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CR-Form-v3

CHANGE REQUEST

25.214 CR 144	rev **-**	Current version:	**3.5.0**

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

Proposed change affects: ✍ (U)SIM [ ] ME/UE [ ] Radio Access Network [X] Core Network [ ]

Title: ✍	Removal of the power balancing algorithm from TS 25.214
Source: ✍	NEC
Work item code: ✍	
Date: ✍	2001-01-12
Category: ✍	**F**
Release: ✍	R99

Use one of the following categories:
- ***F*** *(essential 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)*

Reason for change: ✍	The power balancing algorithm is now described in slightly different ways between TS 25.214 (V3.5.0) and TS 25.433 (V3.4.1). Since the description of that algorithm is essential in TS 25.433 but informative in TS 25.214, the permanent solution to the problem is the removal of the algorithm from TS 25.214.
Summary of change: ✍	CR proposes removing the algorithm from TS 25.214.
Consequences if not approved: ✍	The inconsistency between TS 25.214 and TS 25.433 is not solved.

Clauses affected: ✍	5.2.1.2.2, 5.2.1.3, Annex B.3
Other specs affected: ✍	[ ] Other core specifications ✍ [ ] Test specifications [ ] O&M Specifications
Other comments: ✍	

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ✍ contain pop-up help information about the field that they are closest to.

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 $P(k\text{-}1)$ [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 [6]~~, 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

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

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

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

where

$$\Delta_{sum}(k) = \sum_{i = k - \text{DL\_Power\_Averaging\_Window\_Size} + 1}^{k-1} P_{TPC}(i)$$

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 and DPDCH in the first slot after the transmission gap should be set to the same value as in the slot just before the transmission gap.

In every slot during compressed mode except during downlink transmission gaps, UTRAN shall estimate the k:th TPC command and adjust the current downlink power $P(k\text{-}1)$ [dB] to a new power $P(k)$ [dB] according to the following formula:

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

where $P_{TPC}(k)$ is the k:th power adjustment due to the inner loop power control, $P_{SIR}(k)$ is the k-th power adjustment due to the downlink target SIR variation, 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 [6]~~, and an example of how $P_{bal}(k)$ can be calculated is given in Annex B.3~~.

Due to transmission gaps in uplink compressed frames, there may be missing TPC commands in the uplink. If no uplink TPC command is received, $P_{TPC}(k)$ derived by the Node B shall be set to zero. Otherwise, $P_{TPC}(k)$ is calculated the same way as in normal mode (see sub-clause 5.2.1.2.2) but with a step size $?_{STEP}$ instead of $?_{TPC}$.

The power control step size $?_{STEP} = ?_{RP\text{-}TPC}$ during RPL slots after each transmission gap and $?_{STEP} = ?_{TPC}$ otherwise, where:

- RPL is the recovery period length and is expressed as a number of slots. RPL is equal to the minimum value out of the transmission gap length and 7 slots. If a transmission gap is scheduled to start before RPL slots have elapsed, then the recovery period shall end at the start of the gap, and the value of RPL shall be reduced accordingly.??

?? $?_{RP\text{-}TPC}$ is called the recovery power control step size and is expressed in dB. $?_{RP\text{-}TPC}$ is equal to the minimum value of 3 dB and $2?_{TPC}$.

The power offset $P_{SIR}(k) = ?P_{curr} - ?P_{prev}$, where $?P_{curr}$ and $?P_{prev}$ are respectively the value of ?P in the current slot and the most recently transmitted slot and ?P is computed as follows:

$$?P = \max(?P1\_compression, \ldots, ?Pn\_compression) + ?P1\_coding + ?P2\_coding$$

where n is the number of different TTI lengths amongst TTIs of all TrChs of the CCTrCh, where ?P1_coding and ?P2_coding are computed from uplink parameters DeltaSIR1, DeltaSIR2, DeltaSIRafter1, DeltaSIRafter2 signaled by higher layers as:

- ?P1_coding = DeltaSIR1 if the start of the first transmission gap in the transmission gap pattern is within the current frame.
- ?P1coding = DeltaSIRafter1 if the current frame just follows a frame containing the start of the first transmission gap in the transmission gap pattern.
- ?P2_coding = DeltaSIR2 if the start of the second transmission gap in the transmission gap pattern is within the current frame.
- ?P2_coding = DeltaSIRafter2 if the current frame just follows a frame containing the start of the second transmission gap in the transmission gap pattern.
- ?P1_coding = 0 dB and ?P2_coding = 0 dB in all other cases.

and ?Pi_compression is defined by :

- ?Pi_compression = 3 dB for downlink frames compressed by reducing the spreading factor by 2.
- ?Pi_compression = $10 \log (15*F_i / (15*F_i - TGL_i))$ if there is a transmission gap created by puncturing method within the current TTI of length F_i frames, where TGL_i is the gap length in number of slots (either from one gap or a sum of gaps) in the current TTI of length F_i frames.
- ?Pi_compression = 0 dB in all other cases.

In case several compressed mode patterns are used simultaneously, a ?P offset is computed for each compressed mode pattern and the sum of all ?P offsets is applied to the frame.

B.3 Radio link power balancing

In case of soft handover, UTRAN may employ downlink radio link power balancing, that tries to balance the radio link powers towards reference power. An example of a power balancing adjustment loop is given below.

The UTRAN access point radio link transmission power is adjusted by the power balancing term $P_{bal}(i)$ [dB] which is calculated according to the following equation:

- $P_{bal}(i) = \mathrm{sign}\{(1-r)(P_{REF} - P(i))\}$? $\min\{|(1-r)(P_{REF} - P(i))|, P_{bal,max}\}$;

where:

- $P_{bal}(i)$: radio link power balancing 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 ? *r* ? 1);
- P_{REF}: reference transmission power in dBm;
- $P_{bal,max}$: maximum power change limit for radio link power balancing control in dB.

The actual transmission power level shall be a value which is the nearest allowed power level to *P(i)*. The parameters P_{REF}, and $P_{bal,max}$ are signalled by higher layers. $P_{bal,max}$ shall be a multiple of the power control step size $?_{TPC}$ dB.