TSG-RAN Working Group 1 meeting #15
Berlin, Germany
August 22 – August 25, 2000

TSGR1#15(00)0995

Agenda item: AH99

Source: Siemens

Title: TDD PC in case of multiple CCTrCH

Document for: Discussion

Introduction

In [1] it is described how the downlink power on a CCTrCH's in a TDD system is controlled with the use of two Transmit Power Control (TPC) bits signalled by the UE in the uplink. The TPC bits are transmitted immediately following the midamble as described in [2].

The UE measures the power in all physical channels of a CCTrCH and determines whether it should be raised or lowered. If the received signal power is determined to be too high, the UE sends a 'down' signal to the Node B, and the Node B lowers the transmitted signal power by one step. Conversely, if the UE determines that the received signal power is too small, it sends an 'up' signal to the Node B which then raises the power by one step. The step size is determined by the higher layers, and may be 1dB, 2dB or 3dB.

However, it is possible that each UE will have more than one uplink CCTrCH and more than one downlink CCTrCH. This being the case it is also possible that different downlink CCTrCH's in different time slots may require different power adjustments. It is not clear which uplink CCTrCH will carry the TPC information for a given downlink CCTrCH.

Additionally, it is also possible to have an asymmetrical relationship between the uplink and downlink channels. that is to say, there may be more downlink CCTrCH's than uplink. In this case, the question arises as to how the TPC bits are to be transmitted in the 'missing' uplink CCTrCH. Finally, there is the case of discontinuous uplink transmission. What happens when there is no uplink CCTrCH at all for some period?

CCTrCH id's.

The identification numbers for the CCTrCH is uplink and downlink are allocated according to CCTrCH type. There is a maximum of 8 common and 8 dedicated CCTrCH in the uplink and downlink, and each of these is allocated an id number from 1 to 8. To avoid confusion, for the purpose of this mapping it is suggested that a single numbering scheme be used in Layer One. The dedicated channels should retain their original assignment, and the common channel should have 8 added to their assignment. Thus, CCTrCH's will be allocated id numbers from 1 to 16, with dedicated channels being allocated id's 1 to 8, and common channels allocated numbers 9 to 16.

Proposal

Given the downlink L1 CCTrCH id's $\{d_1, d_2, \ldots, d_m\}$ where m = 1..16 is the number of CCTrCH's dedicated to a single UE (either DCH or DSCH) and uplink L1 CCTrCH id's $\{u_1, u_2, \ldots, u_n\}$ where n = 1..16 is the number of CCTrCH's emanating from a single UE (either DCH or USCH), the following mapping should be applied for the subsequent circumstances:

m=n: For the case where the number of CCTrCH in the uplink and downlink are equal, each uplink CCTrCH shall carry TPC bits for one downlink CCTrCH. The mapping shall be performed in ascending order of id numbers. That is to say, the uplink CCTrCH with the lowest id number shall carry the TPC bits relating to the downlink CCTrCH with the lowest id number, the uplink CCTrCH with the next lowest id number shall carry the TPC bits relating to the

downlink CCTrCH with the next lowest id number and so on. This shall occur whether the CCTrCH's are linked by their content or transport channel id's or not.

m<n: For the case where there are more uplink CCTrCH's than downlink, the above mapping shall apply for the first 'm' uplink CCTrCH's. The remaining uplink CCTrCH's shall carry a repetition of the previous TPC bits in the same order.

m>n: The case where the number of downlink CCTrCH's is greater than the number of uplink requires special consideration. For this case, the 'm' downlink channels must be logically grouped into 'n' groups according to the CCTrCH id number.

There shall be n groups with group id q, q=1,...,n. The mapping of CCTrCH id's to group id's shall be as follows:

Group 1: { d_1, d_2 ,…, d_p },

Group 2: { d_{p+1}, d_{p+2} ,…, d_{2p} },

...

Group n: { $d_{(n-1)p+1}$, $d_{(n-1)p+2}$,…, d_{np} ,d_{np+1}, ..., d_m },

with $p = \lfloor m/n \rfloor$. Each group is then allocated a virtual CCTrCH id equal to the lowest id in the group. The mapping between group id's to uplink CCTrCHs is then the same as in the 'm=n' case.

Discontinuous Transmission

In the case of discontinuous transmission of the uplink CCTrCH, the UE shall do the following:

If a single or several uplink CCTrCH are paused, the UE shall adapt the scheme used to transmit TPC bits. E.g., if there is 3 downlink and 3 uplink CCTrCH's, and one of the uplink CCTrCH's is paused, the UE shall move from symmetrical scheme to asymmetrical scheme.

Conclusion

There is a need to clarify the mapping of the TPC bits in the uplink CCTrCH's to the correct downlink CCTrCH's. By using the CCTrCH id, which is known by both the node B and the UE, a mapping scheme can be derived. In the case of discontinuous transmission, the UE should adapt the scheme autonomously.

References

[1] TSG RAN WG1, "TS 25.224 Physical Layer Procedures (TDD)", V3.3.0

[2] TSG RAN WG1, "TS 25.221 Physical Channels and Mapping of Transport Channels onto Physical Channels (TDD)", V3.3.0