Agenda Item:
Source: NEC and Telecom Modus
Title: Assignment of parameters for slow transmit power control
Document for: Discussion/Decision

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1. Introduction

In TSG-RAN WG1, a downlink transmit power control method has been discussed, which is called "Slow Transmit Power Control (slow TPC)". This method was introduced for downlink packet transmission in the ARIB specification as an option for both UE and network, and was also included in the 3GPP 25.200 series. In order to control and manage this power control method, Layer 3 signaling is required. This contribution explains the concept of slow TPC and proposes the necessary enhancements to relevant RRC protocol messages

2. Slow TPC

This method will be used instead of the fast closed-loop power control when downlink packet data are transmitted via DCH and when a little data including ACK messages are expected for uplink. A typical application is web browsing, which has a relatively high average data rate on the downlink, while on the UL only acknowledgements and URL requests are sent.

When low TPC is used, the UE transmits the DPCCH discontinuously. At regular time instants spaced T_{RINT}, the UE transmits a "Power Control Ratio" on the DPCCH for the duration of one frame. The PCR replaces the normal content of the DPCC frame. T_{RINT} specifies the maximum time distance between the transmission of two power control ratios. The UE may send them more often if it has UL data to transmit. If uplink data exist at that transmission, the power control ratios are transmitted with the uplink data. By using this method, the UE can reduce its power consumption significantly at the expense of a slight decrease in DL capacity. The text for slow TPC in 25.214 is attached in Appendix.

3. RRC Procedures for Slow TPC

The transition between normal fast TPC to slow TPC is controlled by the SRNC using existing RRC messages.

4. Proposal or RRC-Parameters for slow TPC

To utilize this method, we propose to introduce a new IE

> **Slow TPC Info**

This IE contains the following elements:

> **Slow TPC Info**

Parameters	REFERENCE	TYPE	NOTE
Activation Indicator		M	Indicates if Slow TPC should be on or off
Activation time of slow TPC		M	The frame number, at which slow TPC is activated, deactivated or modified with the parameters given in this IE.
T_{RINT}		O	Maximum interval between the transmission of two consecutive Power Control Ratios.
R_{SEARCH}		O	

The IE Slow TPC Info should be introduced in the following messages:

RRC Connection Setup
Physical Channel Reconfiguration
Radio Access Bearer Reconfiguration
Radio Access Bearer Setup
Transport Channel Reconfiguration
Active Set Update
Handover Command
RRC Connection Reestablishment
Transport Format Combination Control

Appendix: Text of slow transmit power control in 25.214

5.2.3.3   Slow transmit power control
Following an order from the network and acknowledgement by the UE, ordinary fast closed-loop transmit power control can be stopped and a slow transmit power control mode can be entered. In this mode, downlink DPCCH/DPDCH transmit power is determined utilising power control ratios reported from the UE. Uplink transmission is suspended when the UE does not have any information to send, and the transmission is resumed to send a power control ratio at least once in every T_{RINT} second. The UE calculates power control ratios in the following steps:
1.   The UE measures the CPICH power of the cell in which the UE is located, and sets the value to Q_1.

2.   The UE measures CPICH powers received from neighbouring cells, and sets the values greater than Q_1/R_{SEARCH} to Q_i, where i = 2, 3, …, n.

3.   The UE sets the power control ratio to $(Q_1 + Q_2 + … + Q_n)/Q_1$.

All TPC bits in the uplink DPCCH are used to send power control ratios. One power control ratio is sent per frame, i.e. 30 TPC bits are used to carry the power control ratio. The coding method is the same as that of default TFCI word described in 4.3.1.1. There are 64 code words. Code word $C_{32,m}$ corresponds to 0.5(m-1) dB and code word $\overline{C_{32,m}}$ corresponds to {0.5(m-1)+0.25} dB where m = 1, 2, …, 32. Following an order from the network, the slow transmit power control is stopped and ordinary fast closed-loop transmit power control is started. The parameters T_{RINT} and R_{SEARCH} are set using higher layer signaling.