

TSG-RAN Working Group 1 meeting #14
Oulu, Finland
July 4 – 7, 2000

TSGR1#14(00)0857

Agenda item:

Source: Nokia

Title: CR 25.214-117: Clarification to DL PC – P-CPICH power level as a reference

Document for: Decision

In last WG1 #13 meeting, tdoc R1-00-0726- CR-090r3, "Level of specification of power control", was approved. In that CR the Maximum_DL_power and Minimum_DL_power were defined as (dB). These power levels are relative to primary CPICH power, as defined in TS 25.433. For clarification, it is proposed that the reference, primary CPICH power, is mentioned also in TS 25.214.

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 117	Current Version: 3.3.0	
GSM (AA.BB) or 3G (AA.BBB) specification number ↑	↑ CR number as allocated by MCC support team	
For submission to: TSG-RAN #9 list expected approval meeting # here ↑	for approval <input checked="" type="checkbox"/> for information <input type="checkbox"/>	strategic <input type="checkbox"/> non-strategic <input type="checkbox"/> (for SMG 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: (U)SIM ME UTRAN / Radio Core Network
 (at least one should be marked with an X)

Source: **Nokia** **Date:** **2000-06-30**

Subject: **Clarification to downlink power control**

Work item:

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

Reason for change: It is clarified that the Maximum_DL_power (dB) and Minimum_DL_power (dB) are power levels relative to primary CPICH power, as defined in TS 25.433.

Clauses affected: **5.2.1.2.2**

Other specs affected:	Other 3G core specifications <input type="checkbox"/> Other GSM core specifications <input type="checkbox"/> MS test specifications <input type="checkbox"/> BSS test specifications <input type="checkbox"/> O&M specifications <input type="checkbox"/>	→ List of CRs: → List of CRs: → List of CRs: → List of CRs: → List of CRs:
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Other comments:

5.2.1.2 Ordinary transmit power control

5.2.1.2.1 UE behaviour

The UE shall generate TPC commands to control the network transmit power and send them in the TPC field of the uplink DPCCH. An example on how to derive the TPC commands is given in Annex B.2.

The UE shall 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.

The UE shall not make any assumptions on how the downlink power is set by UTRAN, in order to not prohibit usage of other UTRAN power control algorithms than what is defined in subclause 5.2.1.2.2.

When TPC commands cannot be generated in the UE 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 UTRAN behaviour

Upon receiving the TPC commands UTRAN shall adjust its downlink DPCCH/DPDCH power accordingly. For DPC_MODE = 0, UTRAN shall estimate the transmitted TPC command TPC_{est} to be 0 or 1, and shall update the power every slot. If DPC_MODE = 1, UTRAN shall estimate the transmitted TPC command TPC_{est} over three slots to be 0 or 1, and shall update the power every three slots.

After estimating the k :th TPC command, UTRAN shall adjust the current downlink power $P(k-1)$ [dB] to a new power $P(k)$ [dB] according to the following formula:

$$P(k) = P(k - 1) + P_{TPC}(k) + P_{bal}(k),$$

where $P_{TPC}(k)$ is the k :th power adjustment due to the inner loop power control, and $P_{bal}(k)$ [dB] is a correction according to the downlink power control procedure for balancing radio link powers towards a common reference power. The power balancing procedure and control of the procedure is described in TS 25.433, and an example of how $P_{bal}(k)$ can be calculated is given in Annex B.3.

$P_{TPC}(k)$ is calculated according to the following.

If the value of *Limited Power Raise Used* parameter is 'Not used', then

$$P_{TPC}(k) = \begin{cases} +\ddot{A}_{TPC} & \text{if } TPC_{est}(k) = 1 \\ -\ddot{A}_{TPC} & \text{if } TPC_{est}(k) = 0 \end{cases}, \text{ [dB]}. \quad (1)$$

If the value of *Limited Power Raise Used* parameter is 'Used', then the k :th inner loop power adjustment shall be calculated as:

$$P_{TPC}(k) = \begin{cases} +\Delta_{TPC} & \text{if } TPC_{est}(k) = 1 \text{ and } \Delta_{sum}(k) + \Delta_{TPC} < \text{Power_Raise_Limit} \\ 0 & \text{if } TPC_{est}(k) = 1 \text{ and } \Delta_{sum}(k) + \Delta_{TPC} \geq \text{Power_Raise_Limit} \\ -\Delta_{TPC} & \text{if } TPC_{est}(k) = 0 \end{cases}, \text{ [dB]} \quad (2)$$

where

$$\Delta_{sum}(k) = \sum_{i=k-DL_Power_Averaging_Window_Size+1}^{k-1} P_{TPC}(i)$$

is the temporary sum of the last $DL_Power_Averaging_Window_Size$ inner loop power adjustments (in dB).

For the first ($DL_Power_Averaging_Window_Size - 1$) adjustments after the activation the limited power raise method, formula (1) shall be used instead of formula (2). $Power_Raise_Limit$ and $DL_Power_Averaging_Window_Size$ are parameters configured in the UTRAN.

The power control step size Δ_{TPC} can take four values: 0.5, 1, 1.5 or 2 dB. It is mandatory for UTRAN to support Δ_{TPC} of 1 dB, while support of other step sizes is optional.

In addition to the above described formulas on how the downlink power is updated, the restrictions below apply.

In case of congestion (commanded power not available), UTRAN may disregard the TPC commands from the UE.

The average power of transmitted DPDCH symbols over one timeslot shall not exceed $Maximum_DL_Power$ (dB), nor shall it be below $Minimum_DL_Power$ (dB). Transmitted DPDCH symbol means here a complex QPSK symbol before spreading which does not contain DTX. $Maximum_DL_Power$ (dB) and $Minimum_DL_Power$ (dB) are power limits for one channelisation code, relative to the primary CPICH power [6].

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.

In compressed mode, compressed frames may occur in either the uplink or the downlink or both. In compressed frames, the transmission of downlink DPDCH(s) and DPCCH shall be stopped during transmission gaps.

The power of the DPCCH in the first slot after the transmission gap should be set to the same value as in the slot just before the transmission gap.

During RPL slots after each transmission gap, ordinary transmit power control algorithm is applied with a step size

Δ_{RP-TPC} instead of Δ_{TPC} , where:

- Δ_{RP-TPC} is called the recovery power control step size and is expressed in dB. Δ_{RP-TPC} is equal to the minimum value of 3 dB and $2\Delta_{TPC}$.
- RPL is called recovery period length and is equal to the minimum value out of the transmission gap length and 7 slots.

After the recovery period, ordinary transmit power control resumes with step size Δ_{TPC} .