

TSG-RAN Working Group1 meeting #6
Espoo(Finland), July 13th – 16th 1999

TSGR1#6(99)A45

Agenda Item :
Source : 3GPP RAN WG1
Title : Liaison statement to WG4 on fast closed loop power control in FDD mode
To : 3GPP RAN WG4
Copy : 3GPP TSG RAN, TSG T1 RF SWG

3GPP RAN WG1 would like to thank RAN WG4 for having sent to RAN WG1 a liaison statement from RAN WG4 related to power control steps contained in R4-99346 "*Liaison statement to WG1 on power control step size*", continuing hence an exchange of information between our two groups on this topic.

3GPP RAN WG1 understands the concerns from 3GPP RAN WG4 regarding the need for RAN WG1 to define a stable power control algorithm in a timely manner to allow RAN WG4 to develop minimum performance requirement and test specifications. During its sixth meeting RAN WG1 made significant progress on the fast closed loop power control and would like to provide the status of our work as follows :

Concerning the UE minimum power control step size and set of power control step size

- 1) The Minimum power control step of 1 dB is mandatory for the UE
- 2) No smaller power control step size is considered for the UE in Release 99, where the PC step size is the size as seen from the RF
- 3) The maximum power control step size is 3 dB
- 4) The power control steps should be a multiple of the minimum power control step, which means that the set of the power control step is [1,2,3].

The decision on the step size was motivated by results on the optimum step sizes for different environments, considering the power control in normal mode as documented before the meeting, a power control algorithm as described below providing smaller emulated step sizes and power control in compressed mode. The highest value 3 dB is assumed to be practical for the power control in compressed mode rather than normal mode.

Concerning the uplink fast closed loop power control in normal mode

Concerning the power control in normal mode , two types of power control algorithms were included in the specification 25.214 specification and shall be supported in a mandatory way by the UE, where a PC algorithm is meant here only to refer to the reaction of a UE to received commands, rather than the full algorithm.

- Algorithm 1 : the algorithm currently specified in which the UE applies the received TPC command on a slot by slot basis, which results in a change of power equal to the step size between two adjacent slots
- algo 2 : an additional algorithm where the UE "concatenates" N consecutive commands, e.g. 3 commands or 5 commands, the power control size being 1 dB

Algo 2 corresponds to an emulation of smaller step sizes. The details of algorithm 2 are still to be agreed. The current working assumption for the algorithm 2 is as follows :

- the set of concatenated commands do not overlap (no running concatenation)
- the sets are aligned to the frame boundary (3 or 5)
- Hard decisions on the N commands and power increase/decrease applied if the N commands in a set are identical

Concerning the uplink fast closed loop power control in compressed mode

The working assumption of WG1, that is documented now in 25.214 is as follows

- 1) If emulated steps are not used in normal mode
 - a) the scheme in normal mode is allowed, where this scheme corresponds to algorithm 1 referred to above
 - b) **one** additional mode relying on fixed step should also be allowed. The characteristics of this second mode are as follows
 - i) initial step size = $\min(2 * \text{power step in normal mode}, 3 \text{ dB})$
 - ii) during a Recovery period, the applied step size = initial step size, and then the UE shall revert to normal mode
 - iii) Such recovery length setting is still for further study and two approaches to define such a recovery period were identified
 - (1) The recovery will be expressed as a function of the Transmission mode parameters and possibly the spreading factor
 - (2) The recovery period may be adaptive taking into account e.g. TPC command inversion
 - c) The mode to use is under the UTRAN control.
- 2) If emulated steps are used in normal mode
 - a) This needs to be further studied since the emulated steps had not been considered till now.

Concerning the uplink fast closed loop power control in soft handover

The uplink power control scheme in soft handover has been stable since the creation of 3GPP. WG1 would like to know whether RAN WG4 intends to develop minimum performance requirements for PC in soft handover. If WG4 was to develop such minimum performance requirement WG1 would like to know whether the level of details in 25.214 is sufficient.

Concerning the downlink power control minimum steps and set of steps

- At its last meeting WG1 had concluded that a minimum power control step size of 1dB should be supported by all UTRAN access points in a mandatory manner, and 0.5 dB could be supported in an optional manner. This is fully stable in WG1
- Concerning the maximum step size, WG1 is currently unclear in the need to specify such a step since the PC is manufacturer dependent. A maximum power control step might be considered if large steps were to cause an problem for the UE decoding.

Concerning the downlink power control in normal mode

The downlink power control is outside the specification. Only the setting of the TPC commands sent by the UE to the UTRAN access points is covered by the specification. No modification has been done on this, meaning that the UE is to send TPC commands every slot, such a TPC command relying on measurement performed on the previous slot. There is no equivalent of the small emulated steps as for the uplink power control.

Downlink power control in compressed mode

As for the normal mode this is outside the scope of the specification. As an example the PC for the uplink was inserted as a possible algorithm.

In addition to the fast closed loop power control, WG1 listed during this meeting a number of items that needs to be solved before the whole power control item can be considered as stable including the open loop power control. Such items are not understood to be under the responsibility of WG1. In order to ensure that such open points are know to other groups, a separate liaison statement was sent to RAN WG2, RAN WG3 and RAN WG4 to address these points.

RAN WG1 will meet after the next RAN WG4 meeting and is ready to consider any further request from WG4 in order to ensure that WG4 meets its schedule. RAN WG1 will keep WG4 informed of any further progress achieved at its next meeting.

