3GPP TSG RAN WG1 Meeting #9
Dresden, Germany, 30 Nov - 3 Dec 1999

***Document* R1-99h81**
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

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25.214	CR	010	Current Version:	v3.0.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	RAN #6	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: Nokia **Date:** 30 Nov 1999

Subject: Soft symbol combining for uplink power control

Work item:

Category: *(only one category shall be marked with an X)*

F	Correction		**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature	X		Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: Using soft symbol information for TPC bits improves the performance without marked complexity increase

Clauses affected: 5.1.2.2.2.3.1

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:

<--------- double-click here for help and instructions on how to create a CR.

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.

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 conduct the soft symbol decision on each of the power control command TPCi, where i = 1, 2, …, N and N is the number of TPC commands not known to be the same, that may be the results of a first phase of combination according to subclause 5.1.2.2.2.3. Then the sensitivity of the soft symbol reliability threshold is improved by Maximum Ratio Combining (MRC) and integrating component. These are run in parallel with soft symbol reliability estimation and the minimum individual output determines the final output. In this approach, the minimum input soft symbols are integrated and a separate soft symbol thresholding for this integrated sum is conducted. After each TPC round, the minimum soft symbol value of that round is added to the integrated sum. If the integrated sum exceeds a predetermined threshold, a power-down command is issued, even if the individual soft symbols from that particular TPC round do not imply a power-down command. If a power-down command is issued, based on the integrated sum exceeding its threshold value or the individual soft symbols, the integrated sum for the next TPC round is again set to zero.

~~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 = γ (W_1, W_2, … W_N, TPC_1, TPC_2, …, 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.~~

~~**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.~~

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