TSG-RAN Working Group 1 meeting #9
Dresden, Germany
November 30 – December 3, 1999

TSGR1#9(99)i64

Agenda item:

Source: Ericsson

Title: CR 25.214-008: Power offset of AICH and PICH

Document for: Decision

At WG1#8 it was decided that the UE is informed about the relative powers of AICH and PICH compared to the primary CPICH. This CR introduces text to document this in 25.214.

Document ??99???
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.214	**CR**	**008**	Current Version:	3.0.0

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

For submission to: TSG-RAN #6	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: Ericsson **Date:** 1999-11-18

Subject: Power offset of AICH and PICH

Work item:

Category:				**Release:**		
	F	Correction			Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature	X		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: At WG1#8 it was decided that the UE should be informed about the relative powers of AICH and PICH compared to the primary CPICH

Clauses affected:

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:

help.doc

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

Appropriate scaling of the output power shall be performed by the UE, so that the output DPCCH power follows the inner loop power control with power steps of $\pm\Delta_{TPC}$ dB.

5.1.2.4.2 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).

5.1.2.4.3 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 TFC in the j:th radio frame.

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 section 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 section 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 TFC used in the j:th frame.

The variable A_j is then computed as:

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

The gain factors for the TFC in the j:th radio frame 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.

If $A_j \leq 1$, then $b_{d,j} = \lceil A_j \rceil$ and $b_{c,j} = 1.0$, where $\lceil \bullet \rceil$ means rounding to closest higher quantized β-value.

The quantized β-values is defined in TS 25.213 section 4.2.1, table 1.

5.2 Downlink power control

The transmit power of the downlink channels is determined by the network. In general the ratio of the transmit power between different downlink channels is not specified and may change with time. However, regulations exist as described in the following sub-clauses.

5.2.1 DPCCH/DPDCH

5.2.1.1 General

The downlink transmit power control procedure controls simultaneously the power of a DPCCH and its corresponding DPDCHs. The power control loop adjusts the power of the DPCCH and DPDCHs with the same amount, i.e. the relative power difference between the DPCCH and DPDCHs is not changed.

The relative transmit power offset between DPCCH fields and DPDCHs is determined by the network The TFCI, TPC and pilot fields of the DPCCH are offset relative to the DPDCHs power by PO1, PO2 and PO3 dB respectively. The power offsets may vary in time.

5.2.1.2 Ordinary transmit power control

The downlink inner-loop power control adjusts the network transmit power in order to keep the received downlink SIR at a given SIR target, SIR_{target}. A higher layer outer loop adjusts SIR_{target} independently for each connection.

The UE should estimate the received downlink DPCCH/DPDCH power of the connection to be power controlled. Simultaneously, the UE should estimate the received interference. The obtained SIR estimate SIR_{est} is then used by the UE to generate TPC commands according to the following rule: if $SIR_{est} > SIR_{target}$ then the TPC command to transmit is “0”, requesting a transmit power decrease, while if $SIR_{est} < SIR_{target}$ then the TPC command to transmit is “1”, requesting a transmit power increase.

When the UE is not in soft handover the TPC command generated is transmitted in the first available TPC field in the uplink DPCCH.

When the UE is in soft handover it should check the downlink power control mode (DPC_MODE) before generating the TPC command

- if DPC_MODE = 0 : the UE sends a unique TPC command in each slot and the TPC command generated is transmitted in the first available TPC field in the uplink DPCCH
- if DPC_MODE = 1 : the UE repeats the same TPC command over 3 slots and the new TPC command is transmitted such that there is a new command at the beginning of the frame.

The DPC_MODE parameter is a UE specific parameter controlled by the UTRAN.

As a response to the received TPC commands, UTRAN may adjust the downlink DPCCH/DPDCH power. The transmitted DPCCH/DPDCH power may not exceed Maximum_DL_Power, nor may it be below Minimum_DL_Power.

< Note: It should be clarified with WG3 if Maximum_DL_Power and Minimum_DL_Power are given as absolute values or relative. >

< Note: It is not clear to what extent the UTRAN response to the received TPC commands should be specified. Until this has been clarified, the text in the paragraph below should be seen as an example of UTRAN behaviour. >

Changes of power shall be a multiple of the minimum step size $\Delta_{TPC,min}$ dB. It is mandatory for UTRAN to support $\Delta_{TPC,min}$ of 1 dB, while support of 0.5 dB is optional.

< Note: It needs to be clarified if an upper limit on the downlink power step should be specified. >

’When SIR measurements cannot be performed due to downlink out-of-synchronisation, the TPC command transmitted shall be set as “1” during the period of out-of-synchronisation.

5.2.1.3 Power control in compressed mode

The aim of downlink power control in uplink or/and downlink compressed mode is to recover as fast as possible a signal-to-interference ratio (SIR) close to the target SIR after each transmission gap.

The UE behaviour is the same in compressed mode as in normal mode, described in subclause 5.2.1.2, i.e. TPC commands should be generated based on the estimated received SIR.

The UTRAN behaviour during compressed mode is not specified. As an example, the algorithm can be similar to uplink power control in downlink compressed mode as described in sub-clause 5.1.2.3.

In downlink compressed mode or in simultaneous downlink and uplink compressed mode, the transmission of downlink DPCCH and DPDCH(s) is stopped.

5.2.1.4 Site selection diversity transmit power control

5.2.1.4.1 General

Site selection diversity transmit power control (SSDT) is an optional macro diversity method in soft handover mode.

Operation is summarised as follows. The UE selects one of the cells from its active set to be 'primary', all other The main objective is to transmit on the downlink from the primary cell, thus reducing the interference caused by multiple transmissions in a soft handover mode. A second objective is to achieve fast site selection without network intervention, thus maintaining the advantage of the soft handover. In order to select a primary cell, each cell is assigned a temporary identification (ID) and UE periodically informs a primary cell ID to the connecting cells. The non-primary cells selected by UE switch off the transmission power. The primary cell ID is delivered by UE to the active cells via uplink FBI field. SSDT activation, SSDT termination and ID assignment are all carried out by higher layer signalling.

5.2.1.4.1.1 Definition of temporary cell identification

Each cell is given a temporary ID during SSDT and the ID is utilised as site selection signal. The ID is given a binary bit sequence. There are three different lengths of coded ID available denoted as "long", "medium" and "short". The network decides which length of coded ID is used. Settings of ID codes for 1-bit and 2-bit FBI are exhibited in Table 1 and Table 2, respectively.

Table 1 : Settings of ID codes for 1 bit FBI

ID label	ID code		
	"long"	**"medium"**	**"short"**
a	000000000000000	0000000(0)	00000
b	111111111111111	1111111(1)	11111
c	000000001111111	0000111(1)	00011
d	111111110000000	1111000(0)	11100
e	000011111111000	0011110(0)	00110
f	111100000000111	1100001(1)	11001
g	001111000011110	0110011(0)	01010
h	110000111100001	1001100(1)	10101

Table 2 : Settings of ID codes for 2 bit FBI

ID label	ID code (Column and Row denote slot position and FBI-bit position.)		
	"long"	**"medium"**	**"short"**
a	0000000(0) 0000000(0)	000(0) 000(0)	000 000
b	1111111(1) 1111111(1)	111(1) 111(1)	111 111
c	0000000(0) 1111111(1)	000(0) 111(1)	000 111
d	1111111(1) 0000000(0)	111(1) 000(0)	111 000
e	0000111(1) 1111000(0)	001(1) 110(0)	001 100
f	1111000(0) 0000111(1)	110(0) 001(1)	110 011
g	0011110(0) 0011110(0)	011(0) 011(0)	010 010
h	1100001(1) 1100001(1)	100(1) 100(1)	101 101

ID must be terminated within a frame. If FBI space for sending a given ID cannot be obtained within a frame, hence if the entire ID is not transmitted within a frame but must be split over two frames, the last bit(s) of the ID is(are) punctured. The relating bit(s) to be punctured are shown with brackets in Table 1 and Table 2.

5.2.1.4.2 TPC procedure in UE

The TPC procedure of the UE in SSDT is identical to that described in subclause 5.2.3.2.

5.2.1.4.3 Selection of primary cell

The UE selects a primary cell periodically by measuring the RSCP of CPICHs transmitted by the active cells. The cell with the highest CPICH RSCP is detected as a primary cell.

5.2.1.4.4 Delivery of primary cell ID

The UE periodically sends the ID code of the primary cell via portion of the uplink FBI field assigned for SSDT use (FBI S field). A cell recognises its state as non-primary if the following two conditions are fulfilled simultaneously:

- the received primary ID code does not match with the own ID code,
- and the received uplink signal quality satisfies a quality threshold, Qth, a parameter defined by the network.

Otherwise the cell recognises its state as primary.

At the UE, the primary ID code to be sent to the cells is segmented into a number of portions. These portions are distributed in the uplink FBI S-field. The cell in SSDT collects the distributed portions of the primary ID code and then detects the transmitted ID. Period of primary cell update depends on the settings of code length and the number of FBI bits assigned for SSDT use as shown in Table 3

Table 3 : Period of primary cell update

code length	The number of FBI bits per slot assigned for SSDT	
	1	2
"long"	1 update per frame	2 updates per frame

"medium"	2 updates per frame	4 updates per frame
"short"	3 updates per frame	5 updates per frame

5.2.1.4.5 TPC procedure in the network

In SSDT, a non-primary cell can switch off its DPDCH output (i.e. no transmissions).

The cell manages two downlink transmission power levels, P1, and P2. Power level P1 is used for downlink DPCCH transmission power level and this level is updated as the same way specified in 5.2.3.2 regardless of the selected state (primary or non-primary). The actual transmission power of TFCI, TPC and pilot fields of DPCCH is set by adding P1 and the offsets PO1, PO2 and PO3, respectively, as specified in 5.2.3.1. P2 is used for downlink DPDCH transmission power level and this level is set to P1 if the cell is selected as primary, otherwise P2 is switched off. The cell updates P1 first and P2 next, and then the two power settings P1 and P2 are maintained within the power control dynamic range. Table 4 summarizes the updating method of P1 and P2.

Table 4 : Updating of P1 and P2

State of cell	P1 (DPCCH)	P2 (DPDCH)
non primary	Updated by the same way as specified in 5.2.3.2	Switched off
primary		= P1

5.2.2 Power Control with DSCH

The DSCH power control can be based on the following solutions, which are selectable, by the network.

- Inner-loop power control based on the power control commands sent by the UE on the uplink DPCCH.
- Slow power control.

5.2.3 AICH

The UE is informed about the relative transmit power of the AICH (measured as the power per transmitted acquisition indicator) compared to the primary CPICH transmit power by the higher layers.

5.2.4 PICH

The UE is informed about the relative transmit power of the PICH compared to the primary CPICH transmit power by the higher layers.