TSG-RAN Working Group 1 meeting #7 TSGR1#7(99)c06
Hannover, Germany
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Source: Motorola

Influence of Tranceiver chain phase imbalances on TxAA performance

1 Introduction

In last meeting there were some questions on TxAA performance when there was a phase difference between the transceiving chains of the transmitting antennas. This contribution gives the answers to those questions and shows that TxAA performance is very robust to transceiver chain phase imbalances.

2 System Model

Figure 1 shows the transceiver scheme for a Node B using TxAA and 2 antennas. The model considers the phases introduced by the receiving and the transmitting chains.

TxAA consists of a set of weights applied to each of the transmitting antennas to maximise the power received at the UE. These weights are calculated using uplink channel estimations available at the Node B and they include the phase introduced by both receivers (ϕ_{1r}, ϕ_{2r}).

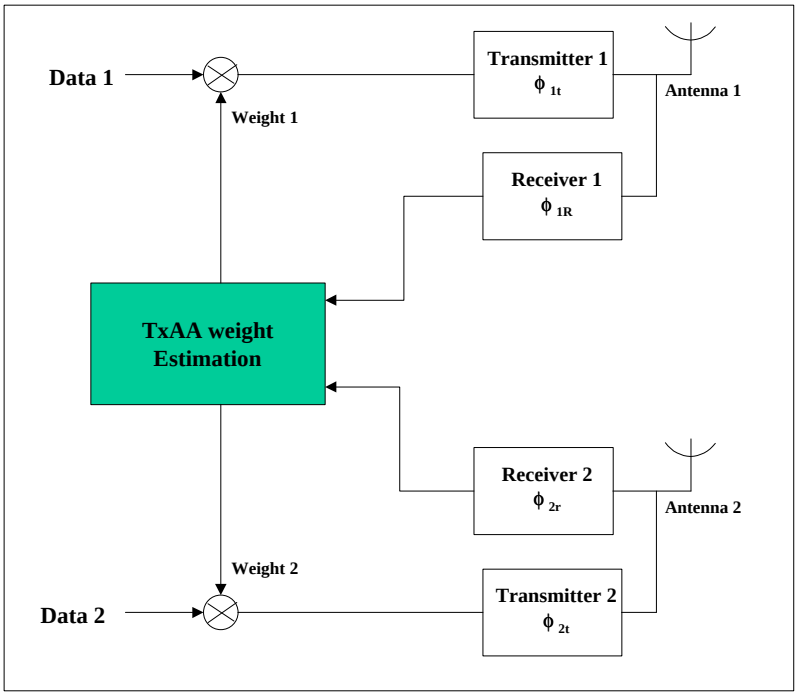

Figure 1: Node B transceiver chain

The absolute phases of TxAA weights are irrelevant. The critical point is to maintain the phase difference between the weights that ensures a constructive addition of the received signals at the UE. The following equation must be fulfilled to ensure that TxAA performance is optimal:

$$|(\phi_{1r} - \phi_{1t})-(\phi_{2r}, \phi_{2t})| = 0.$$

This contribution will analyse system performance when the previous condition is not verified:

$$|(\phi_{1r} - \phi_{1t})-(\phi_{2r}, \phi_{2t})| = P$$

3 Simulation Results

Simulations for different values of P have been performed under the following conditions:

- MMSE JD
- 8 Users
- Midamble Channel estimation
- Eb/No=8dB in Indoor A simulations
- Eb/No=4dB in Vehicular A simulations
- Ideal weight estimation

Indoor A channels

Figure 2 shows that TxAA performance is very small degraded for values of P<40° and that TxAA outperforms STD for values of P<75°. Moreover, the single antenna limit is reached for P>90°.

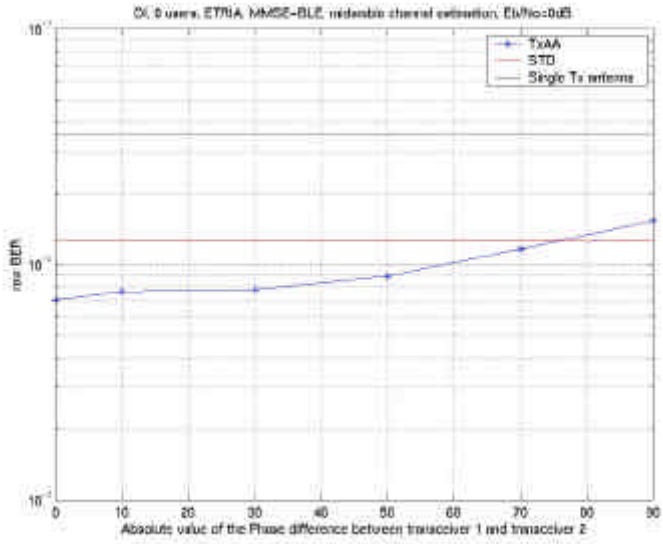

Figure 2: Indoor A

Vehicular A channels

Figure 3 shows that TxAA performance is very small degraded for values of P<30° and that TxAA outperforms STD for values of P<75°. Moreover, the single antenna limit is reached for P>90°.

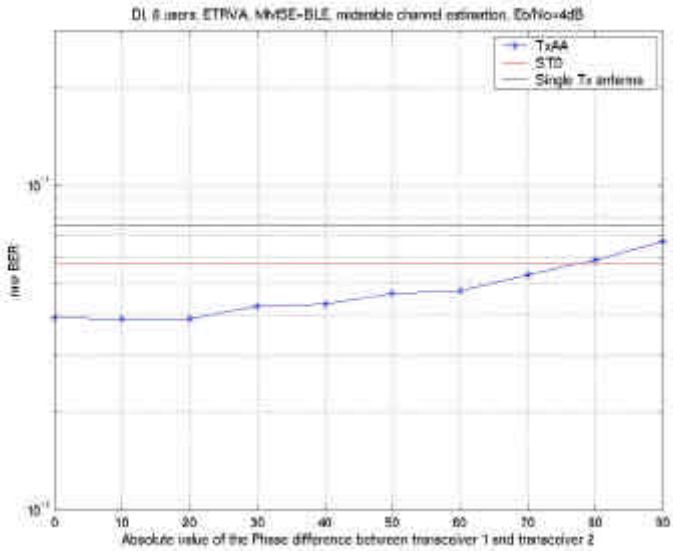

Figure 3: Vehicular A

4 Conclusion

This contribution has showed that TxAA is very robust to transceiver chain phase imbalances. TxAA performance is better than STD performance for phase imbalances up to 75° and is better than the single Tx antenna for phase imbalances up to 90°.