Las Vegas, USA, February 27th – March 2nd , 2001

Agenda Item: Rel –99 CRs

Document for: Decision

Source: Nokia

Title: DL PC behaviour during UL out-of-sync

Introduction

The UTRAN behaviour when UL is out of synchronization is currently partly described in TS25.214 and TS25.433 (NBAP signaling). The description for downlink TPC commands during RL initialization is already specified. However, during UL out-of-sync the UTRAN is not receiving TPC commands from the UE and there is currently no description how the Node B is to set its transmission power in this case.

Proposal

Nokia proposes adding a description on the L1 behaviour of Node B to TS25.214. A new section on TPC command generation in uplink during out of synchronization is added to TS25.214 as described in the attached CR. In order to facilitate the UL TPC command generation during UL out-of-sync, an IE "UL TPC pattern 01 count" ahould be added to the NBAP signaling in TS25.433. A liaison to RAN WG3 would be drafted to clarify the changes proposed to be made in TS25.214 and request the defition of the new IE.

CR-Form-v3

CHANGE REQUEST

✎ **25.214** CR **160** ✎ 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: ✎	DL PC behaviour during UL out-of-sync
Source: ✎	Nokia
Work item code: ✎	***Date:*** ✎ 26.02.2001
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: ✎	DL transmission power behaviour is not defined when uplink is out of synchronization and no TPC bits are sent to Node B
Summary of change: ✎	A description on DL transmission power behaviour during UE out-of-sync is added
Consequences if not approved: ✎	The behaviour of DL transmission power is not described in UL out-of-sync situations

Clauses affected: ✎	5.2.1.2
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.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

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 subclauses.

Higher layer power settings shall be interpreted as setting of the total power, i.e. the sum of the power from the two antennas in case of transmit diversity.

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. The method for controlling the power offsets within UTRAN is specified in [6]

The power of CCC field in DL DPCCH for CPCH is the same as the power of the pilot field.

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 in 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.

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 [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

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

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

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

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].

5.2.1.2.3   TPC command generation on uplink during the period of out-of synchronisation

If the uplink TPC commands cannot be estimated in the UTRAN due to uplink out-of synchronization, Node Bs that have not yet achieved uplink synchronisation shall follow a specific TPC pattern for downlink power setting as follows:

-   a value 'n' is obtained from the parameter "UL TPC pattern 01 count" passed by higher layers,

-   the TPC pattern shall consist of n instances of "01" plus one instance of "1",

-   the TPC pattern continuously repeats but shall be forcibly re-started at the beginning of each frame where CFN mod 4 = 0.

Furthermore, the Node B shall also check that the average power of transmitted DPDCH symbols over one timeslot does not exceed the maximum power for DL DPCH.

The TPC pattern shall terminate once uplink synchronisation is achieved.