3GPP TSG RAN Meeting #23 **Tdoc RP-040128**
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Source: **Ericsson**

Title: **Discussion on HSDPA reconfiguration**

Agenda Item: **7.2.5**

Document for: **Discussion and decision**

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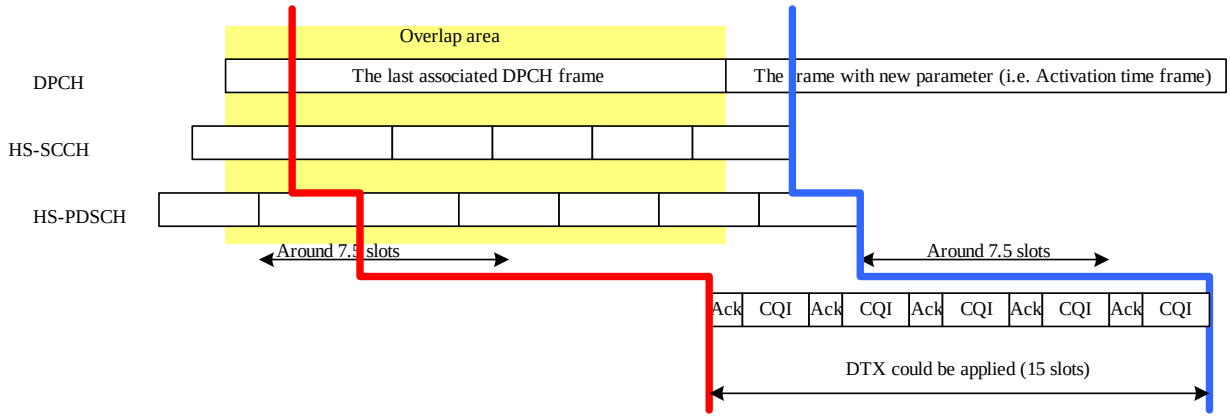
1. Introduction

In [1,2] a number of parameters are listed causing the UE to apply DTX in the "DTX could be applied" period in the figure (taken from [1]) below. This contribution tries to identify if there is any ambiguity in the specifications related to ACK/NACK or CQI reporting justifying DTX.



2. Discussion

It could be noted that the discussion below assumes that an activation time different from "now" is used. However, there is no fundamental difference for the UE if "now" or a CFN is used as an activation time. The only difference is for UTRAN. In case UTRAN uses "now" there is an ambiguity from a UTRAN point of view when "now" is applied in the UE. This is however, always the case if activation time "now" is used, and it is nothing that is specifically related to HS-DSCH reconfigurations.

2.1. H-RNTI

H-RNTI is used as scrambling of HS-SCCH, but since activation time is given for HS-SCCH there is no ambiguity when the old H-RNTI and the new H-RNTI should be used.

Also there is no impact on ACK/NACK or CQI reporting related to H-RNTI.

2.2. MAC-hs reset

MAC-hs reset is usually performed in case the serving hs cell is changed from one Node-B to another when the H-ARQ soft information is lost. This could also be applied for cell changes also within the same Node-B if there is other implementation restrictions in the Node-B causing soft information to be lost at cell change.

Independent of how MAC-hs reset is used, this happens at a given activation time and there is no ambiguity how ACK/NACK and CQI reporting should be done related to the time just before this activation time or just after this activation time.

MAC-hs reset is not related to CQI reporting. For ACK/NACK reporting, there might be a clarification needed what the UE should send, when the soft buffer is flushed during HARQ (e.g. it could be clarified in 25.321 to send a NACK).

2.3. Reconfiguration of HARQ processes and reconfiguration of HARQ memory partitioning

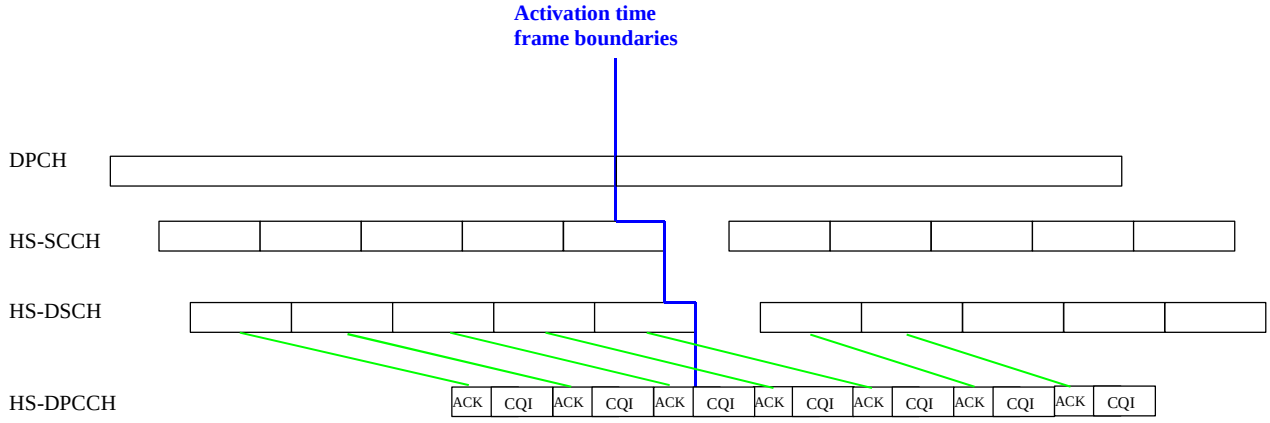
Both these reconfigurations are typically done at an activation time. Even though these could be seen as not reconfigured very often it is still clear in the current specification what configuration should be used by the UE before the activation time and after the activation time. Also it is clear which HS-DSCH transmission that the ACK/NACK signaling corresponds to, and which sub-frames the CQI reporting corresponds to. I.e. there is no ambiguity justifying DTX. It is argued in [1] that MAC-hs reset will be done in conjunction with the reconfiguration, so there is no ambiguity related to this reconfiguration itself, and the UE behavior should be according to what is specified for MAC-hs reset.

2.4. Reconfiguration of DPCH timing offset $\tau_{DPCH,n}$ for HS-DSCH serving cell

We do not see an issue of CQI or ACK/NACK reporting related to this reconfiguration. See also related discussion below on change of HS-DSCH serving cell.

2.5. Change of HS-DSCH serving cell

As could be seen in Figure 34 in 25.211 there is a given timing between HS-PDSCH and the Uplink HS-DPCCH. In case of HS-DSCH cell change within the active set the situation will look something like in the following figure in case the timing of DPCH and HS-DPCCH is kept, while there can be a discontinuity in HS-SCCH and HS-PDSCH transmission, due to the alignment with a different cell timing (P-CCPCH).



It can be seen that both before and after the activation time there is no ambiguity on the ACK/NACK signalling. Also there is no ambiguity related to CQI reporting, unless the reconfiguration is done during the 3-slot period where CQI should be estimated. For the ACK/NACK signaling, there is no big ambiguity to which HS-PDSCH sub-frame that the ACK/NACK signaling corresponds to, i.e. the next ACK/NACK will correspond to the next HS-DSCH sub-frame.

It could also be argued that the new NodeB cannot interpret the ACK/NACK related to previous HS-DSCH transmission in the old cell, but since the new cell may belong to the same NodeB, we should not rule out the possibility to use the ACK/NACK signaling. Therefore, the UE should continue sending the ACK/NACK even after the reconfiguration.

For the timing between HS-PDSCH and uplink HS-DPCCH, what could be seen as missing is what happens with this time relation in case of a reconfiguration that changes the UE timing (e.g. a HHO, using synchronization procedure A). The UE behavior for this case could be defined such that the ACK/NACK/CQI signaling is the same way as for the initial RL setup.

Concluding for change of serving cell, it is only in the case of reconfiguration during the 3 slot estimation period of CQI that potentially need to be clarified. It could be stated either that the UE report is unspecified or that the UE takes an average anyway and that the UTRAN know that this average is done on both the old and the new cell. This and a possible clarification of “normal” ACK/NACK reporting could be done e.g. in 25.214.

2.6. Reconfiguration of transmission gap pattern sequence

ACK/NACK and CQI reporting during compressed mode is specified in 25.214 (6A.3):

- *The UE shall neglect a HS-SCCH or HS-PDSCH transmission, if a part of the HS-SCCH or a part of the corresponding HS-PDSCH overlaps with a downlink transmission gap on the associated DPCH. In this case, neither ACK, nor NACK shall be transmitted by the UE to respond to the corresponding downlink transmission.*

- *If a part of a HS-DPCCH slot allocated for ACK/NACK information overlaps with an uplink transmission gap on the associated DPCH, the UE shall not transmit ACK/NACK information in that slot.*

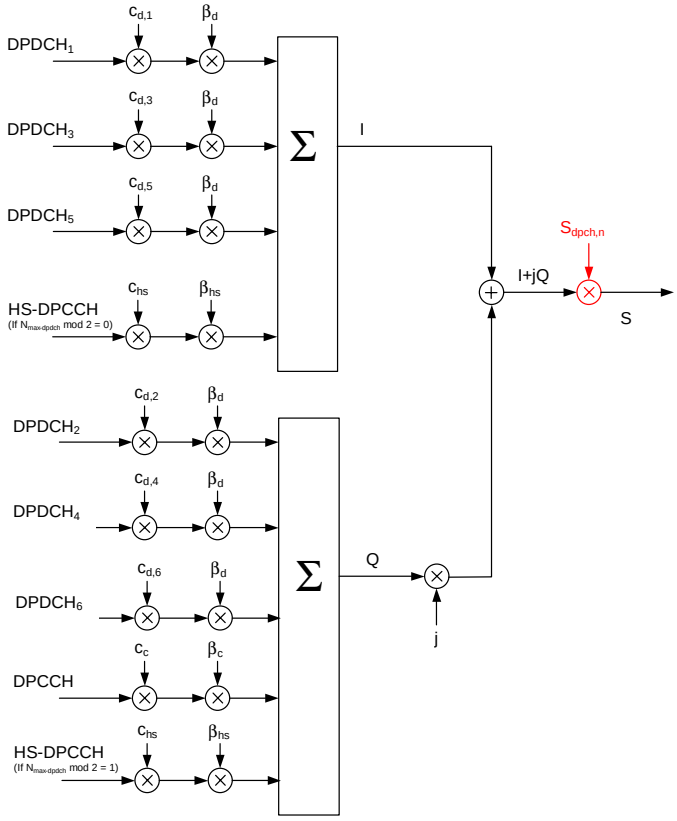
- *If in a HS-DPCCH sub-frame a part of the slots allocated for CQI information overlaps with an uplink transmission gap on the associated DPCH, the UE shall not transmit CQI information in that sub-frame.*

- *If a CQI report is scheduled in the current CQI field according to subclause 6A.1.2 paragraph (2), and the corresponding 3-slot reference period (as defined in subclause 6A.2) wholly or partly overlaps a downlink transmission gap, then the UE shall use DTX in the current CQI field and in the CQI fields in the next (N_cqi_transmit–1) subframes.*

All reconfigurations of compressed mode are synchronized in UE and UTRAN, so all occurrences of transmission gaps are known to UE and UTRAN and the UE behavior is already specified. Therefore there is no need to interrupt the ACK/NACK or CQI transmission in addition to what is specified in 25.214 (6A.3).

2.7. Reconfiguration of scrambling code of uplink DPCH

The UE can only transmit with one uplink scrambling code, therefore a scrambling code change on the DPCH implies a scrambling code change on the HS-DPCCH (see figure below from 25.213).



The timing of the change is the uplink DPCH frame boundary, which is offset to the HS-DPCCH subframe boundary by a multiple of 256 chip, in other words, the change of scrambling code may not be aligned with the HS-DPCCH subframe boundary. Since it is still aligned with a multiple of 256chip, there will be no change of scrambling code in the middle of a channelisation code length. Therefore, there is no need to interrupt the ACK/NACK or CQI transmission in case the uplink scrambling code is changed.

2.8. Reconfiguration of IQ mapping of HS-DPCCH

The IQ mapping of HS-DPCCH may change when the number of uplink DPDCH changes, i.e. aligned with a DPCH frame boundary. The change is synchronized in UE and UTRAN. As explained above, the uplink DPCH

frame boundary is 256chip aligned with the beginning of a channelisation code length on HS-DPCCH, the change of IQ mapping will not happen during the length of a channelisation code (up to 256 chip). Therefore there is no need to interrupt the ACK/NACK or CQI transmission when the IQ mapping of the HS-DPCCH is changed.

2.9. Reconfiguration of TX diversity mode for HS-DSCH serving cell, reconfiguration of closed loop timing adjustment mode for HS-DSCH serving cell

If the TX diversity mode is reconfigured in the HS-DSCH serving cell, this is done in a synchronized way in UE and UTRAN. This can happen during a CQI reference period, resulting in potentially inaccurate CQI. However, as it is known to the NodeB when it changes the TX diversity mode, it can consider this, so there is no reason to interrupt ACK/NACK or CQI transmission when the TX diversity mode or the closed loop timing adjustment mode is reconfigured.

2.10. Reconfiguration of phase reference, reconfiguration of scrambling code or channelisation code of S-CPCH in case of S-CPICH may be used as phase reference, reconfiguration of default power offset between HS-PDSCH and P-CPICH/S-CPICH

If the phase reference is reconfigured, this is done with a given CFN, and also the NodeB is informed about this. There might be potential impact on one CQI report, but as the event is known in the NodeB, the UE can just report CQI based on its measurements and the NodeB may consider this. There is no reason to interrupt ACK/NACK or CQI transmission when the TX diversity mode or the closed loop timing adjustment mode is reconfigured.

2.11. Reconfiguration of ACK/NACK repetition factor

When the ACK/NACK repetition factor is reconfigured at a given CFN, the ACK/NACK repetition may not be able to be continued, so the UE behavior needs to be defined for this case. We suggest to follow an earlier made proposal, i.e. to stop the ACK/NACK repetition at the CFN in which the reconfiguration becomes active.

2.12. Reconfiguration of CQI repetition factor

The problem is similar as for the case of change of ACK/NACK repetition factor, so we suggest to stop the CQI repetition and transmit “fresh” CQI values starting from the first CQI field that belongs to the CFN in which the reconfiguration becomes active.

2.13. Reconfiguration of CQI feedback cycle k

The CQI reporting occasions are specified in 25.214 based on CFN and feedback cycle k.

$$\left(5\times CFN+\left\lceil m\times 256chip/7680chip\right\rceil\right)\bmod k'=0 \text{ with } k'=k/(2ms)$$

If the feedback cycle is reconfigured at a given CFN, this is done in a synchronized way in UE and UTRAN, and the UE can just continue to report CQI in all subframes that fulfill the relation given above. It may need to be clarified that the CQI repetition will stop before the first “fresh” CQI value is reported.

3. Conclusion

Based on the discussion, we do not see a reason why the CQI and ACK/NACK reporting cannot be carried on in case of the following reconfigurations:

- H-RNTI
- HARQ process and HARQ memory partitioning
- DPCH timing offset $\tau_{DPCH,\,n}$ for HS-DSCH serving cell
- Transmission gap pattern sequence
- Uplink scrambling code
- Change of HS-DPCCH IQ mapping
- TX diversity mode or closed loop timing adjustment mode
- Phase reference

- Scrambling code or channelisation code of S-CPCH in case of S-CPICH may be used as phase reference
- Default power offset between HS-PDSCH and P-CPICH/S-CPICH
- CQI feedback cycle k

We acknowledge that there is a need to specify the UE behavior when the following parameters are reconfigured:

- CQI repetition factor (clarification in 25.214)
- ACK/NACK repetition factor (clarification in 25.214)
- MAC-hs reset (clarification in 25.321)
- Change of HS-DSCH serving cell (clarification in 25.214)

We agree that there might be a need for clarification in 25.214 on CQI reporting during power control preamble, e.g. by allowing the UE to use DTX.

4. References

[1] RP-040123, Clarification on reconfiguration of HSDPA, Panasonic

[2] R1-031068, Clarification on the reconfiguration of HSDPA, Panasonic

5. Annex: Further references to existing specifications

---------- Extract from 25.331 section 8.6.3.1 ----------

8.6.3.1 Activation time

If the UE receives a message in which presence is needed for the IE "Activation time", and the value is other than the default value "Now", the UE shall:

1> let the "reference CCTrCH" be defined as the CCTrCh that includes any transport channel or is associated with any physical channel which is being added, re-configured or removed, or, in the case of DSCH (FDD only) or HS-DSCH, the CCTrCh including the associated DCH;

1> if the frame boundary immediately before the frame with the CFN (Connection Frame Number) value indicated by the IE "Activation Time" is at the TTI boundary common to all the transport channels that are multiplexed onto the reference CCTrCh:

2> select that frame boundary as the activation time T.

1> else:

2> select the next TTI boundary, which is common to all the transport channels that are multiplexed onto the reference CCTrCh, after the frame with the CFN (Connection Frame Number) value indicated by the IE "Activation Time", as the activation time T.

1> at the activation time T:

2> for a physical channel reconfiguration other than an HS-DSCH related reconfiguration, caused by the received message:

3> release the physical channel configuration, which was present before T;

3> initiate the establishment of the physical channel configuration as specified for the physical channel information elements in the received message as specified elsewhere.

2> for an HS-DSCH related reconfiguration caused by the received message:

3> select the HS-SCCH subframe boundary immediately before the first HS-SCCH subframe, which entirely falls within the 10 ms frame following T;

3> start using, at that HS-SCCH subframe boundary, the new HS-DSCH configuration in the received message, replacing any old HS-DSCH configuration.

2> for actions, other than a physical channel reconfiguration, caused by the received message:

3> perform the actions for the information elements in the received message as specified elsewhere.

NOTE: An "HS-DSCH related reconfiguration" includes, in particular, reconfigurations that need to be time-aligned with the 2ms subframe of the HS-SCCH, HS-PDSCH and/or HS-DPCCH. For example, start and stop of HS-SCCH reception and serving HS-DSCH cell change.

If the UE receives a message in which presence is needed for the IE "Activation time", and the value is the default value "Now", the UE shall:

1> choose an activation time T as soon as possible after the reception of the message, respecting the performance requirements in subclause 13.5;

1> at the activation time T:

2> perform the actions for the information elements in the received message as specified elsewhere.

NOTE: In FDD, if the UE was in idle mode or CELL_FACH state upon reception of the message, regardless of the state the UE enters after reception of the message, and the value of the IE "Activation time" in the received message is different from "Now", the UE behaviour is unspecified. In TDD, if the UE was in idle mode or

CELL_FACH state upon reception of the message, the value of the IE "Activation time" in the received message is relative to the CFN associated with the cell from which the message was received.

---------- End Extract from 25.331 section 8.6.3.1 ----------

It could be seen that activation time clearly specify the frame boundary concerned for DPCH and sub-frame boundary for HS-SCCH. HS-PDSCH has fixed timing to HS-SCCH so also for HS-PDCH the exact time when to apply a change in configuration is given in detail.

---------- Extract from 25.211 section 7.7 ----------

7.7 Uplink DPCCH/HS-DPCCH/HS-PDSCH timing at the UE

Figure 34 shows the timing offset between the uplink DPCH, the HS-PDSCH and the HS-DPCCH at the UE. An HS-DPCCH sub-frame starts $m \times 256$ chips after the start of an uplink DPCH frame that corresponds to the DL DPCH frame from the HS-DSCH serving cell containing the beginning of the related HS-PDSCH subframe with *m* calculated as

$m = (T_{TX\_diff} /256) + 101$

where T_{TX_diff} is the difference in chips (T_{TX_diff} =0, 256, ..., 38144), between

- the transmit timing of the start of the related HS-PDSCH subframe (see sub-clauses 7.8 and 7.1)

and

- the transmit timing of the start of the downlink DPCH frame from the HS-DSCH serving cell that contains the beginning of the HS-PDSCH subframe (see sub-clause 7.1).

At any one time, *m* therefore takes one of a set of five possible values according to the transmission timing of HS-DSCH sub-frame timings relative to the DPCH frame boundary. The UE and Node B shall only update the set of values of *m* in connection to UTRAN reconfiguration of downlink timing.

More information about uplink timing adjustments can be found in [5].

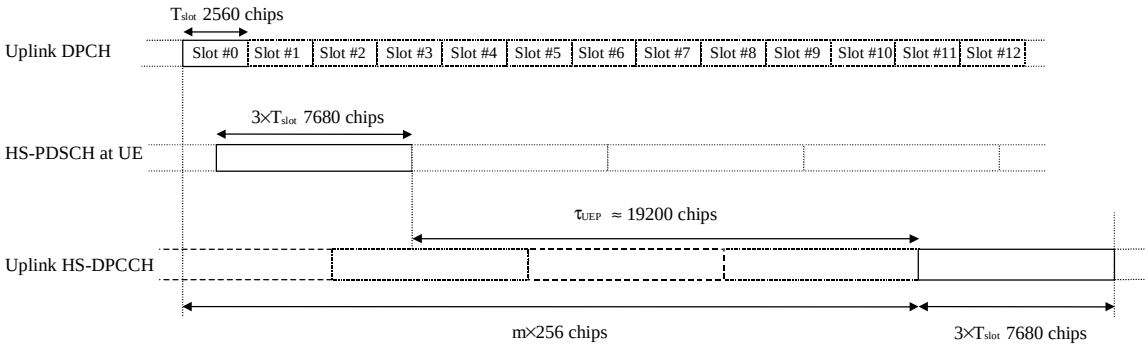


Figure 34: Timing structure at the UE for HS-DPCCH control signalling

---------- End Extract from 25.211 section 7.7 ----------