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Agenda item: HSDPA

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Title: DL control channel structures for parameters sent simultaneously with HS-DSCH TTI

Document for: Discussion

1. Introduction

In this paper it is analysed what kind of control channel structure could carry the HS-DSCH related parameters which do not have to be sent before the corresponding HS-DSCH TTI.

This paper is a revision of 12A010007, which was the first version of this paper, presented in WG1/WG2 adhoc in Sophia Antipolis, 5th –6th April. Main changes compared to that are following:

- Table 1 is modified according to [1].
- The changes in the table 1 are taken into account the coding rate calculations in chapter 4.2

So the exact values of the resulting coding rates differ a little bit compared to first version of the paper. However, the main conclusion has not changed: it seems that SF=256 is needed for the shared control channel , carrying these parameters.

2. Signaling parameters needed in downlink

Table 1 below was introduced in [1]. It contains a summary of the draft analysis of the HS-DSCH related parameters needed in downlink. See [1] for further details of each parameter.

Parameter	Before the HSDSCH data packet			Simultaneously with HSDSCH data packet		
	Min	**Prop**	**Max**	**Min**	**Prop**	**Max**
UE identification	1	1	16	-	-	-
MCS	2	2	3	-	-	-
HS-DSCH power level	0	0	n	-	-	-
Code channels	0	2	8	-	4	-
FHARQ process #	-	-	-	0	0	3
FHARQ redundancy version	-	-	-	0	0	2
FHARQ packet number	-	-	-	2	5	5
Power offset for uplink	-	-	-	0	2	4
Total	3	5	27+n	2	11	14

Table 1. Summary of HS-DSCH related parameters in downlink.

3. Basic assumptions

The channel where these parameters are sent is a shared control channel, which is read by always only one UE at a time. If code multiplexing is not used, then there will exist only one shared control channel of the type described in the next chapter.

If code multiplexing is used , then there has to be as many of these shared channels as what is the maximum number of UEs that can be code multiplexed to the same TTI. In that case there has to be some kind of predefined mapping to the shared channels, so that UE knows what shared control channels it has to receive. It could be e.g. defined so that since it is proposed that UE will receive the starting point of the code tree beforehand [1] , the mapping to shared control channels would be somehow tied to that information. E.g. if there are at max two UEs that can be code multiplexed to the same TTI, it could be defined so that if UE will receive information that its starting point in the code tree is the first code channel in the HSDPA code tree, the UE shall receive the shared control channel #1, otherwise it shall receive shared control channel #2.

And if there would be e.g. at max four UEs that can be code multiplexed to the same TTI, it could be defined so that the starting point in the code tree will be directly mapped to the shared control channel it shall receive, see below.

Starting point in the code tree (code number)	Shared control channel
1	#1
2	#2
5	#3
7	#4

Table 2. Example mapping of UEs to different shared control channels, when max number of UEs =4 per TTI, and there are max 10 code channels in the HSDPA code tree.

Max time period for these parameters is the TTI length of the HS-DSCH , here the assumption is either TTI=3 slots or TTI=5 slots.

4. Possible control channel structures

4.1. Number of bits available

Table 2 below shows how many bits there are available for the control channel, in different cases. The assumption is that pilot, TFCI or TPC bits are not transmitted here, since they are transmitted on associated DCH , dedicated for each UE.

Case	SF	TTI/slots	Nbits
a)	512	3	30
b)	256	3	60
c)	512	5	50
d)	256	5	100

Table 3. Number of bits available for different cases.

4.2. Possible cases

a) SF=512, TTI=3 slots: 30 bits available

Parameter	Info bits	Encoded bits	Coding rate with CRC=8 Tail = 8	Coding rate without CRC, tail
Code channels	4			
FHARQ packet number	5			
Power offset for uplink	2			
Total	**11**	**30**	**no coding**	**1 / 2.7**

b) SF=256, TTI=3 slots: 60 bits available

Parameter	Info bits	Encoded bits	Coding rate with CRC=8 Tail = 8	Coding rate without CRC, tail
Code channels	4			
FHARQ packet number	5			
Power offset for uplink	2			
Total	**11**	**60**	**1 / 2.2**	**1 / 5.4**

c) SF=512, TTI=5 slots: 50 bits available

Parameter	Info bits	Encoded bits	Coding rate with CRC=8 Tail = 8	Coding rate without CRC, tail
Code channels	4			
FHARQ packet number	5			
Power offset for uplink	2			
Total	**11**	**50**	**1 / 1.9**	**1 / 4.5**

d) SF=256, TTI=5 slots: 100 bits available

Parameter	Info bits	Encoded bits	Coding rate with CRC=8 Tail = 8.	Coding rate without CRC, tail
Code channels	4			
FHARQ packet number	5			
Power offset for uplink	2			
Total	**11**	**100**	**1 / 3.7**	**1 / 9**

5. Conclusions

Tables 4 and 5 show the conclusionary tables of different cases. It can be seen that in order to include CRC and tail bits, SF=256 is needed, both for TTI=3 slots and TTI=5 slots case; shaded in the two tables.

SF	TTI	CRC, tail	Coding rate	Suggested coding method
512	3	yes	No coding	-
512	3	no	1 / 2.7	-
256	3	yes	1 / 2.2	convolutional coding
256	3	no	1 / 5.4	

Table 4. Coding possibilities for TTI=3 slots.

SF	TTI	CRC, tail	Coding rate	Suggested coding method
512	5	yes	1 / 1.9	-
512	5	no	1 / 4.5	-
256	5	yes	1 / 3.7	Convolutional coding

Table 5. Coding possibilities for TTI=5 slots.

REFERENCES

[1] WG2 #21 meeting, R2-01-1177, "HSDPA related signaling parameters in downlink, version 2", Nokia.