TSG-RAN Working Group 1 meeting #7bis **TSGR1#7bis(99)f09**

Kyongju (Korea), 4th-5th October 99

Agenda Item : Ad Hoc 9

Source : Nortel Networks[1]

Title : On slow power control

Document for : Discussion

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1. Introduction

In this contribution, we would like to summarise the discussions and issues concerning slow transmit power control and propose a way to proceed with it in the standardisation process. Slow transmit power control was present in ARIB volume 3 specifications and it was included in UTRA WG1 specifications in the merge process between ETSI and ARIB as no opposition was encountered. However many concerns have been raised since then in email discussions regarding this scheme.

In this contribution we summarise the identified issues and propose a way forward to handle this item in 3GPP RAN. We believe that there is a potential benefit for a slow power control. However the slow power control scheme presently documented was not extensively evaluated/analysed. RAN WG1 should hence move this item to later Releases, the slow power control becoming then mandatory to UE depending on service capabilities.

2. References

[1] TSGR1#7 99-c00 Text modification for slow transmit power control in 25.211, 25.212 and 25.214, NEC.

[2] TSGR1#7 99-c01 Benefits of slow transmit power, NEC.

[2] TSGR1#7 99-c16 New power control ratio measurement in slow transmit power control, Samsung.

3. Content of the current scheme

3.1 Description

The scope of the proposal contained in [2] is the downlink power control in case of packet data transmission or more generally when there is a need to transmit information on the uplink at low rate, in a sporadic manner, for example acknowledgement for downlink packets. The aim is to reduce the transmit power on the uplink to save UE battery.

Uplink transmission is interrupted when the UE does not have any information to transmit and is resumed at least once every T_{RINT} second to transmit the Power Control Ratio (PCR). The PCR is calculated as the ratio of the received power of the CPICH of the serving cell and the sum of this power and the received powers of the CPICHs of the neighbouring cells if they are above a certain threshold. It is then encoded as the TFCI bits using bi-orthogonal code and transmitted over the TPC bits of the DPCCH in the next complete frame.

To allow the uplink power control to start again some dummy slots are sent prior to the resumption of the transmission.

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[1] Contact persons : Sarah Boumendil, Evelyne Le Strat

3.2 Identified issues

The documents given in reference describe this scheme and give results to evaluate its performance in terms of transmitted power, however before including this scheme in the standard, we need to evaluate the relevance of the PCR calculation as questioned in [3], evaluate the impact on the downlink and uplink power control and assure that the needed changes are correctly implemented in the WG2 and WG3 specifications.

3.2.1. PCR calculation

From [2] and [3], it seems that there is a need to find the relevant PCR calculation and especially compare the existing proposals not only from the SIR estimation point of view but also as far as global performance of power control (uplink and downlink) are concerned.

3.2.2. Impact on uplink power control

In a similar fashion as in uplink compressed mode, the fact that transmission is interrupted in the uplink, raises a certain number of issues, even with the introduction of dummy slots prior to the resumption of transmission : what type of power control should best be applied when resuming the transmission, which step size should be used, for how long?

We think that all these aspects have not been clearly evaluated and that is it essential to ensure that slow transmit power control does not degrade the performance of the overall power control.

3.2.3. Impact on downlink power control

The concerns raised are the same as for the uplink power control. It is clear that the aim is to reduce the transmitted power in uplink but to do so no TPC command is transmitted to the node B for possibly several frames. The impact of the interruption of downlink power control on the performance of the system also needs to be clearly evaluated, especially as this feature is proposed for the non soft handover case were the channel might vary more rapidly as in the soft handover case. The UE can still measure the power from the node B but is not able to send commands to follow the variations of the propagation channel, this again raises certain questions : should the same step size be used for downlink power control when resuming uplink transmission, for how long?...

3.2.4. Protocol perspective

For the time being, slow power control only exists in WG1 specifications hence further work is needed from WG2 and WG3 to include this feature in their specifications if it is accepted. It might lead to the identification of several issues. One already identified in the current proposal is the fact that acknowledgements from packets do not necessarily come every 10 frames. So it is not clear if whether there are transmission events every T_{RINT} seconds as well as transmission events in-between if acknowledgements have to be sent. In that case, will the UE also transmit the PCR together with the acknowledgement?

3.2.5. How should this feature appear in the standard?

The current proposal is that slow transmit power control should be optional for both the UE and the UTRAN. In that case it is most likely that we will hardly ever have a UE that supports the feature connected to a UTRAN that also supports the feature. It seems that this makes the specifications more complex for little benefit. So our point of view is that if this feature is to be supported in a future release it should be mandatory for the UE otherwise there is little chance that it will ever be used

4. Proposal how to proceed with STPC

Taking into account the previous points that require further studies and elaboration, we think it would

beneficial not to include slow transmit power control in release 99. This would give the groups involved in its implementation some time to :

- agree on the fact that the proposed scheme is beneficial, on the basis of simulations in realistic environments (multipath profile, speeds...), taking into account the impact on both uplink and downlink power control
- decide on its implementation in terms of measurements (PCR), protocols...
- decide if it has to be mandatory for the UE or not

5. Conclusion

As many concerns have been raised on the efficiency and implementation of slow transmit power control, Nortel Networks recommends that it should not be part of release 99 to allow WG1,2,3 to fully elaborate the scheme.