TSG-RAN Working Group 1 meeting #3 **TSGR1#3(99)181**

Nynäshamn (Sweden), 22nd-25th March 99

Agenda Item	**:**	6
Source	**:**	**ad-hoc 9 Chairman**
Title	**:**	ad-hoc 9 report
Document for	**:**	Discussion

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1. Introduction

This document reports on the discussions that took place on the RAN WG1 reflector in the framework of ad-hoc 9 (Closed loop power control for FDD). The discussion on the reflector dealt mainly with the following topics :

1) Power control step sizes for uplink and downlink power control in relation with current status in WG4
2) Adaptive step power control proposal from Panasonic (R1-99151)
3) Clarification on Selection Site transmit diversity (SSDT)

The following sections a summary of the discussion on each of these topics

2. Power control step sizes for uplink and downlink power control in relation with current status in WG4

The discussion on power control step sizes was re-initiated by Nokia and the discussion was continued by Nortel, Nokia and Omnitel, both on the WG1 and WG4 reflector, the objective being to get information from the WG4 side on the limitations imposed by the RF side and hardware aspects.

The following should be noted :

1) We should take a particular care on the terminology in order to avoid misunderstanding between WG1 and WG2. What is meant by minimum step size of power control for WG1 is called step size by WG4, assuming that step sizes corresponding to multiple of the minimum step size are supported. It is however not clear from the e-mail discussion whether there are limits on the maximum step size between consecutive slots knowing that there is absolute limit imposed to the total range of power control.
2) The current status of the work in WG4 is the following :
    a) For the Base station
        i) The total dynamic range for the power is 18dB for macro base station (output power of 43 dBm at the antenna connector). The value is not into brackets.
        ii) The power control dynamic range, meaning the maximum range of transmit power on a per channel is 25 dB.
        iii) The minimum power control step size is 1dB. The value is though between square brackets.
    b) For the UE
        i) The power step size is [1 dB]. It is not clear what is really meant, in particular whether multiples of 1 dB are allowed. It was not clear whether this is to be understood as limiting the power change at rate changes or whether this is assumed to apply only at fixed rates.
3) Background for the different values for WG4 documentation was provided by Nokia as far as the Node B is concerned .

a) It was in particular explained that the restricted total dynamic range is due to the fact that the Perch channel (CCPCH+SCH) is always transmitted.

b) The power control dynamic range is not service specific

c) Values correspond to macro BTS case but thy are not expected to require modification for other type of equipment.

4) Many questions were asked by Nortel on S4.01 regarding the UE on the following topics but no answer was provided :

a) Power split between DPCCH/DPDCH (it is not referred to inS4.01 A)

b) A.2.1 - Step sizes

c) A.2.2 rate of change

5) It was commented by Omnitel that the efficiency of the fast closed loop power control and more generally pwoer control in the downlink will be limited by the restricted power control range and asked whether the effect had been quantified. Nokia provided some more explanation and background for the 25dB range.

6) Power control steps were suggested as follows by Nokia

a) For the uplink it is suggest to have +/- 1dB for release 99 and possibly other steps for future releases.

b) For the downlink Nokia listed possible ways to specify the steps sizes, either a list of steps or the minimum step sizes and the number of such step sizes. Nokia is of the opinion that 1 d should be mandatory and 0.5 dB optional which should provide sufficient flexibility to the operator and Node B manufacturers.

c) No comment was made on the actual proposal from Nokia.

3. Adaptive step power control proposal from Panasonic (R1-99151)

3.1 Main characteristics of the proposal

The proposal from Panasonic consists in allows adaptive step size for the uplink closed loop power control. The information on which should be the step size is transmitted by the Node B by using offsets on the transmit power between the data field and the pilot bits, where such an offset effectively codes the step size. The proposal was evaluated for the uplink power control case, for different cases of propagation model (1path, 2path Rayleigh fading) and different velocities. One of the rationale for the scheme was indicated to be the slotted mode.

It was indicated by the proponents that the proposal could equally apply to the downlink power control.

3.2 Comments exchanged over the reflector

3.2.1. Robustness of the scheme to errors

It was commented by a number of companies (France Telecom, Nokia, Nortel and Philips) that the scheme is expected to be very sensitive to TPC errors. Multi-level power control are known to work well for reduced TPC errors. For higher error rates the single level power control would work better (France Telecom).

Nortel expressed concerns on the accuracy on the power offset with might lead to some decoding error of the power control step to apply, which in turn will affect the performance of the scheme. It was understood that the simulation of the scheme had not accounted for transmit power inaccuracy or power offset estimation errors. No comment was provided by Panasonic on this point.

3.2.2. Alternative ways to offer flexibility and/or power control improvement

It was commented that multi-level power control step can be advantageously combined with the reliability criterion (Philips and France Telecom). The case where no change in power would occur if TPCis unreliable could in particular be added. Panasonic agreed that this could indeed be better.

It was however anticipated that the scheme earlier on presented by CSELT, consisting in coding different steps using the 2 TPC bits, which would lead to a 4 power level power control) might offer performance advantage (France Telecom). Pansonic had not performed simulations to compare their scheme to that 4 level scheme.

3.2.3. Relationship with power offsets used for other purposes

Nortel expressed concerns that such a problem would effectively prevent the use of power offsets on the downlink for other purposes than setting the power control step size. Nortel reminded the ad-hoc that the use of power offset had so far been discussed in the framework of uplink power control improvement in soft handover cases.

3.2.4. Impact of the proposal for the downlink power control

- Power offsets within the DPCCH field

It was asked by Philips whether some problems were anticipated due to the fact that the step size would have to be encoded by using some power offset between the pilot bits and the remaining elements in the DPCCH. Nokia also indicated that they were not particularly keen in introducing power offsets in the uplink PDCCH.

Panasonic answered that no problem was anticipated.

3.2.5. Conclusion

Companies aprt from the proponents themselves agreed that the proposal was not acceptable in its present form (Philips, Nokia, Nortel and France Telecom). It was however agreed that results from Panasonic show some limitations of the currrent scheme. Therefore improvement of the current scheme may be looked for. Panasonic however concluded that they will be continuing their work considering bigger step sizes and the slotted mode case.

4. Clarification on Selection Site transmit diversity (SSDT)

Questions were asked by Motorola regarding operation of the UE in the case multiple cells in the active set declare themselves as primary cell. In such a case the non primary cells would cause interference to the signal transmitted by the primary cell. Motorola suggested that the UE has some ways to detect that multiple cells are transmitted which would allow MRC between the difference cells. However it was not clear how such detection would be possible. Motorola also asked questions on how the TPC should be fixed, whether the were to take into account only the primary cell or all cells transmitted at the same time.

Fujitsu clarified that the DPCCH is always transmitted even from the secondary cell, which effectively corresponds to the DTX case. It was initially indicated by Fujitsu that the DTX presence could be indicated in the TFCI but it was later commented by Motorola that it was not clear at this stage whether the TFCI encodes the case of absence of transmission. Furthermore the TFCI is interleaved of a frame and the current text in S1.14 allows the cell selection to happen every 4 slot which is in contradiction with the TFCI use for DTX detection. So we might have to rely only on some form of blind detection.

Motorola raised concerns on the need to track every DPCCH in the active set. This might lead to the need to have either a high number of Rake fingers or to reduce to 1 the number of rake fingers used to decode the primary BS. NEC commented that they believe that there is anyway a sufficient number of fingers to track every cell in the active set. This conclusion relies on the fact that in normal SHO mode all cell are effectively tracked for each slot. Comment from the chairman : is that true that all cells in the active set are effectively tracked ? In the case of 6 ways hand-off this means that more than 6 fingers are available. This is not quite in line with the assumption for IS-95 so this requires more checking .

Conclusion : the discussion allowed to have some better understanding. It is not quite clear yet how the error in SSDT should be accounted for in particular when the rate of selection is higher than the frame rate, since part of the frame can be transmitted from multiple cell and part in one single cell. Complexity must be clarified and in

particular the assumptions that the number of fingers is always higher than the maximum number of cells in the active set ?

5. Conclusion

The current status of ad-hoc is the following

- No decision has been taken on power control step or level of standardisation of the dl power control. Discussion however allowed to understand some of the aspects for the BTS. A number of questions remain without any answer. A liaison statement listing questions should be sent to WG4.
- The ASPC proposal did not get accepted by the group. However it is understood that he current scheme might have some limitations. So multi-level power control scheme taking into account reliability aspects might be further investigated. The scheme proposed by CSELT might be revisited.
- Clarification on SSDT is still needed. Although the discussion allow to clarify further the scheme in the case of errors (multiple cells end up transmitting) , not all answers or assumption are understood.

A number of points identified for further study at the last meeting or requiring some clarification have not be discussed over the reflector. The ad-hoc should attempt to deal with those by the next meeting

- Fast closed loop power control in slotted mode
- Fast closed loop power control for variable rate
- Fast closed loop power control in relation with downlink shared channels
- Level of standardisation for downlink power control at the Node B
- Way to express requirements for PC at the UE, in relation with WG4 (indeed we cannot describe a procedure fully independently from the way requirements are specified by WG4). This would have some consequence on the description of uplink power control.