TSG-RAN Meeting #22 **RP-030698**
Maui, Hawaii, USA, 9 - 12 December 2003

Title: **Independent Release 4 CR to TS 25.224 and shadow Release 5 CR**

Source: **InterDigital**

Agenda item: **7.2.4**

RP tdoc#	WG tdoc#	Spec	CR	R	Subject	Ph	Cat	Current	New	WI	Remarks
RP-030698	R1-031109	25.224	127	1	Correction to computed gain factors with signalled reference gain factor values	Rel-4	F	4.9.0	4.10.0	TEI4	
RP-030698	R1-031109	25.224	128	1	Correction to computed gain factors with signalled reference gain factor values	Rel-5	A	5.6.0	5.7.0	TEI4	

3GPP TSG-RAN Meeting #22 **Tdoc ⌘RP-030698**
Maui, Hawaii, USA, December 9th – 12th, 2003

CR-Form-v7

CHANGE REQUEST

⌘	25.224	CR	127	⌘ rev	1	⌘	Current version:	4.9.0	⌘

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Proposed change affects:	UICC apps⌘		ME	X	Radio Access Network	X	Core Network	

Title:	⌘	Correction to computed gain factors with signalled reference gain factor values
Source:	⌘	InterDigital
Work item code:	⌘	TEI4
Date:	⌘	04/12/2003
Category:	⌘	**F**
Release:	⌘	Rel-4

Use one of the following categories:
***F** (correction)*
***A** (corresponds to a correction in an earlier release)*
***B** (addition of feature),*
***C** (functional modification of feature)*
***D** (editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change: ⌘ The gain factors compensate for differences in Tx power requirements of different TFCs assigned to a CCTrCH: Because each TFC represents a different combination of data from each of the TrCHs in the CCTrCH, different amount of repetition or puncturing result. Since puncturing or repetition affect the Tx power required to obtain a particular target Eb/N0, the gain factors applied thus depend on the particular TFC being used. The individual gain factors for the TFCs in a CCTrCH can be derived autonomously by the UE from the gain factor setting, β_{ref} , of a RRC signaled reference TFC. This signaled β_{ref} has a range of 1/8 to 16/8 in 1/8 increments (TS25.331 and TS25.223). The UE needs to compute the individual gain factors for the TFCs in the TFCS based on (a) the signaled baseline gain settings for the reference TFC, (b) from the SFs of the PhyCHs resulting from the mapping of a particular TFC and (c) from the semi-static rate-matching attribute of the TrCh in the CCTrCh. The equation used by the UE in TS25.224 to compute the gain factors from the reference TFC takes into account (b) and (c), but not (a).

$$\beta_j = \sqrt{\frac{L_{ref}}{L_j}} \times \sqrt{\frac{K_j}{K_{ref}}}$$

The missing β_{ref}- factor in the equation was obviously intended, but must have been omitted by an editorial error. In current TS25.224, the equation is therefore only correct for a signaled β_{ref} equal to 1 (contrary to the range allowed by

		TS25.331). The corrected and originally intended equation should be: $$\beta_j = \beta_{ref} \cdot \sqrt{\frac{L_{ref}}{L_j}} \sqrt{\frac{K_j}{K_{ref}}}$$
Summary of change:	⌘	The RRC signaled reference gain factor value, β_{ref} , is included as scaling factor into the equation defining the relationship between computed gain factors and the settings of the reference TFC.
Consequences if not approved:	⌘	After successful PhyCH establishment, the UL outer-loop power control converges to a given SIR target based on the gain factors currently configured for that radio link. During a PhyCH reconfiguration procedure, such as occurring during a handover and because of DCA in UTRA TDD, the UE will re-calculate the gain factor values for all TFCs based on the static reference gain factor setting β_{ref} =1. This can result in gain factors that do not yield the same output power relative to the puncturing/repetition rate for which the UL power control has originally converged and then would result in Tx power settings off by up to 9 dB. The static reference gain factor setting and lack of RRC control over the UE gain factor computation will therefore force UL outer-loop power control to re-converge with the consequence of inducing significant noise rise in the reallocated timeslots or alternatively BLER on the reconfigured radio link is impacted when choosing conservative settings every time the PhyCHs of a radio link are reconfigured. **Isolated impact analysis:** **If the UE implements this change, but not the network, the UE will compute gain factor settings as by current specification (i.e. network assumes β_{ref} =1 for which the corrected and the old equation yield the same values). If the network implements the change, but not the UE, the impact on UL power-control convergence is unchanged compared to current specification. The CR has an isolated impact.**

Clauses affected:	⌘	4.2.2.3				
		Y	**N**			
Other specs affected:	⌘		**X**	Other core specifications	⌘	
			X	Test specifications		
			X	O&M Specifications		
Other comments:	⌘	-				

4.2.2.3 DPCH, PUSCH

The transmit power for DPCH and PUSCH is set by higher layers based on open loop power control as described in [15].

4.2.2.3.1 Gain Factors

Two or more transport channels may be multiplexed onto a CCTrCH as described in [9]. These transport channels undergo rate matching which involves repetition or puncturing. This rate matching affects the transmit power required to obtain a particular E_b/N_0. Thus, the transmission power of the CCTrCH shall be weighted by a gain factor β.

There are two ways of controlling the gain factors for different TFC's within a CCTrCH transmitted in a radio frame:

- β is signalled for the TFC, or
- β is computed for the TFC, based upon the signalled settings for a reference TFC.

Combinations of the two above methods may be used to associate β values to all TFC's in the TFCS for a CCTrCH. The two methods are described in sections 4.2.2.3.1.1 and 4.2.2.3.1.2 respectively. Several reference TFC's for several different CCTrCH's may be signalled from higher layers.

The weight and gain factors may vary on a radio frame basis depending upon the current SF and TFC used. The setting of weight and gain factors is independent of any other form of power control. That means that the transmit power P_{UL} is calculated according to the formula given in [15] and then the weight and gain factors are applied on top of that, cf. [10].

4.2.2.3.1.1 Signalled Gain Factors

When the gain factor β_j is signalled by higher layers for a certain TFC, the signalled values are used directly for weighting DPCH or PUSCH within a CCTrCH. Exact values are given in [10].

4.2.2.3.1.2 Computed Gain Factors

The gain factor β_j may also be computed for certain TFCs, based on the signalled settings for a reference TFC:

Let β_{ref} denote the signalled gain factor for the reference TFC. Further, let β_j denote the gain factor 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*, N_i is the number of bits output from the radio frame segmentation block for transport channel *i* 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.

Moreover, define the variable $L_{ref} = \sum_i \frac{1}{SF_i}$

where SF_i is the spreading factor of DPCH or PUSCH *i* and the sum is taken over all DPCH or PUSCH *i* used in the reference TFC.

Similarly, define the variable $L_j = \sum_i \frac{1}{SF_i}$

where the sum is taken over all DPCH or PUSCH *i* used in the *j*-th TFC.

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

$$\beta_j = \sqrt{\frac{L_{ref}}{L_j}} \times \sqrt{\frac{K_j}{K_{ref}}}\ \beta_j = \beta_{ref} \cdot \sqrt{\frac{L_{ref}}{L_j}} \sqrt{\frac{K_j}{K_{ref}}}$$

No quantisation of β_j is performed and as such, values other than the quantised β_j given in [10] may be used.

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Tdoc ⌘RP-030698

CR-Form-v7

CHANGE REQUEST

⌘ **25.224**	**CR 128**	⌘ **rev**	**1**	⌘	Current version:	**5.6.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects:	UICC apps⌘		ME	X	Radio Access Network	X	Core Network

Title: ⌘	Correction to computed gain factors with signalled reference gain factor values
Source: ⌘	InterDigital
Work item code: ⌘	TEI4
Date: ⌘	04/12/2003
Category: ⌘	**A**
Release: ⌘	Rel-5

Use one of the following categories:
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Rel-5 (Release 5)
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Reason for change: ⌘ The gain factors compensate for differences in Tx power requirements of different TFCs assigned to a CCTrCH: Because each TFC represents a different combination of data from each of the TrCHs in the CCTrCH, different amount of repetition or puncturing result. Since puncturing or repetition affect the Tx power required to obtain a particular target Eb/N0, the gain factors applied thus depend on the particular TFC being used. The individual gain factors for the TFCs in a CCTrCH can be derived autonomously by the UE from the gain factor setting, β_{ref} , of a RRC signaled reference TFC. This signaled β_{ref} has a range of 1/8 to 16/8 in 1/8 increments (TS25.331 and TS25.223). The UE needs to compute the individual gain factors for the TFCs in the TFCS based on (a) the signaled baseline gain settings for the reference TFC, (b) from the SFs of the PhyCHs resulting from the mapping of a particular TFC and (c) from the semi-static rate-matching attribute of the TrCh in the CCTrCh. The equation used by the UE in TS25.224 to compute the gain factors from the reference TFC takes into account (b) and (c), but not (a).

$$\beta_j = \sqrt{\frac{L_{ref}}{L_j}} \times \sqrt{\frac{K_j}{K_{ref}}}$$

The missing β_{ref}. factor in the equation was obviously intended, but must have been omitted by an editorial error. In current TS25.224, the equation is therefore only correct for a signaled β_{ref} equal to 1 (contrary to the range allowed by

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Clauses affected:	⌘	4.2.2.3				
		Y	**N**			
Other specs affected:	⌘		**X**	Other core specifications	⌘	
			X	Test specifications		
			X	O&M Specifications		
Other comments:	⌘	-				

4.2.2.3 DPCH, PUSCH and HS-SICH

The transmit power for DPCH, PUSCH and HS-SICH is set by higher layers based on open loop power control as described in [15].

In the case that an ACK is being transmitted on the HS-SICH, the UE shall apply a power offset to the transmit power of the entire HS-SICH. This power offset shall be signalled by higher layers.

4.2.2.3.1 Gain Factors

Two or more transport channels may be multiplexed onto a CCTrCH as described in [9]. These transport channels undergo rate matching which involves repetition or puncturing. This rate matching affects the transmit power required to obtain a particular E_b/N_0. Thus, the transmission power of the CCTrCH shall be weighted by a gain factor β.

There are two ways of controlling the gain factors for different TFC's within a CCTrCH transmitted in a radio frame:

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The weight and gain factors may vary on a radio frame basis depending upon the current SF and TFC used. The setting of weight and gain factors is independent of any other form of power control. That means that the transmit power P_{UL} is calculated according to the formula given in [15] and then the weight and gain factors are applied on top of that, cf. [10].

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where SF_i is the spreading factor of DPCH or PUSCH *i* and the sum is taken over all DPCH or PUSCH *i* used in the reference TFC.

Similarly, define the variable $L_j = \sum_i \frac{1}{SF_i}$

where the sum is taken over all DPCH or PUSCH *i* used in the *j*-th TFC.

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

$$\beta_j = \sqrt{\frac{L_{ref}}{L_j}} \times \sqrt{\frac{K_j}{K_{ref}}}$$ $$\beta_j = \beta_{ref} \cdot \sqrt{\frac{L_{ref}}{L_j}} \sqrt{\frac{K_j}{K_{ref}}}$$

No quantisation of β_j is performed and as such, values other than the quantised β_j given in [10] may be used.