TSG-RAN WG 1, Meeting #16 R1-00-1270
Pusan, Korea, Oct 12

Agenda Item: AH27: Radio Link Performance Improvement

Source: SAMSUNG

Title: DSCH Tx Diversity Operation in SHO Region

Document for: Discussion & Decision

Introduction

In the last TSG RAN WG1 #11 plenary meeting, Qualcomm pointed out some problems related to the power control behavior of PDSCH associated with DPCH in soft handover (SHO) region. The problem was also indicated by Nokia, and a TR was submitted in the #15 meeting [2] and was approved as a work item as well.

Closed loop Tx diversity behavior has a problem similar to the power control due to the same reasons as in DSCH power control in SHO region.

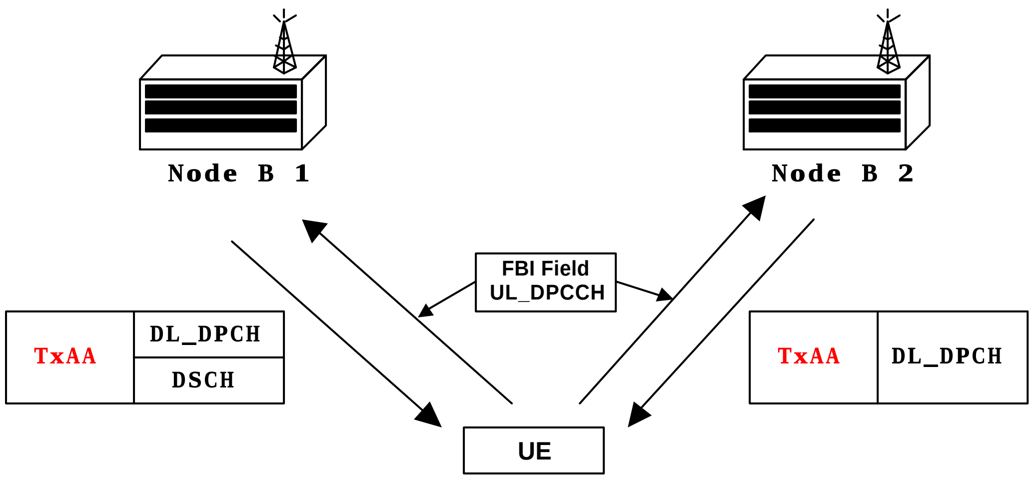

Fig 1.

In general, when a UE in SHO region has a PDSCH link associated with DPCH, PDSCH is transmitted from only one cell while DPCH is transmitted from all the cells in the active set, as shown in Fig 1. The reason for transmitting PDSCH from only one cell is, as indicated in the previous contributions, to reduce the significant interference created by simultaneous transmission from various cells. It is because PDSCH is usually a high data rate channel powered by, for instance, more than 5 % of the total downlink power. And another reason is that PDSCH is operated on such a complicated time schedule that it cannot be transmitted from several cells simultaneously.

The weight factor of the closed loop Tx Diversity for downlink DPCH in SHO region is determined by considering the radio link of all cells in the active set. When PDSCH is associated with DPCH, the PDSCH is transmitted from only one cell, which is not necessarily the primary cell among the cells located in the active sets. If, the cell that transmits PDSCH is not the primary cell state, the transmission antenna diversity weight factor is not guaranteed to be suitable for PDSCH transmission. Consequently, serious performance degradation can occur to the PDSCH diversity transmission. Even when the base station that transmits PDSCH is the primary cell state, the weight factor is also not suitable unless the active set is unbalanced. In this contribution, we present several ways to solve the problem and suggest further operation method.

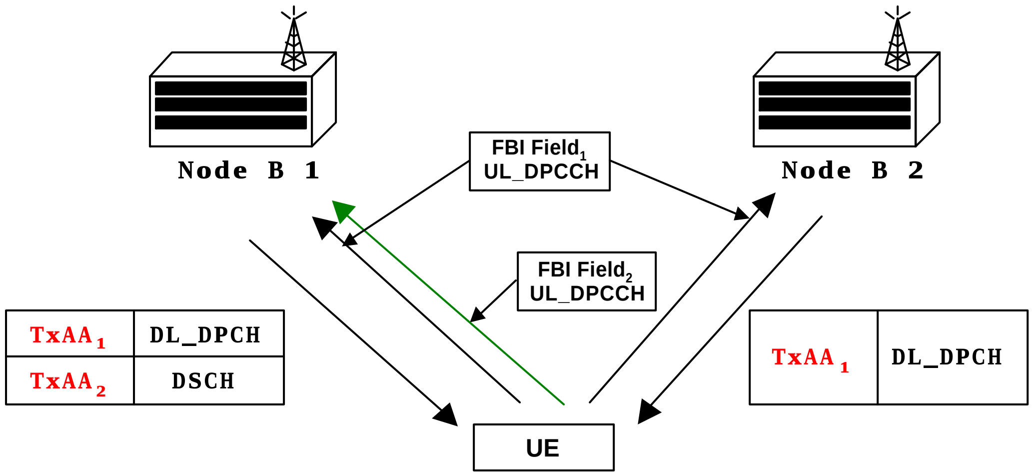

Fig 2.

Proposed methods

1.<u>Modified FBI field</u>

As shown in Fig 2, we can create two different weight values for DPCH and PDSCH respectively, and transmit them to the cell. In the case that UE is under low-speed circumstances, the feedback information format per slot in closed loop Tx diversity mode 1 will be as shown in Table 2, i.e., timely multiplexing of two information and transmitting them in one FBI D field, i.e., field index 0 and 1 corresponds to DPCH and PDSCH, respectively. And the quality of Tx antenna diversity is maintained. Note that table 1 is the existing feedback information format per slot in closed loop Tx diversity mode 1.

Table 1.

Slot #		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
FSM	0	0	?/2	0	?/2	0	?/2	0	?/2	0	?/2	0	?/2	0	?/2	0
	1	?	-?/2	?	-?/2	?	-?/2	?	-?/2	?	-?/2	?	-?/2	?	-?/2	?

Table 2.

Slot #		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
FSM	0	0	0	?/2	?/2	0	0	?/2	?/2	0	0	?/2	?/2	0	0	?/2
	1	?	?	-?/2	-?/2	?	?	-?/2	-?/2	?	?	-?/2	-?/2	?	?	-?/2
Field Index		0	1	0	1	0	1	0	1	0	1	0	1	0	1	0

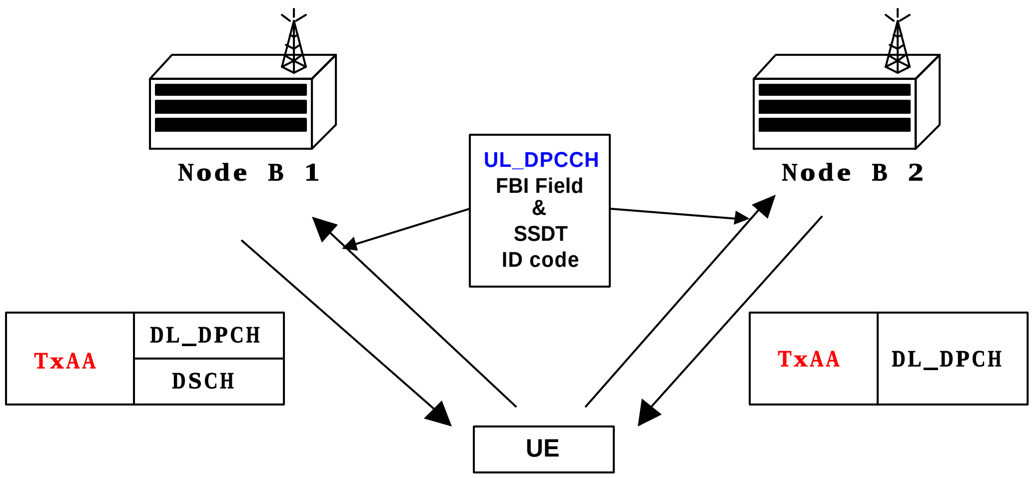

Fig 3.

2.Extended SSDT

Fig 3 describes the SSDT signaling method. Using SSTD signaling method, even in the case of not applying SSDT, UE can know whether the cell is the primary cell or not. If the cell that transmits PDSCH is the primary cell, the Tx antenna diversity weight received from the UE reflects the channel information of the cell, thus PDSCH is transmitted without power offset, as is the case when the UE is not in SHO region. Otherwise, we need to transmit PDSCH with power offset. And in the case of using TxAA, we need to allocate higher power offset than that of single antenna or open loop diversity, because not only TPC but also the TxAA does not work properly.

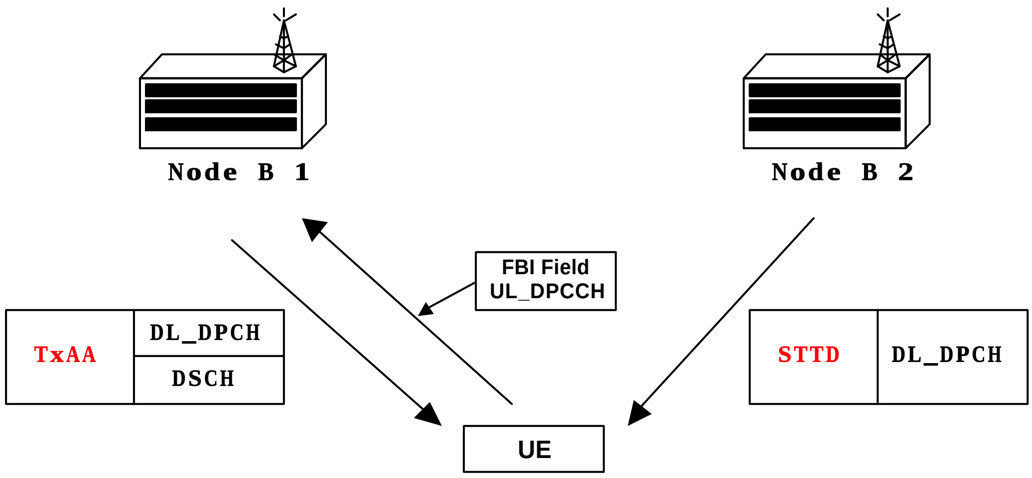

Fig 4.

3.TxAA/STTD

There are two different Tx antenna diversity methods. As for a data channel, the STTD is applied for an open loop method, and TxAA is applied for a closed loop method. Unlike TxAA, however, STTD does not need feedback information, and thus can be used as a Tx diversity for Node B that transmitting the DPCH not associated with PDSCH in SHO region, while using TxAA for Node B that transmitting the PDSCH and DPCH associated with each other. In other words, application of TxAA is limited only to the cell carrying DSCH and STTD is applied to the remaining cells among cells of active set of vice versa. Therefore, in case PDSCH is associated with DPCH in SHO region, the problem can be avoided by a proper combination of TxAA and STTD as shown in Fig 4.

Conclusion

We propose an efficient DSCH Tx diversity schemes in SHO region as follows:

1) In TxAA, Modify FBI D field allocated for closed loop Tx antenna diversity to carry information on both PDSCH and DPCH. This method is applicable for low-speed UE,

2) Extended SSDT signaling using power offset according to diversity mode to assign more power to PDSCH,

3) Combination of TxAA and STTD.

As for 3) combination of TxAA and SSDT, it needs additional signaling, but has the advantage of having little impact on R'99 UE HW. There will be further comparison of advantages and disadvantages of the proposed schemes in the next contribution.

References

[1] Qualcomm, Power control in DCH/DSCH mode, 3GPP TSG-RAN WG1#11 R1-00-0327

[2] Nokia, Draft TR for the DSCH power control improvement in Soft Handover, 3GPP TSG-RAN WG1#15 R1-00-1026