applied without leading to a severe performance degradation of several dB's in terms of E_b/N_0.
- The dual Tx antenna JP mode leads to a 2.5-2.8 dB maximum gain compared to TxAA using JD.
- The dual Tx antenna JP mode leads to a 4.4-4.7 dB maximum gain compared to STD using JD.

This leads to the conclusions:

⇒ A transmission scheme applying joint MAI and ISI cancellation algorithms (like JD or JP) is required to guaranty system capacity and coverage even in indoor environments.

⇒ The JP scheme applied to multiple transmit antennas leads to significant performance gains compared to other Tx diversity schemes also in indoor environments. This gain is achieved with the least complex detection algorithm.

5. References

[1] Tdoc 3GPP TSGR1#6(99)918, “Tx Diversity with Joint Predistortion”, source: Bosch, July 1999.

[2] Tdoc 3GPP TSGR1#6(99)879, “More results on transmit diversity for the TDD mode”, source: Motorola, July 1999.