3GPP TSG-RAN WG1#9 TSGR1#8(99)j48

Dresden, Germany

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Agenda Item: AdHoc 1 + 6

Source: Bosch

TDD transmit diversity with Joint Predistortion – further simulation results (2)

1. Introduction

This paper presents further link level simulation results of dual Tx antenna Joint Predistortion (JP) in indoor environments. Tx diversity with JP was introduced at WG1#6 in [1] followed by additional simulation results in [2] and [3]. At WG1#8 two concerns were raised regarding the simulation conditions [4]:

a) Uplink (UL) conditions were too optimistic (E_b/N_0=8 dB).

b) JP includes a kind of fast power control which makes the comparison to JD (Joint Detection) unfair.

The simulation results shown in this paper address these two concerns and we try to clarify related questions. Here E_b/N_0=6 dB is used in the UL and fast power control is also applied to the schemes with JD (Single Tx Antenna, TxAA).

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	GHz
	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
data detection	MMSE-BLE (Single Tx,TxAA), MF (JP)
channel estimation	correlation, 2(IA)/4(IB) strongest taps sel.
channel type	IndoorA, IndoorB

Two different frame structures were investigated:

FS1: Single switching points with nearly symmetric DL/UL allocation (8/7)

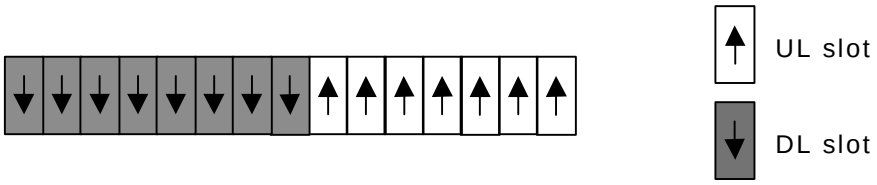

Figure 1: TDD FS1.

FS2: Multiple switching points with asymmetric DL/UL allocation (4/11)

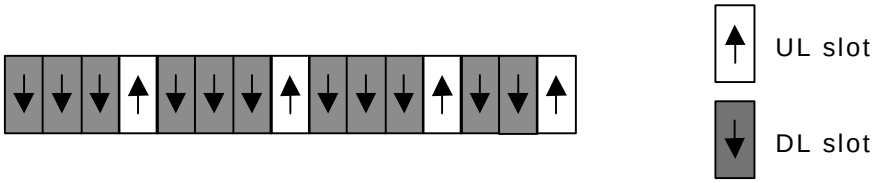

Figure 2: TDD FS2.

3. Simulation results

The following two figures present the obtained simulation results for the IndoorA and IndoorB channel model. E_b/N_0=6 dB in the UL and E_b/N_0=8 dB in the DL. We compare the single Tx antenna Joint Detection (JD) performance with dual Tx antenna TxAA and JP in terms of raw BER. 'PC-' indicates that fast power control has been applied to the scheme.

The worst case with respect to UL channel estimation was always used, which means that UL and DL slots have the maximum time separation.

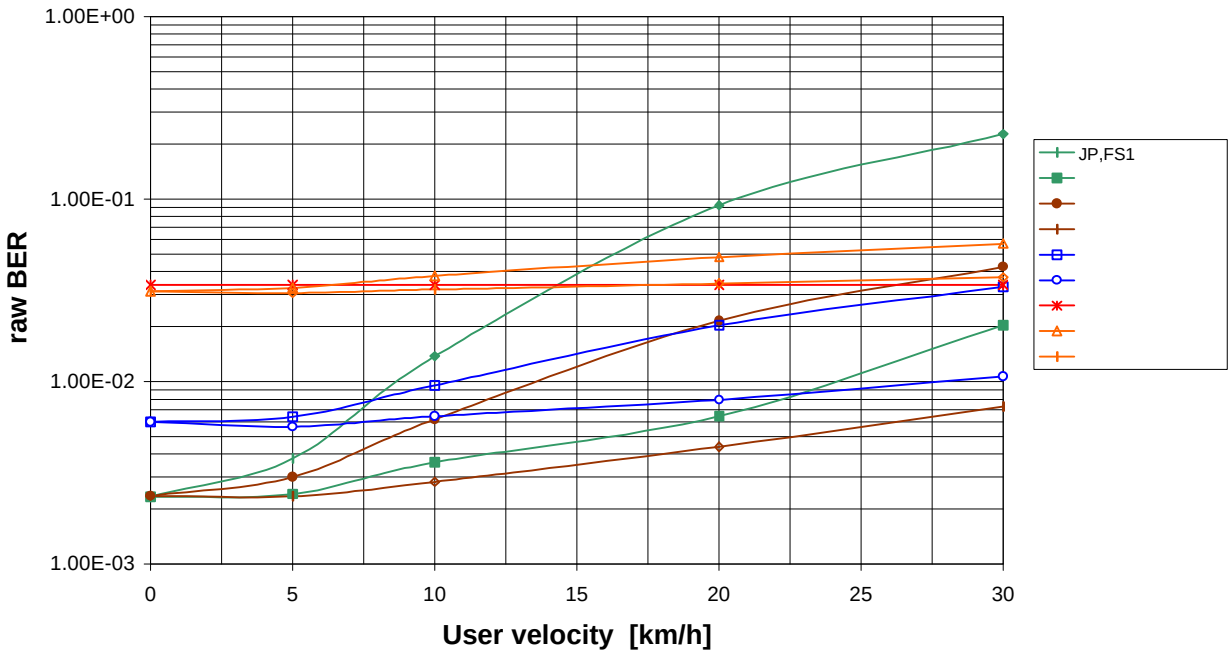

Figure 3: Raw BER performance of single Tx antenna JD, dual Tx antenna TxAA and JP in the IndoorA environment.

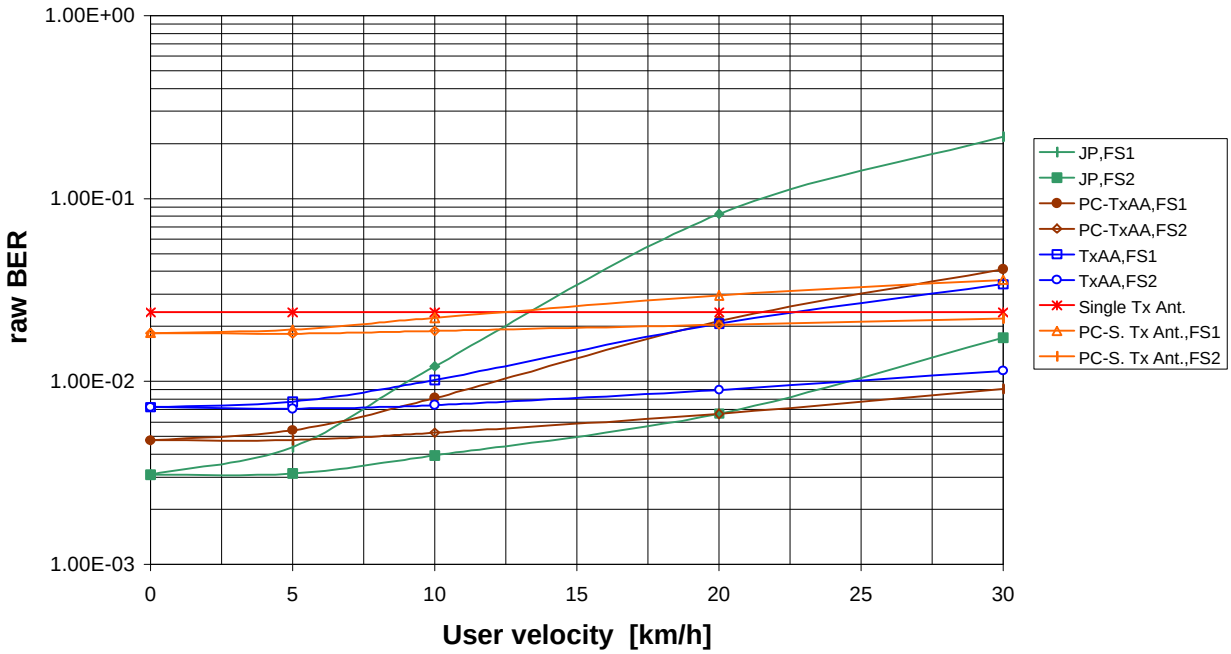

Figure 4: Raw BER performance of single Tx antenna JD, dual Tx antenna TxAA and JP in the IndoorB environment.

In addition the following figure shows simulation results of single Tx antenna JD with and without power control in the important region around raw BER=10e-2 (Indoor A channel, no UL/DL time difference, E_b/N_0=6 dB in UL). This enables the comparison with Figure 3 to find out the maximum gain of Tx diversity with and without applied fast PC.

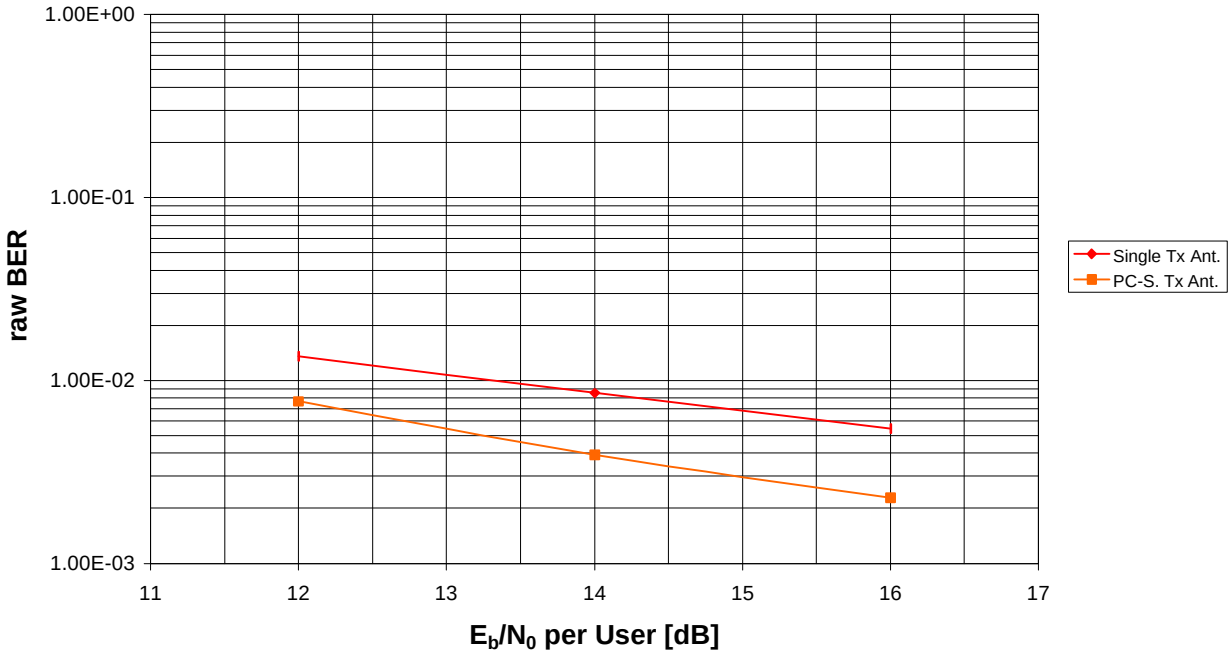

Figure 5: Single Tx antenna JD performance with and without fast PC (Indoor A channel).

4. Conclusions

Regarding the two concerns mentioned in the introduction the presented simulation results lead to the following conclusions:

a) There is no important difference of JP performance with E_b/N_0=6 dB compared to E_b/N_0=8 dB in the UL.

b) Fast power control has been applied to single Tx antenna JD and TxAA to allow a fair comparison to JP. In the Indoor A channel JP shows a similar performance as PC-TxAA up to about 5 km/h mobile velocity with FS1 and up to about 10 Km/h mobile velocity with FS2. With the Indoor B channel JP outperforms PC-TxAA up to 7 km/h with FS1 and up to 20 km/h with FS2.

In general the following observations are interesting:

⇒ Fast open loop power control provides a significant performance improvement in low-fading-rate indoor environments even with JD (2-3 dB gain in terms of E_b/N_0) if the target raw BER is 1e-2 and lower. If the target raw BER is higher than 1e-2 (e.g. 3e-2, see Figure 3) no significant gain is achieved with fast PC.

⇒ The maximum Tx diversity gain in terms of E_b/N_0 with 2 transmit antennas in the Indoor A channel is 7.6 dB without fast PC (TxAA) and 8.0 dB with fast PC (TxAA or JP).

5. References

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

[2] Tdoc 3GPP TSGR1#7(99)a82, “TDD downlink performance in indoor environments”, source: Bosch, August 1999.

[3] Tdoc 3GPP TSGR1#7(99)g20, “TDD transmit diversity with Joint Predistortion – further simulation results”, source: Bosch, October 1999.

[4] Tdoc 3GPP TSGR1#8(99)g81, “Report from Ad Hoc #1: TDD”, source: Ad Hoc #1, October 1999.