TSG-RAN Working Group 1 meeting #12
Seoul, Korea, April 10 – 13, 2000

TSGR1#12(00)0549

Agenda item:

Source: Nokia

Title: DPDCH/DPCCH gain factors

Document for: Decision

Summary:

1) Rounding always to lower quantized value

Clarification of the specification 25.214 chapter 5.1.2.5.3 "Computed gain factors"is needed. Following example clarifies the possible problem with current computation algorithm of DPDCH/DPCCH gain factors.

Let us assume (variables below are from 25.214 chapter 5.1.2.5.3):

Kj = Kref; Lref = Lj; Bd,ref = 1.0, Bc,ref = 0.5333

With the above assumptions the Aj = 1/0.5333 and Bc,j = 0.5333 (= exactly one of the quantized values) which will be rounded to the closest lower quantized B-value, i.e. Bc,j becomes 0.4667 (see 25.213 Table 1 for the quantization values of the gain parameters).

Is the current specification correct i.e. if the value that is to be rounded is exactly one of the B values still it is rounded down one step so that we get lower value like the specification requires?
Or should this work so that if the value is exactly one of the B values then that value is selected, not a lower value?
Our understanding is that the latter way is correct.

2) Possible rounding problem

Let us assume following parameter values Kj = 400000; Kref = 100000; Bd,ref =1.0 (Bd,ref = 15) and Bc,ref = 0.5333 (Bc,ref= 8).

Based to the current specification Aj becomes (1.0/0.5333)* 2 = 3.75023439 and Bc,j = 1/3.75023439 = 0.26665. The closest quantized value is 0.2667 which is larger than the calculated value and 0.2000 is selected for Bc,j (Bc,j = 3) after downwards rounding.

If the quantization values of the gain parameters (see 25.213 Table 1) would be presented as fraction values instead of decimal values the above mentioned rounding problem would not happen.

Let us assume following parameter values Kj = 400000, Kref = 100000, Bd,ref = 1 (Bd,ref = 15) and Bc,ref = 8/15 (Bc,ref = 8). Aj becomes 30/8 and Bc,j = 8/30 = 4/15. Now Bc,j = 4 is selected for Bc,j (assuming that the problem presented in 1) is corrected).

3) Proposed specification changes

The B-value will be exactly the corresponding quantized value if the B-value that is to be rounded is exactly one of the B values from Table 1 (25.213). Due to this a change for the 25.214 chapter 5.1.2.5.3 and 5.1.2.5.4 is proposed.

Quantization values of the gain parameters in 25.213 Table 1 are proposed to be specified as fraction values instead of decimal values.

3GPP TSG RAN WG1 Meeting #12
Seoul, Korea, 10-14 April 2000

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CHANGE REQUEST

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25.213	**CR**	**035**	Current Version:	3.2.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	RAN#8	for approval	X	strategic		*(for SMG use only)*
List expected approval meeting # here ↑		for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: Nokia **Date:** 8.4.2000

Subject: DPDCH/DPCCH gain factors

Work item:

Category:				**Release:**		
	F	Correction	X		Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature			Release 97	
shall be marked	C	Functional modification of feature			Release 98	
with an X)	D	Editorial modification			Release 99	X
					Release 00	

Reason for change: Quantization values of the gain parameters in Table 1 are proposed to be specified as fraction values instead of decimal values to avoid possible rounding errors in the case when gain factors are computed.

Clauses affected: 4.2.1

Other specs affected:			
	Other 3G core specifications		→ List of CRs:
	Other GSM core specifications		→ List of CRs:
	MS test specifications		→ List of CRs:
	BSS test specifications		→ List of CRs:
	O&M specifications		→ List of CRs:

Other comments:

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4.2 Spreading

4.2.1 DPCCH/DPDCH

Figure 1 illustrates the principle of the uplink spreading of DPCCH and DPDCHs. The binary DPCCH and DPDCHs to be spread are represented by real-valued sequences, i.e. the binary value "0" is mapped to the real value +1, while the binary value "1" is mapped to the real value –1. The DPCCH is spread to the chip rate by the channelization code c_c, while the *n*:th DPDCH called $DPDCH_n$ is spread to the chip rate by the channelization code $c_{d,n}$. One DPCCH and up to six parallel DPDCHs can be transmitted simultaneously, i.e. $1 \leq n \leq 6$.

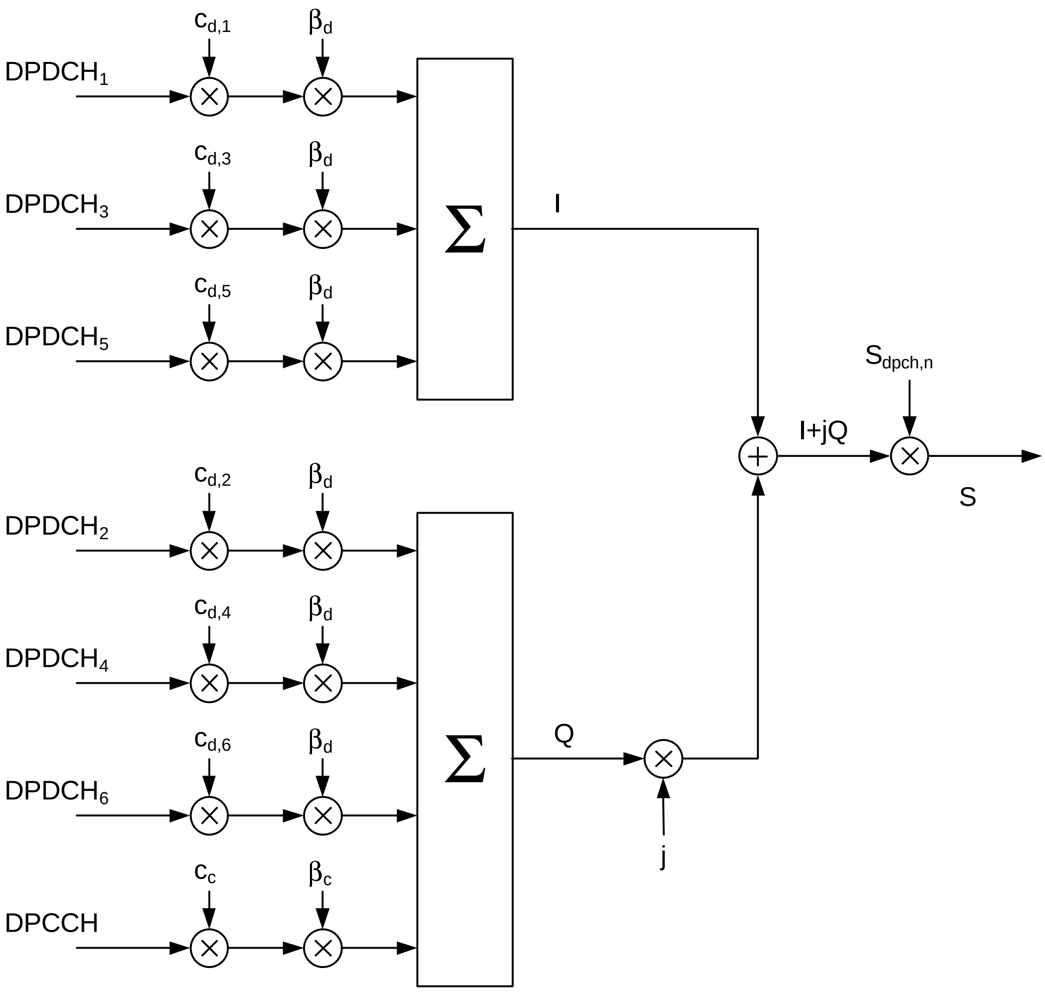

Figure 1: Spreading for uplink DPCCH and DPDCHs

After channelization, the real-valued spread signals are weighted by gain factors, β_c for DPCCH and β_d for all DPDCHs.

At every instant in time, at least one of the values β_c and β_d has the amplitude 1.0. The β-values are quantized into 4 bit words. The quantization steps are given in table 1.

Table 1: The quantization of the gain parameters

Signalling values for β_c and β_d	Quantized amplitude ratios β_c and β_d
15	1.0
14	~~0.9333~~14/15
13	~~0.8666~~13/15
12	~~0.8000~~12/15
11	~~0.7333~~11/15
10	~~0.6667~~10/15
9	~~0.6000~~9/15
8	~~0.5333~~8/15
7	~~0.4667~~7/15
6	~~0.4000~~6/15
5	~~0.3333~~5/15
4	~~0.2667~~4/15
3	~~0.2000~~3/15
2	~~0.1333~~2/15
1	~~0.0667~~1/15
0	Switch off

After the weighting, the stream of real-valued chips on the I- and Q-branches are then summed and treated as a complex-valued stream of chips. This complex-valued signal is then scrambled by the complex-valued scrambling code $S_{dpch,n}$. The scrambling code is applied aligned with the radio frames, i.e. the first scrambling chip corresponds to the beginning of a radio frame.

3GPP TSG RAN WG1 Meeting #12
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CHANGE REQUEST

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25.214	**CR**	**095**	Current Version:	3.2.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	RAN#8	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: *(at least one should be marked with an X)*

(U)SIM	ME	UTRAN / Radio	Core Network
	X	X	

Source:	Nokia
Date:	8.4.2000
Subject:	DPDCH/DPCCH gain factors
Work item:	

Category: *(only one category shall be marked with an X)*

F	Correction	X
A	Corresponds to a correction in an earlier release	
B	Addition of feature	
C	Functional modification of feature	
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: If the computed DPDCH/DPCCH gain factor value that is to be rounded is exactly one of the B values in TS 25.213 Table 1 it is unnecessarily rounded one step down.

Clauses affected: 5.1.2.5.3 and 5.1.2.5.4

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments:

<--------- double-click here for help and instructions on how to create a CR.

5.1.2.5 Setting of the uplink DPCCH/DPDCH power difference

5.1.2.5.1 General

The uplink DPCCH and DPDCH(s) are transmitted on different codes as defined in subclause 4.2.1 of TS 25.213. The gain factors β_c and β_d may vary for each TFC. There are two ways of controlling the gain factors of the DPCCH code and the DPDCH codes for different TFCs in normal (non-compressed) frames:

- b_c and b_d are signalled for the TFC, or
- b_c and b_d is computed for the TFC, based on the signalled settings for a reference TFC.

Combinations of the two above methods may be used to associate b_c and b_d values to all TFCs in the TFCS. The two methods are described in subclauses 5.1.2.5.2 and 5.1.2.5.3 respectively. Several reference TFCs may be signalled from higher layers.

The gain factors may vary on radio frame basis depending on the current TFC used. Further, the setting of gain factors is independent of the inner loop power control.

The UE shall scale the total transmit power of the DPCCH and DPDCH(s) , such that the DPCCH output power follows the changes required by the power control procedure with power adjustments of Δ_{DPCCH} dB, unless this would result in a UE transmit power above the maximum allowed power. In this case the UE shall scale the total transmit power so that it is equal to the maximum allowed power.

The gain factors during compressed frames are based on the gain factors defined in normal frames, as specified in subclause 5.1.2.5.4.

5.1.2.5.2 Signalled gain factors

When the gain factors b_c and b_d are signalled by higher layers for a certain TFC, the signalled values are used directly for weighting of DPCCH and DPDCH(s).

5.1.2.5.3 Computed gain factors

The gain factors b_c and b_d may also be computed for certain TFCs, based on the signalled settings for a reference TFC.

Let $b_{c,ref}$ and $b_{d,ref}$ denote the signalled gain factors for the reference TFC. Further, let $b_{c,j}$ and $b_{d,j}$ denote the gain factors used for the j:th TFC. Also let L_{ref} denote the number of DPDCHs used for the reference TFC and L_j denote the number of DPDCHs used for the j:th TFC.

Define the variable

$$K_{ref} = \sum_i RM_i \cdot N_i \ ;$$

where RM_i is the semi-static rate matching attribute for transport channel i (defined in TS 25.212 subclause 4.2.7), N_i is the number of bits output from the radio frame segmentation block for transport channel i (defined in TS 25.212 subclause 4.2.6.1), and the sum is taken over all the transport channels i in the reference TFC.

Similarly, define the variable

$$K_j = \sum_i RM_i \cdot N_i \ ;$$

where the sum is taken over all the transport channels i in the j:th TFC.

The variable A_j is then computed as:

$$A_j = \frac{b_{d,ref}}{b_{c,ref}} \cdot \sqrt{\frac{L_{ref}}{L_j}} \sqrt{\frac{K_j}{K_{ref}}} .$$

The gain factors for the *j*:th TFC are then computed as follows:

- If $A_j > 1$, then $b_{d,j} = 1.0$ and ~~$b_{c,j} = \lfloor 1/A_j \rfloor$, where $\lfloor \bullet \rfloor$ means rounding to closest lower quantized β-value~~ $b_{c,j}$ is the largest quantized b -value, for which the condition $b_{c,j} \le 1/A_j$ holds. Since $b_{c,j}$ may not be set to zero, if the above rounding results in a zero value, $b_{c,j}$ shall be set to the lowest quantized amplitude ratio of 1/15 ~~0.0667~~ as specified in TS 25.213.
- If $A_j \le 1$, then $b_{d,j}$ is the smallest quantized b -value, for which the condition $b_{d,j} \ge A_j$ holds ~~$b_{d,j} = \lceil A_j \rceil$~~ and $b_{c,j} = 1.0$ ~~, where $\lceil \bullet \rceil$ means rounding to closest higher quantized β-value~~.

The quantized β-values are ~~is~~ defined in TS 25.213 subclause 4.2.1, table 1.

5.1.2.5.4 Setting of the uplink DPCCH/DPDCH power difference in compressed mode

The gain factors used during a compressed frame for a certain TFC are calculated from the gain factors used in normal (non-compressed) frames for that TFC. Let $b_{c,j}$ and $b_{d,j}$ denote the gain factors for the *j*:th TFC in a normal frame. Further, let $b_{c,C,j}$ and $b_{d,C,j}$ denote the gain factors used for the *j*:th TFC when the frame is compressed. The variable $A_{C,j}$ is computed as:

$$A_{C,j} = \frac{b_{d,j}}{b_{c,j}} \cdot \sqrt{\frac{15 \cdot N_{pilot,C}}{N_{slots,C} \cdot N_{pilot,N}}} ;$$

where $N_{pilot,C}$ is the number of pilot bits per slot when in compressed mode, and $N_{pilot,N}$ is the number of pilot bits per slot in normal mode. $N_{slots,C}$ is the number of slots in the compressed frame used for transmitting the data.

The gain factors for the *j*:th TFC in a compressed frame are computed as follows:

If $A_{C,j} > 1$, then $b_{d,C,j} = 1.0$ and ~~$b_{c,C,j} = \lfloor 1/A_{C,j} \rfloor$, where $\lfloor \bullet \rfloor$ means rounding to closest lower quantized β-value~~ $b_{c,C,j}$ is the largest quantized b -value, for which the condition $b_{c,C,j} \le 1/A_{C,j}$ holds. Since $b_{c,j}$ may not be set to zero, if the above rounding results in a zero value, $b_{c,j}$ shall be set to the lowest quantized amplitude ratio of 1/15 ~~0.0667~~ as specified in TS 25.213.

If $A_{C,j} \le 1$, then $b_{d,C,j}$ is the smallest quantized b -value, for which the condition $b_{d,C,j} \ge A_{C,j}$ holds ~~$b_{d,C,j} = \lceil A_{C,j} \rceil$~~ and $b_{c,C,j} = 1.0$ ~~, where $\lceil \bullet \rceil$ means rounding to closest higher quantized β-value~~.

The quantized β-values are ~~is~~ defined in TS 25.213 subclause 4.2.1, table 1