

**Agenda Item:** 9.2.4  
**Source:** SAMSUNG Electronics Co.  
**Title:** RRC procedures and parameters for gated transmission of uplink/downlink DPCCH in control only substate  
**Document for:** Decision

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## 1. Introduction

This document addresses the RRC procedures and parameters to perform DPCCH transmission gating in control only substate [1]. The gated transmission of DPCCH means non-continuous transmission of DPCCH when no user traffic is transmitted on DPDCH. This gated transmission reduces UE's power consumption and air interference level induced while maintaining a dedicated channel between UE and UTRAN.

## 2. Gated transmission of DPCCH in control only substate

### 2.1 Rationale of gated transmission of DPCCH

The DPDCH is used for transmission of signalling traffic in control only substate, whereas it is used for transmission of both user and signalling traffic in user data active substate. The signalling traffics generated at control only substate are mostly related to state transition or mobility management, and their amount is much smaller than that of the traffic generated at user data active substate.

In order to achieve quick transition to user data active substate, a bi-directional dedicated channel is maintained in control only substate. This maintaining means keeping synchronisation and power control loop between UE and UTRAN, and it is performed by transmitting of TPC, TFCI and Pilot every 0.65[ms].

The current transmission rate of TPC, TFCI and Pilot ensures reasonable FER(Frame Error Rate) even at user data active substate where user traffic and signalling traffic can be transmitted on DPDCH at every frame. And, this DPCCH transmission rate is also applied on control only substate. To maintain same FER at control only substate seems superfluous since no traffic is transmitted on DPDCH in most frames.

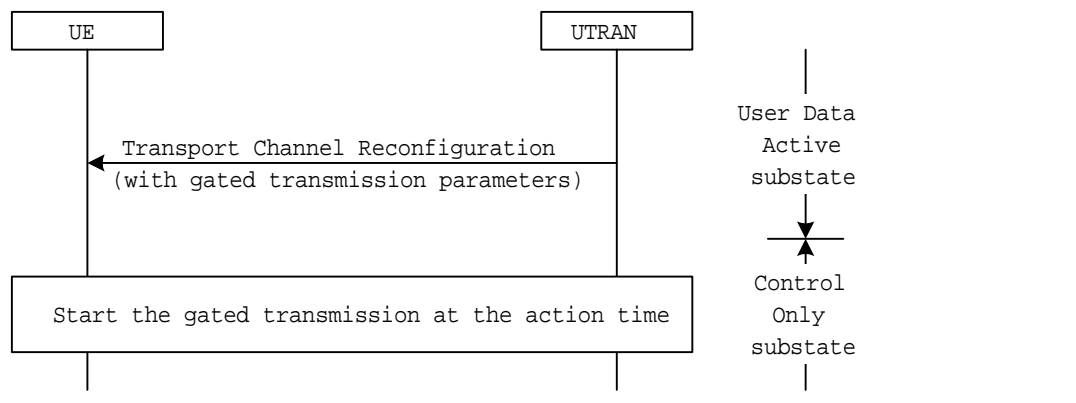
If gated transmission technique is applied on dedicated channel, then the UE and UTRAN decrease TPC, TFCI and Pilot transmission rate with predefined or specified value when they transit into control only from user data active substate. While transmitting signalling frame on DPDCH, UE or UTRAN increases its transmission power in order to compensate the effect of degraded power control. By above operation, we can save UE's battery power and reduce interference level without degradation of DPDCH FER since, in most case, UE and UTRAN transmit TPC, TFCI and Pilot with reduced rate.

### 2.2 Detailed operation

#### Initiation/termination of gated transmission

The gated transmission of uplink/downlink DPCCH is initiated by the state transition from user data active substate to control only substate. Since RRC procedure will provide stable state transition

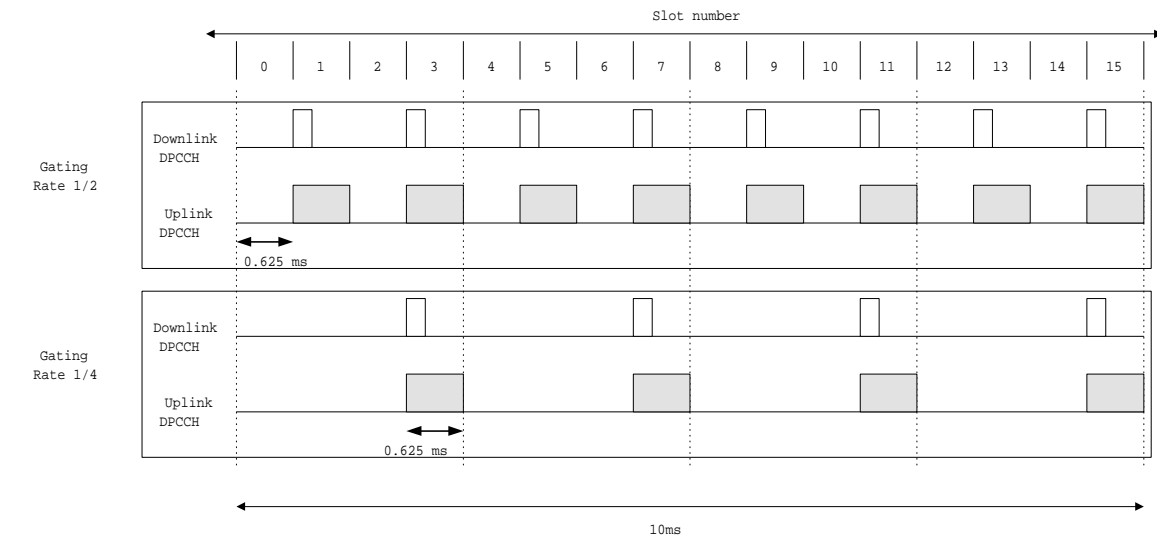
mechanism ensuring RRC state consistency between UE and UTRAN, there is no need to design initiation procedure only for gated transmission. Therefore, by defining of gated transmission related parameters as a part of physical channel parameters of RRC procedure, we can initiate gated transmission of uplink/downlink DPCCH. A sending of link level acknowledgement message as a response to state transition order message is recommended for gated transmission confirmation. However, there is no need to define additional response message only for gate transmission. Even the case that no signalling messages are used for state transition between user traffic active substate and control only substate, for example just using timer, it is possible to initiate gated transmission if the gated transmission related parameters had negotiated between UE and UTRAN during RAB control procedure. With the same procedure, it is possible to terminate gated transmission without additional signalling messages. The following figure depict initiation procedure of DPCCH gated transmission.



**Figure 1 : Gated transmission initiation procedure - UTRAN initiated, Using signalling message**

#### Gated transmission of TPC, TFCI and Pilot

If gated transmission is initiated, then the transmission of both uplink and downlink DPCCH are gated simultaneously. For simplicity, the unit period of the gated transmission is 0.625ms(1 slot), with gating rate option of 1(No gating), 1/2, 1/4, and 1/8 gating. The 1/2 gating means transmitting DPCCH by 2 unit periods(1.25ms) and the 1/4 means transmitting DPCCH by 4 unit periods(2.5ms). The actual gating rate can be decided by UTRAN according as variation of air link status. While transmitting signalling message on DPDCH in gated transmission applied control only substate, the UE or UTRAN increases transmission power of DPDCH in order to compensate the effect of degraded power control loop. And, for assisting demodulation process of DPDCH being performed at receiver side, the transmitter fully transmits TPC, TFCI and Pilot signals without gating while transmit signalling message on DPDCH even at gating applied control only substate.



**Figure 2. Example of gated transmission of uplink/downlink DPCCH**

### Difference between gated transmission and transmission stop/resumption

The transmission stop/resumption operation is also one of the approaches aiming to minimise DCH maintaining overhead. However, it is hard to classify the gated transmission as an extended concept of transmission stop/resumption since there is a major technical difference between them at the perspective of physical layer. The gated transmission just means varying power control rate from 1600[hz], 800[hz], 400[hz], to 200[hz] without breaking of closed power control loop between UE and UTRAN. But, transmission stop/resumption means the stopping of DPCCH transmission and it results in breaking of closed power control loop. Therefore, the transmission stop/resumption procedure requires a channel reacquisition procedure to resume DPCCH transmission and this reacquisition procedure similar to channel establishing procedure. Since the power control loop is maintained under the gated transmission, it is possible to make immediate transition to other RRC substates.

### 3. The effect of gated transmission on RRC procedure.

This gated transmission of uplink/downlink DPCCH is a kind of methods that reduce maintaining overhead (Code channel, Transmission of TPC, TFCI, and Pilot signal) of dedicated physical channel. By the result of this, we can extend control only substate staying time. It is obvious that if control only substate staying time is short, then no gain can be achieved from gated transmission. However, the control only substate staying time has close relationship to user traffic pattern especially to the distribution of packet interval time between two adjacent packet bursts. Therefore, the method aiming to reduce DCH maintenance overhead whether it is gated transmission or transmission stop/resumption has meaning for certain user traffic.

### 4. Proposal

We propose to include following text into section 10 of S2.31[2].

## 10.2.6.X DPCH Gating Control Info

<u>Parameters</u>	<u>REFERENCE</u>	<u>TYPE</u>	<u>NOTE</u>
<u>Gated transmission rate</u>		<u>M</u>	<u>Represents gated transmission rate of uplink/downlink DPCH in control only substate. The available rates are 1(every 0.625ms), 1/2(every 1.25ms), 1/4(every 2.5ms), and 1/8(every 5ms).</u>
<u>Activation time</u>		<u>M</u>	<u>Represents activation time of gate transmission</u>

## 5. Reference

- [1] 3GPP RAN S2.03 UE Functions and Interlayer Procedures in Connected Mode
- [2] 3GPP RAN S2.31 RRC Protocol Specification
- [3] 3GPP RAN S1.14 FDD Physical layer procedures
- [4] 3GPP RAN WG1 TSGR1-478 Gated transmission of DPCH in DCH/DCH control only substate
- [5] 3GPP RAN WG2 TSGR2-299 RRC Procedures for gated transmission of uplink/downlink DPCH in control only substate.