TSG RAN WG1 Meeting #18 ***TSGR1#18(01)0112***
Boston, USA, 15th – 18th January 2001

Agenda Item: 4

Source: Philips

Title: Correction to TS25.214 (R99) for UL power control in compressed mode

Document for: Decision

Introduction

This CR is a revised version of that contained in R1-00-0024.

The attached CR makes a correction to the corrections which were agreed in CR25.214-140 [1] at RAN WG1 #17. The sense of the intention of that CR is not changed, but the terminology is clarified following discussion on the email reflector:

The term $?_{PILOT}$ is now only used to indicate the magnitude of a required *step* in uplink transmit power. $?_{PILOT}$ is defined every slot and may take a non-zero value at the start and end of each compressed frame (i.e. a frame containing a transmission gap). $?_{PILOT}$ would typically take a positive value at the start of a compressed frame and a negative value at the end.

When calculating the SIR target to be used by the Node B during uplink compressed frames, an offset corresponding in magnitude to $?_{PILOT}$ has to be applied to the SIR target. However, this is described in terms of an offset which must be applied *throughout* the compressed frame, and not in terms of a step applied at the beginning and end of a compressed frame. Furthermore, this offset is relative to a normal, non-compressed frame, and may not be equal to the size of the $?_{PILOT}$ step at the beginning of the frame (e.g. in the case of two consecutive compressed frames containing different slot formats.) This offset is therefore now described in the attached CR as $?SIR_{PILOT}$, and is defined separately from $?_{PILOT}$.

Additionally, in order to make clear when exactly the SIR_{cm_target} applies, the description of compressed mode is improved.

Reference

[1] 3GPP R1-00-1400, “CR 25.214-140: uplink power control in compressed mode”, Alcatel, November 2000

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CHANGE REQUEST

✍	**25.214**	**CR**	**142r1**	✍ rev	**-**	✍ Current version:	**3.5.0** ✍

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

Title: ✍	Uplink power control in compressed mode		
Source: ✍	Philips		
Work item code: ✍		***Date:*** ✍	2001-01-05
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: ✍	Correction of the uplink power control algorithm in compressed mode
Summary of change: ✍	?$_{PILOT}$ is changed to ?SIR$_{PILOT}$, which is then defined separately from ?$_{PILOT}$.
Consequences if not approved: ✍	The specification is otherwise ambiguous as ?$_{PILOT}$ takes two different meanings in different places.

Clauses affected: ✍	5.1.2.3	
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.

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.

5.1.2.3 Transmit power control in compressed mode

In compressed mode, one or more transmission gap pattern sequences are active. Therefore some frames are compressed and contain transmission gaps. The uplink power control procedure is as specified in clause 5.1.2.2, using the same UTRAN supplied parameters for Power Control Algorithm and step size ($?_{TPC}$), but with additional features which aim to recover as rapidly as possible a signal-to-interference ratio (SIR) close to the target SIR after each transmission gap.

The serving cells (cells in the active set) should estimate signal-to-interference ratio SIR_{est} of the received uplink DPCH. The serving cells should then generate TPC commands and transmit the commands once per slot, except during downlink transmission gaps, according to the following rule: if $SIR_{est} > SIR_{cm\_target}$ then the TPC command to transmit is "0", while if $SIR_{est} < SIR_{cm\_target}$ then the TPC command to transmit is "1".

SIR_{cm_target} is the target SIR during compressed mode and fulfils

$SIR_{cm\_target} = SIR_{target}$ + ~~?~~ $?SIR_{PILOT}$ + ? SIR1_coding + ? SIR2_coding,

where ? SIR1_coding and ? SIR2_coding are computed from uplink parameters DeltaSIR1, DeltaSIR2, DeltaSIRafter1, DeltaSIRafter2 signalled by higher layers as:

- ? SIR1_coding = DeltaSIR1 if the start of the first transmission gap in the transmission gap pattern is within the current uplink frame.
- ? SIR1_coding = DeltaSIRafter1 if the current uplink frame just follows a frame containing the start of the first transmission gap in the transmission gap pattern.
- ? SIR2_coding = DeltaSIR2 if the start of the second transmission gap in the transmission gap pattern is within the current uplink frame.
- ? SIR2_coding = DeltaSIRafter2 if the current uplink frame just follows a frame containing the start of the second transmission gap in the transmission gap pattern.
- ? SIR1_coding = 0 dB and ? SIR2_coding = 0 dB in all other cases.

~~And~~ ~~?~~ $?SIR_{PILOT}$ is defined ~~below~~ as: $?SIR_{PILOT} = 10Log_{10} (N_{pilot,N} / N_{pilot,curr\_frame})$.

where $N_{pilot,curr\_frame}$ is the number of pilot bits per slot in the current uplink frame, and $N_{pilot,N}$ is the number of pilot bits per slot in a normal uplink frame without a transmission gap.

In the case of several compressed mode pattern sequences ~~are~~being used simultaneously, ? SIR1_coding and ? SIR2_coding offsets are computed for each compressed mode pattern and all ? SIR1_coding and ? SIR2_coding offsets are summed together.

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

Due to the transmission gaps in compressed frames, there may be missing TPC commands in the downlink. If no downlink TPC command is transmitted, the corresponding TPC_cmd derived by the UE shall be set to zero.

Compressed and non-compressed frames in the uplink DPCCH may have a different number of pilot bits per slot. A change in the transmit power of the uplink DPCCH would be needed in order to compensate for the change in the total pilot energy. Therefore at the start of each slot the UE shall derive the value of a power offset $?_{PILOT}$. If the number of pilot bits per slot in the uplink DPCCH is different from its value in the most recently transmitted slot, $?_{PILOT}$ (in dB) shall be given by:

$$?_{PILOT} = 10Log_{10} (N_{pilot,prev}/N_{pilot,curr});$$

where $N_{pilot,prev}$ is the number of pilot bits in the most recently transmitted slot , and $N_{pilot,curr}$ is the number of pilot bits in the current slot. Otherwise, including during transmission gaps in the downlink, $?_{PILOT}$ shall be zero.

Unless otherwise specified, in every slot during compressed mode the UE shall adjust the transmit power of the uplink DPCCH with a step of $?_{DPCCH}$ (in dB) which is given by:

? $$?_{DPCCH} = ?_{TPC} ? TPC\_cmd + ?_{PILOT}.$$

At the start of the first slot after an uplink or downlink transmission gap the UE shall apply a change in the transmit power of the uplink DPCCH by an amount $?_{DPCCH}$ (in dB), with respect to the uplink DPCCH power in the most recently transmitted uplink slot, where:

?

$$?_{DPCCH} = ?_{RESUME} + ?_{PILOT.}$$

The value of $?_{RESUME}$ (in dB) shall be determined by the UE according to the Initial Transmit Power mode (ITP). The ITP is a UE specific parameter, which is signalled by the network with the other compressed mode parameters (see [4]). The different modes are summarised in table 1.

Table 1: Initial Transmit Power modes during compressed mode

Initial Transmit Power mode	Description
0	$?_{RESUME} = ?_{TPC}\ ?\ TPC\_cmd_{gap}$
1	$?_{RESUME} = ?_{last}$

In the case of a transmission gap in the uplink, TPC_cmd_{gap} shall be the value of TPC_cmd derived in the first slot of the uplink transmission gap, if a downlink TPC_command is transmitted in that slot. Otherwise TPC_cmd_{gap} shall be zero.

$?_{last}$ shall be equal to the most recently computed value of $?_i$. $?_i$ shall be updated according to the following recursive relations, which shall be executed in all slots in which both the uplink DPCCH and a downlink TPC command are transmitted, and in the first slot of an uplink transmission gap if a downlink TPC command is transmitted in that slot:

$$?_i\ ?\ 0.9375 ?_{i?1}\ ?\ 0.96875 TPC\_cmd_i ?_{TPC} k_{sc}$$
$$?_{i?1}\ ?\ ?_i$$

where: TPC_cmd_i is the power control command derived by the UE in that slot;

k_{sc} = 0 if additional scaling is applied in the current slot and the previous slot as described in sub-clause 5.1.2.6, and k_{sc} = 1 otherwise.

$?_{i-1}$ is the value of $?_i$ computed for the previous slot. The value of $?_{i-1}$ shall be initialised to zero when the uplink DPCCH is activated, and also at the end of the first slot after each uplink transmission gap, and also at the end of the first slot after each downlink transmission gap. The value of $?_i$ shall be set to zero at the end of the first slot after each uplink transmission gap.

After a transmission gap in either the uplink or the downlink, the period following resumption of simultaneous uplink and downlink DPCCH transmission is called a recovery period. 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.

During the recovery period, 2 modes are possible for the power control algorithm. The Recovery Period Power control mode (RPP) is signalled with the other compressed mode parameters (see [4]). The different modes are summarised in the table 2:

Table 2: Recovery Period Power control modes during compressed mode

Recovery Period power control mode	Description
0	Transmit power control is applied using the algorithm determined by the value of PCA, as in subclause 5.1.2.2 with step size $?_{TPC.}$
1	Transmit power control is applied using algorithm 1 (see subclause 5.1.2.2.2) with step size $?_{RP-TPC}$ during RPL slots after each transmission gap.

For RPP mode 0, the step size is not changed during the recovery period and ordinary transmit power control is applied (see subclause 5.1.2.2), using the algorithm for processing TPC commands determined by the value of PCA (see sub clauses 5.1.2.2.2 and 5.1.2.2.3).

For RPP mode 1, during RPL slots after each transmission gap, power control algorithm 1 is applied with a step size $?_{RP-TPC}$ instead of $?_{TPC}$, regardless of the value of PCA. Therefore, the change in uplink DPCCH transmit power at the start of each of the RPL+1 slots immediately following the transmission gap (except for the first slot after the transmission gap) is given by:

$$? \qquad ?_{DPCCH} = ?_{RP-TPC} ?\ TPC\_cmd + ?_{PILOT}$$

$?_{RP-TPC}$ is called the recovery power control step size and is expressed in dB. If PCA has the value 1, $?_{RP-TPC}$ is equal to the minimum value of 3 dB and $2?_{TPC}$. If PCA has the value 2 , $?_{RP-TPC}$ is equal to 1 dB.

After the recovery period, ordinary transmit power control resumes using the algorithm specified by the value of PCA and with step size $?_{TPC}$.

If PCA has the value 2 , the sets of slots over which the TPC commands are processed shall remain aligned to the frame boundaries in the compressed frame. For both RPP mode 0 and RPP mode 1, if the transmission gap or the recovery period results in any incomplete sets of TPC commands, TPC_cmd shall be zero for those sets of slots which are incomplete.