TSG-RAN WG1, Meeting #15 R1-00-1119
Berlin, Germany, 22-25 August, 2000

Agenda item:

Source: QUALCOMM Europe

Title: Improved PDSCH power control

Document for: Discussion & Decision

Introduction

This document provides a summary of proposals received in R1 in relation to improved PDSCH power control. It also briefly describes another mechanism to provide enhanced DPSCH power control support. It includes a high level description of each approach, its benefits, drawbacks and associated open items (open items in relation to initial assessment not final specification). Finally it discusses some items for inclusion in the associated technical report.

Best cell method [2, 3]

Description

The UE indicates which is the best cell (from its point of view) to the network. If the PDSCH is being transmitted from the best (average of the indications received from the UE) then Node B applies power control commands to the PDSCH in that cell. Otherwise it uses a fixed power allocation of fixed power offset relative to the associated DPCH as in R'99. The indication mechanism is based on the one used for SSTD.

Benefits

- Does not require any change in the UE HW.
- Backward compatible with R'99 terminals

Drawbacks

- Only improves the performance in some scenarios (unbalanced active set power distribution).
- Can actually hurt the performance in some other scenarios (almost balanced active set, error in cell selection)
- Decreases the average interference generated by PDSCH but does not necessarily provide additional capacity as the base station has to set aside the power required for fixed power or fixed offset PDSCH transmission in case the power control "mode" suddenly changes.

Open issues

- The actual performance in balanced active set scenario (how much does it hurt).
- The qualitative and quantitative gains compared to R'99.
- Transition between both power control states.

Block error indication method (alternative proposal, [5, 6])

Description

The UE sends a 100 Hz, 1 bit, feedback to the network indicating whether any of the blocks in the previous frame has been received in error (based on CRC check). In case no TTI with CRC ended in the previous frame, the Node B knows it and discards the information sent by the UE. The information is sent by stealing one power control slot per frame on the associated DPCH. This method is part of the TIA/EIA-IS-2000 specification.

Benefits

- Does not require any change in the UE HW.

Drawbacks

- Performance gain depends on transport channel configuration (CRC, TTI).
  Since CRC is used for the outer loop and at least one transport channel is expected to include CRC integrity protection CRC will, in principle, be available in most cases. However, depending on the TTI of the TrCH with CRC protection, the effective feedback rate could be 100 Hz (10 ms TTI), 50 Hz (20 ms TTI), 25 Hz (40 ms TTI) or 12.5 Hz (80 ms TTI).
- Power control loop is not maintained when no data is sent over the PDSCH

Open issues

- The qualitative and quantitative gains compared to R'99.

SIR based method [1, 5, 6]

Description

The UE derives an independent power control command based on the PDSCH symbols (non-coherent accumulation, PDSCH TFC is known in advance) and steals every 3, 5 or 15 slots of the associated DPCH UL power control stream to transmit the PDSCH power control commands. Alternatively, new UL slot structure could be defined. This method is part of the IS-2000 specification.

Benefits

- Full fast inner loop power control solution.

Drawbacks

- Requires the introduction of a specific PDSCH power control decision algorithm in the UE. The complexity increase is not expected to be significant but requires HW changes.
- In case new UL slot formats are defined the Node B HW might also have to be modified.
- Power control loop is not maintained when no data is sent over the PDSCH.

Open issues

- The qualitative and quantitative gains compared to R'99.

Technical report [4]

Besides the impact on the physical layer, the three solutions would require similar changes to the signaling messages in order to support the transition to and out of that mode and indication of the applicable parameters.

Besides the technical consideration, we suggest that the structure of the report is adjusted to accommodate multiple proposals.

Conclusion

We believe that improved shared channel power control capability is beneficial and should be considered for inclusion in R'2000 or later. However we believe that further work is necessary to decide on the best method to enhance the DPSCH power control capability as the performance improvement provided by the three listed solutions is not know. At this point we suggest that all the proposals are listed in the technical report together with a list of benefits and drawbacks as well as areas for further evaluation.

References

[1] 3GPP Tdoc R1-00-0327, "Power control in DCH/DSCH mode", Qualcomm

[2] 3GPP Tdoc R1-00-0891, "DSCH power control", Nokia

[3] 3GPP Tdoc R1-00-1025, "DSCH power control improvement in Soft Handover : Further elaboration of the proposal", Nokia

[4] 3GPP Tdoc R1-00-1026, "Draft TR for the DSCH power control improvement in Soft Handover" Nokia

[5] 3GPP2 C.S0002-A, "Physical Layer Standard for cdma2000 Spread Spectrum Systems", 3GPP2

[6] 3GPP2 C.S0005-A , "Upper Layer (Layer 3) Signaling Standard for cdma2000 Spread Spectrum Systems", 3GPP2