TSG-RAN Working Group 1 meeting #9 *TSGR1#9(99)l71*

Dresden, Germany

November 30 – December 3, 1999

Source: TSG RAN WG1

Title: Liaison statement on adjustment loop for DL power drifting

To: TSG RAN WG3, TSG RAN WG2

Copy: TSG RAN WG4

RAN WG1 would like to inform RAN WG3 about the conclusion on downlink power control adjustment loop and other issues related to power balancing algorithms. In the liaison statement R3-99d13, RAN WG3 was asking RAN WG1 what was the status of the standardisation of the adjustment loop in RAN WG1. Furthermore RAN WG3 was asking information about the potential benefit of having the convergence parameter *r* as UE specific parameter.

During its 9th meeting, RAN WG1 reviewed further simulation results evaluating the performance of adjustment loop: R1-99a88, R1-99j14, and R1-99k01. In these simulations, limitations on power control steps were taken into account and evaluation was conducted with additional simulation conditions. After discussions, RAN WG1 concluded that adjustment loop is one useful method to alleviate the power drifting problem, and did not identify any serious problems. The support of the adjustment loop is however understood to be an optional feature for the Node Bs. Although there was an opinion that a specific algorithm should not be specified in the Layer 1 specifications, it was agreed that some description of this adjustment loop in the RAN WG1 specifications is needed, assuming that some adjustment loop parameters will be signalled by the RNC to the Node Bs. RAN WG1 agreed to incorporate a description of adjustment loop in 25.214 on the basis of the proposal from NEC relying on two parameters (the *r* convergence parameter and the maximum size of the adjustment step, see attached CR25.214-042).

However other additional parameters were discussed in the RAN WG1 as the time interval during which a certain amount of power adjustment should be done. More details on the parameters and their expected use should be provided soon. However RAN WG1 would like to ask RAN WG3 and RAN WG2 for their views on the possibility/benefit of having other parameters in addition to the convergence parameter and the maximum size of the adjustment step. It is anticipated that these parameters would allow some flexibility and allow specifying some “average behaviour” of the Node B without specifying the exact algorithm. RAN WG1 would like to ask feedback from WG2 and WG3 on this level of specification of the downlink power control. Although RAN WG1 already agreed some text in 25.214, RAN WG1 is ready to modify the description of the adjustment loop in 25.214 if such additional parameters were agreed.

Signalling to support adjustment loop should be designed in order to allow enabling/disabling the adjustment loop considering that adjustment loop may be supported by only part of the cells in the active set. It should allow also setting parameters for the adjustment loop operation with possibly different exact algorithms applied in different cells.

Regarding the convergence parameter *r*, it is used for controlling the speed of adjustment. As the value becomes smaller, the speed of adjustment becomes faster. However, this may increase the impact on inner-loop power control. In principle, the convergence parameter *r* should be determined considering step size of inner-loop power control and dynamic range of downlink power so that the impact on inner-loop power control is negligible.

As concerns adjusting *r* parameter per UE, there was an agreement that the *r* parameter should be UE specific. When adjustment loop is employed in all Node-Bs, we do not find any good reason to dynamically change the value of the convergence parameter *r*.

3GPP TSG RAN WG1 Meeting #9
Dresden, Germany, Nov 30 – Dec 3, 1999

Document R1-99l59
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**	**042r1**	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
list expected approval meeting # here ↑		for information		non-strategic		use only)

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	

Source: NEC **Date:** 1999-12-3

Subject: Inclusion of adjustment loop in downlink power control

Work item:

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

F	Correction		**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature	X		Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: To align with Layer 2/3 specifications, regarding adjustment loop control.

Clauses affected: 5.2.1.2

Other specs affected:

Other 3G core specifications	X	→ 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:

5.2.1.2 Ordinary transmit power control

5.2.1.2.1 General

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.

5.2.1.2.2 Adjustment loop

UTRAN may further employ adjustment loop, in which they change their calculated transmission powers *P(i)* in every slot according to the following equation:

$$P(i+1) = P(i) + S_{INNER}(i) + S_{ADJ}(i)$$

$$S_{ADJ}(i) = sign\{(1-r)(P_{REF} - P(i))\}\ min\{|(1-r)(P_{REF} - P(i))|, S_{ADJ\_MAX}\}$$

where

$P(i)$: calculated transmission power of UTRAN access point in dBm,

$S_{INNER}(i)$: inner loop control in dB,

$S_{ADJ}(i)$: adjustment loop control in dB, *sign{x}*: sign function of the value *x*, i.e. +1 when x>0, 0 when x=0, and –1 when x<0,

r: convergence coefficient ($0 \leq r \leq 1$),

P_{REF}: reference transmission power in dBm,

S_{ADJ_MAX}: maximum power change limit by adjustment loop in dB.

The actual change in the transmitted power level due to the adjustment loop is a value which is the nearest allowed TPC step to $S_{ADJ}(i)$. The parameters, *r*, P_{REF}, and S_{ADJ_MAX} shall be signalled by higher layers. S_{ADJ_MAX} shall be a multiple of the minimum step size $_{TPC,min}$ dB.