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Agenda Item: TDD Ad Hoc.

Source: Nokia

Updated Downlink Shared Channel (DSCH) physical layer signalling with TDD

Introduction

In the last meeting the principle of having DSCH (and USCH) for TDD were agreed but the details of these are missing from the specifications. The physical layer signaling was discussed in the last TDD Ad Hoc and the need for both TFCI and midamble based signaling was identified. This contribution proposes a detailed description of the physical layer signaling methods in connection with the DSCH in TDD. This document contains the revised text reviewed in Ad Hoc 1 based in Tdoc B09.

Motivation for two physical layer signalling methods.

In FDD the TFCI on the DCH can be used with the DSCH to give frame by frame indication of the existance of user data on the DSCH.

The same can and should also be specified for TDD. However there are some differences between FDD and TDD which show that TFCI alone is not always sufficient or optimal way to make the DSCH physical layer signalling with TDD. The reasons are the following:

- In TDD the DSCH may be associated with FACH as well. This FACH may not always contain the data for the user which is intended to use the associated DSCH and hence the user would be unaware that there is a DSCH that it is supposed to use. Also, the, TFCI is not always present on FACH..

- In TDD the interference will vary on a slot by slot basis, in fact a great deal more than with FDD and, thus having the signalling together with the data presents performance benefits in some scenarios.

- The reliability of the TFCI with a few bits may be a problem in some environments (low speeds), especially if interleaving over two frames is not possible. With a small number of TFCI bits, a PDSCH midamble has clearly more energy assuming identical TX power.

- The complexity is not increased as the requirements, such as buffering etc., are at the same level or below that of the TFCI use. The channel estimator output would only need to be used for the additional comparison operation with the reference midamble power level from the DCH or FACH.

The TFCI can not be replaced fully since midamble based method can not be used if there are many possible combinations (TFCI method has higher granularity) to be indicated at the same time, thus both methods are needed for proper operation with DSCH in TDD. The proposed method should be seen rather as complementing DSCH use with TFCI.

For DCA operation there are no compromises introduced by this as both TFCI based and midamble based methods are under RNC control along with the DSCH data transmission.

Summary of the proposed methods in addition to TFCI based signalling.

A UE that has been allocated to have data on the DSCH will also be given a midamble that corresponds to this particular DSCH and this midamble is independent from the midamble that is used on the DCH or FACH.

The UE will compare the output of the channel estimator, using the known midamble, to the reference value obtained from the midamble on the DCH or FACH. Based on this comparison the UE should decide whether to decode or not the DSCH slot it has received.

The receiver functionality above is naturally an example only, and should not be described in the specification as such. As far as the midambles are concerned, there are 128 different midambles and 16 shifts for each, so this presents a sufficient number of midambles that are available for this scheme and hence no extra changes are needed.

Which method is used and when is naturally up to the UTRAN to decide.

Conclusions

The proposed physical layer method for the TDD DSCH allows the use of a fast physical layer signaling, similar to FDD, and to retain the user service quality with DSCH. It is not intended to exclude the possibility of using the higher layer signaling for indicating the existence of a downlink shared channel.

The attached text for TDD DSCH signaling is proposed to be added to the 25.221.

It is also identified that for proper parameterisation purposes, RAN WG2 needs to be informed of the related signaling needs with TDD DSCH.

TEXT PROPOSAL FOR 25.221 section 5.6

5.6 Physical Downlink Shared Channel (PDSCH)

For Physical Downlink Shared Channel (PDSCH) the burst structure of DPCH as described in section 5.2 shall be used. User specific physical layer parameters like power control or directive antenna settings are derived from the associated channel (FACH or DCH).

To indicate to the UE that there is data to decode on the DSCH, three signalling methods are available:~~,~~

1) using the TFCI field of the associated channel or PDSCH

2) ~~,~~using on the DSCH user specific midamble derived from the set of midambles used for that cell

3) using higher layer signalling.

When the midamble based method is used, the UE shall decode the PDSCH if the PDSCH was transmitted with the midamble indicated for the UE by UTRAN.