TSG-RAN Working Group 1 meeting #9
Dresden, Germany
November 30 – December 3, 1999

TSGR1#9(99)k15

Agenda item: AH17

Title: CR 25.214-035: Power control when idle periods are present.

Source: Ericsson

Document for: Decision

Background

The OTDOA-IPDL method is included in R99. The following CR includes changes to the power control procedures in order to minimize the effect of idle periods in the downlink, which might be present when the OTDOA-IPDL LCS method is used.

3GPP TSG RAN WG1 Meeting #9
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***Document* R1#9(99)k15**
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**	**035**	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 #9	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑	for information		non-strategic		

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 X		UTRAN / Radio X		Core Network

Source: Ericsson   **Date:** 1999-11-30

Subject: Power control procedures during idle periods.

Work item: 25.214

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

Reason for change: Power control procedures to minimize the effect of idle periods in the downlink

Clauses affected:

Other specs affected:			
	Other 3G core specifications		→ 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:

After deriving of the combined TPC command TPC_cmd using one of the two supported algorithms, the UE shall adjust the transmit power of the uplink dedicated physical channels with a step of Δ_{TPC} dB according to the TPC command. If TPC_cmd equals 1 then the transmit power of the uplink DPCCH and uplink DPDCHs shall be increased by Δ_{TPC} dB. If TPC_cmd equals -1 then the transmit power of the uplink DPCCH and uplink DPDCHs shall be decreased by Δ_{TPC} dB. If TPC_cmd equals 0 then the transmit power of the uplink DPCCH and uplink DPDCHs shall be unchanged.

Any power increase or decrease shall take place immediately before the start of the pilot field on the DPCCH.

5.1.2.2.1.1 Out of synchronisation handling

5.1.2.2.2 Algorithm 1 for processing TPC commands

5.1.2.2.2.1 Derivation of TPC_cmd when only one TPC command is received in each slot

When a UE is not in soft handover, only one TPC command will be received in each slot. In this case, the value of TPC_cmd is derived as follows:

- If the received TPC command is equal to 0 then TPC_cmd for that slot is –1.
- If the received TPC command is equal to 1, then TPC_cmd for that slot is 1.
- If the UE knows that the link was idle during the TPC command then the TPC_cmd for that slot is 0.

5.1.2.2.2.2 Combining of TPC commands known to be the same

When a UE is in soft handover, multiple TPC commands may be received in each slot from different cells in the active set. In some cases, the UE has the knowledge that some of the transmitted TPC commands in a slot are the same. This is the case e.g. with receiver diversity or so called softer handover when the UTRAN transmits the same command in all the serving cells the UE is in softer handover with. For these cases, the TPC commands known to be the same are combined into one TPC command, to be further combined with other TPC commands as described in subclause 5.1.2.2.2.3.

5.1.2.2.2.3 Combining of TPC commands not known to be the same

In general in case of soft handover, the TPC commands transmitted in the same slot in the different cells may be different.

This subclause describes the general scheme for combination of the TPC commands not known to be the same and then provides an example of such a scheme. It is to be further decided what should be subject to detailed standardisation, depending on final requirements. The example might be considered as the scheme from which minimum requirement will be derived or may become the mandatory algorithm.

5.1.2.2.2.3.1 General scheme

First, the UE shall estimate the signal-to-interference ratio PC_SIR_i on each of the power control commands TPC_i, where i = 1, 2, …, N and N is the number of TPC commands not known to be the same, that may be the result of a first phase of combination according to subclause 5.1.2.2.2.2.

Then the UE assigns to each of the TPC_i command a reliability figure W_i, where W_i is a function β of PC_SIR_i, $W_i = \beta(PC\_SIR_i)$. Finally, the UE derives a combined TPC command, TPC_cmd, as a function γ of all the N power control commands TPC_i and reliability estimates W_i:

$TPC\_cmd = \gamma (W_1, W_2, \ldots W_N, TPC_1, TPC_2, \ldots, TPC_N)$, where TPC_cmd can take the values 1 or -1.

5.1.2.2.2.3.2 Example of the scheme

A particular example of the scheme is obtained when using the following definition of the functions β and γ:

For β: the reliability figure W_i is set to 0 if PC_SIR_i < PC_thr, otherwise W_i is set to 1. This means that the power control command is assumed unreliable if the signal-to-interference ratio of the TPC commands is lower than a minimum value PC_thr. If the UE knows that one ore more of the active links are idle during the reception of the TPC command the reliability figure W_i for these links are set to zero

For γ: if there is at least one TPC_i command, for which W_i = 1 and TPC_i = 0, or if W_i = 0 and TPC_i = 0 for all N TPC_i commands, then TPC_cmd is set to 1, otherwise TPC_cmd is set to 1. Such a function γ means that the power is decreased if at least one cell for which the reliability criterion is satisfied asks for a power decrease.

5.1.2.2.3 Algorithm 2 for processing TPC commands

NOTE: Algorithm 2 makes it possible to emulate smaller step sizes than the minimum power control step specified in section 5.1.2.2.1, or to turn off uplink power control by transmitting an alternating series of TPC commands.

5.1.2.2.3.1 Derivation of TPC_cmd when only one TPC command is received in each slot

When a UE is not in soft handover, only one TPC command will be received in each slot. In this case, the UE shall process received TPC commands on a 5-slot cycle, where the sets of 5 slots shall be aligned to the frame boundaries and there shall be no overlap between each set of 5 slots.

The value of TPC_cmd is derived as follows:

- For the first 4 slots of a set, TPC_cmd = 0.
- For the fifth slot of a set, the UE uses hard decisions on each of the 5 received TPC commands as follows:
- If all 5 hard decisions within a set are 1 then TPC_cmd = 1 in the 5^{th} slot.
    - If all 5 hard decisions within a set are 0 then TPC_cmd = -1 in the 5^{th} slot.
    - Otherwise, TPC_cmd = 0 in the 5^{th} slot.
    - If the UE knows that the link was idle during one of the TPC commands the decision is based on the other slots.

5.1.2.2.3.2 Combining of TPC commands known to be the same

When a UE is in soft handover, multiple TPC commands may be received in each slot from different cells in the active set. In some cases, the UE has the knowledge that some of the transmitted TPC commands in a slot are the same. This is the case e.g. with receiver diversity or so called softer handover when the UTRAN transmits the same command in all the serving cells the UE is in softer handover with. For these cases, the TPC commands known to be the same are combined into one TPC command, to be processed and further combined with any other TPC commands as described in subclause 5.1.2.2.3.3.

5.1.2.2.3.3 Combining of TPC commands not known to be the same

In general in case of soft handover, the TPC commands transmitted in the same slot in the different cells may be different.

This subclause describes the general scheme for combination of the TPC commands not known to be the same and then provides an example of such scheme. It is to be further decided what should be subject to detailed standardisation, depending on final requirements. The example might be considered as the scheme from which minimum requirement will be derived or may become the mandatory algorithm.

5.1.2.2.3.3.1 General scheme

The UE shall make a hard decision on the value of each TPC_i, where i = 1, 2, …, N and N is the number of TPC commands not known to be the same, that may be the result of a first phase of combination according to subclause 5.1.2.2.3.2..

The UE shall follow this procedure for 3 consecutive slots, resulting in N hard decisions for each of the 3 slots.

The sets of 3 slots shall be aligned to the frame boundaries and there shall be no overlap between each set of 3 slots.

The value of TPC_cmd is zero for the first 2 slots. After 3 slots have elapsed, the UE shall determine the value of TPC_cmd for the third slot in the following way:

The UE first determines one temporary TPC command, TPC_temp_i, for each of the N sets of 3 TPC commands as follows:

- If all 3 hard decisions within a set are “1”, TPC_temp_i = 1
- If all 3 hard decisions within a set are “0”, TPC_temp_i = -1
- Otherwise, TPC_temp_i = 0
- If the UE knows that the link was idle during one of the TPC commands the decision is based on the other slots.

Finally, the UE derives a combined TPC command for the third slot, TPC_cmd, as a function γ of all the N temporary power control commands TPC_temp_i:

TPC_cmd(3^{rd} slot) = γ (TPC_temp_1, TPC_temp_2, …, TPC_temp_N), where TPC_cmd(3^{rd} slot) can take the values 1, 0 or –1.

5.1.2.2.3.3.2 Example of the scheme

A particular example of the scheme is obtained when using the following definition of the function γ:

TPC_cmd is set to 1 if $\frac{1}{N}\sum_{i=1}^{N} TPC\_temp_i > 0.5$.

TPC_cmd is set to -1 if $\frac{1}{N}\sum_{i=1}^{N} TPC\_temp_i < -0.5$.

Otherwise, TPC_cmd is set to 0.