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1 Introduction

One of the objectives of allowing the NodeB control of the TFCS subset is to dynamically manage the UL radio resource usage and transmissions to optimize the overall system throughput. Having the NodeB in control of the subset reduces the latency that is experienced in the current R99/4/5 uplink RNC TFCS control. As in HSDPA, with NodeB control scheduling and control of the TFCS subset, better adaptation to the channel variation is possible. However, one disadvantage is that since the resource management entity for E-DCH is located at the Node B, it is difficult to coordinate the control between the different NodeBs during soft handover operation.

SHO support for EDCH was agreed in WG1#37 in Montreal. In this document, the support of SHO for EDCH is evaluated from the point of view of different Scheduling and HARQ schemes.

2 Handover Scenarios

As the radio resource management and dynamic control of the UL transmission residing at the Node B, the behaviors of the supported enhancements for the EDCH feature, such as scheduling and HARQ, needs to be specified clearly during the handover. One NodeB control function in the R99/4/5 DCH is the inner loop power control. The R99/4/5 UL DCH supports soft handover with DL TPC combining strategy for the UL inner loop power control. The R5 HSDPA feature is designed to schedule user in time and code domain based on the DL radio channel condition feedback from the UE. In HSDPA, the support of soft handover is not provided mainly due to the difficulty of the scheduling control function coordination between Node B in short interval and the delay tolerance of the best effort service class defined for the HSDPA. Thus, for EDCH to support SHO, similar difficulties need to be overcome.

2.1 Different Scheduling Modes

Many issues related to scheduler operation in SHO exist e.g. the selection of the scheduler entity in SHO. However, they will not be discussed here. Instead, in this section, the support of SHO by the type of scheduler: Rate and Time or Rate Scheduling is discussed.

With Rate and Time scheduling, the Node B controls the UE transmission data rate and its transmission duration to optimize the system capacity. Since the UL system capacity is interference limited, the control of an UE transmission data rate is also relative to the interference it creates to other UEs. . The rate scheduling

technique manipulates individual UE's UL data rate based on its radio channel condition and the system load. However, regardless of the scheduling modes being implemented, the common feature presents during handover period is that all Node Bs in the active set will receive the UL transmission from the UE. Hence:

- In order that the RoT for a specific Cell not to be adversely affected due to transmission from a UE in SHO, the NodeBs in the Active Set controlling the specific Cell needs to support scheduling operations for UE in SHO;

- If the NodeB supports SHO scheduling, it would also attempt to receive and decode the uplink transmission from the SHO UE. Hence, the gain from selection combining at the RNC is possible. However, if the NodeB support of SHO scheduling is removed, the NodeB may decide not to decode the uplink transmission, resulting in loss of combining gain;

Rate Scheduling: With rate scheduling, the Node B dynamically sets the TFCS subset at each scheduling period time interval. All Node Bs in the active set during the SHO would operates the handover independently and would send independent comments to control the transmission rate of the UE in SHO. It would also evaluate its own system load. This behavior is similar to that of UL power control during the soft handover. *Thus, rate scheduling technique should support soft handover with the addition of the combining strategy of the received rate control comments from each Node B.*

Rate and Time Scheduling: With rate and time scheduling, the Node B selects a sub-group of UEs to transmit at their given data rate at each time interval. In a given radio resource, the rate and time scheduling tends to distribute the UL data transmission in time domain with higher data rate. The higher data rate transmission potentially could create larger interference to other user, compared to Rate scheduling due to the un-synchronized NodeBs in SHO. *Thus, the performance gains of rate and time scheduling in SHO should be investigated further and should be kept as the working assumption now.*

2.2 HARQ Modes

In the previous meeting, both Incremental redundancy and Chase combining have been agreed. Within these two modes, the options of operating with synchronous or asynchronous modes exist [1]. Between these two modes, the effects of link imbalance are different. To support SHO for Edch implies that multiple HARQ entities are needed for the UE in SHO. Due to link imbalance, the state machines across the different HARQ entities across the active set could be unsynchronized e.g. different ACK/NACK error transition probabilities on the different SHO links.

Because of the different link performances, multiple error scenarios could potentially exist among the different HARQ entities. A key task is then to optimize the 'synchronization' of the different HARQ entities so that the performance degradation is minimized. Between Chase and IR, the latter would require more uplink signaling bits and between synchronous and asynchronous, the latter would require larger signaling bits. While the benefits of asynchronous HARQ are discussed in [1], the gains of Chase over IR for SHO are less obvious.

3 Summary

It is proposed that the following working way forward be considered:

1. Soft handover should be supported for Rate scheduling to enable the soft handover gain,

2. The support of SHO for Rate and Time scheduling be kept as an option until its performance gains or degradation is shown through simulation studeis,

3. Chase combining be supported for SHO and IR be kept as an option until its performance gains in SHO is verified.

4 References

[1] R1-Async, “Asynchronous/Synchronous HARQ” Lucent.