Agenda Item: **Adhoc 14**

Source: **SAMSUNG Electronics Co.**

Title: **More clarification on DPCCH gating in COS**

Document for: **Discussion**

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1. Introduction

It has been raised questions about gated transmission of uplink/downlink DPCCH during Control Only Substate(COS). In this paper, we clarify the issues about TFCI.

2. Question

There was a question about how TFCI is working during DPCCH gating in COS since TFCI bit is gated off when there is no signaling MSG.

Before we answer to that question, we have to remember the fact that the DPCCH fields(Pilot and TFCI) are not gated if there is some signalling MSG even using DPCCH gating scheme in COS. So, There is no problem during that period. Figure 2 and 3 depict the DPCCH gating during DPDCH transmission.
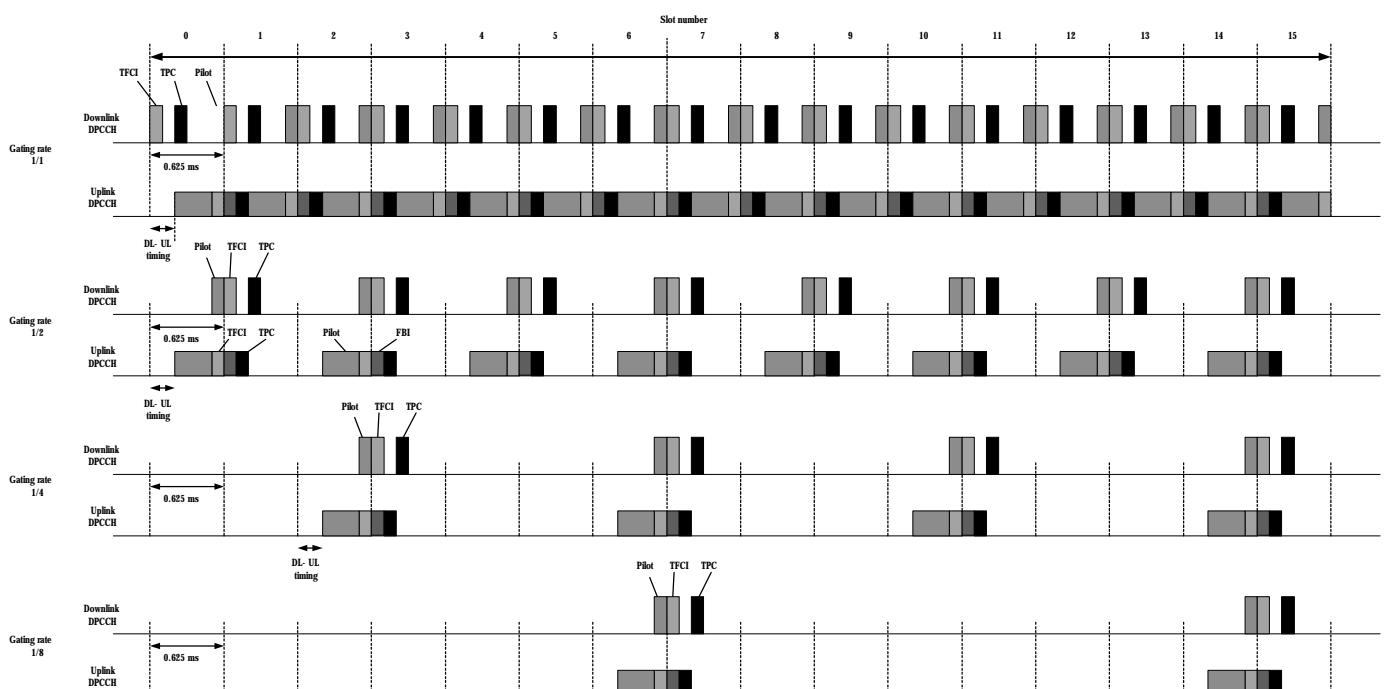

Figure 1. Example of uplink/downlink DPCCH gating structure(16 slots@4.096Mcps) [1]
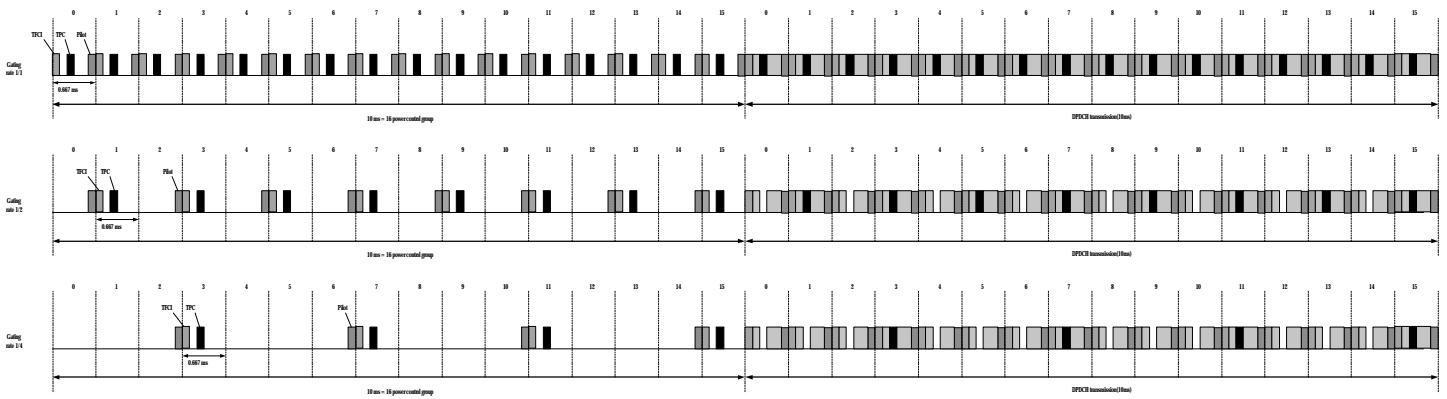
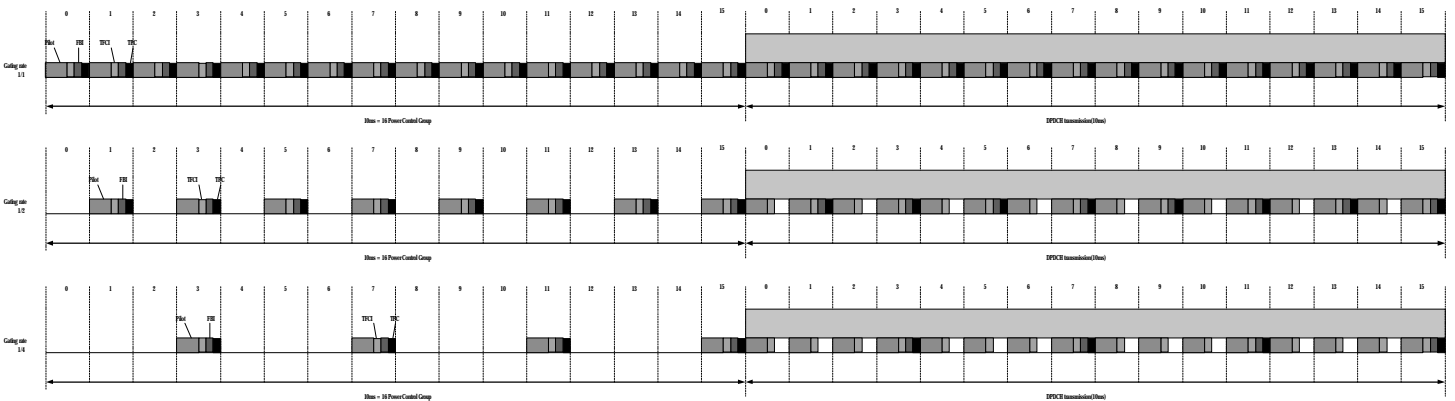Figure 2. Downlink DPCCH gating during DPDCH transmission

Figure 3. Uplink DPCCH gating during DPDCH transmission

3. Answers

We have answers for each cases.

3.1 For the case of blind rate detection

Basically there is no impact on the blind rate detection because blind rate detection is nothing to do with TFCI. By the way, side information such as DTX detection is possible to improve the performance of blind rate detection when we have a capability of DPCCH gating(see section 4).

3.2 For the case in which TFCI is used
3.2.1 During DPDCH transmission

As mentioned before, the DPCCH fields are not gated during DPDCH transmission in COS. Therefore, the receiver can use all TFCI fields. Therefore, there is no concerns using DPCCH gating if the receiver does not miss DPDCH frame.

3.2.2 During No DPDCH transmission

In this case, we can have wrong result of TFCI decoding so we can have wrong result for the entire frame. That is not definitely desirable at all.

However, we can avoid this situation by the following simple technique. That is DTX detection. Since some of periods in DPCCH are transmitted and some of them are not, we can use this information by just measuring energy in those period and make a decision if there is message or not.

It turns out we can achieve pretty good performance even though a very simple algorithm is applied. In following simulation, we use only one threshold to determine the existence of message.

4. DTX detection performance
4.1 Simulation environment

We evaluated link level simulations. The detailed simulation parameters are as shown in table 1.

Carrier frequency	2 GHz

Chip rate		4.096 Mcps
Channel Symbol rate	DPDCH	32 ksps
	DPCCH	16 ksps
Modulation	Data	BPSK
	Spreading	QPSK
Frame format(DPDCH)		Random data, 320symbols / 10ms
Slot structure	DPCCH	Pilot: 8, TPC: 2
	DPDCH	Data: 20
Channel model	Multi-path fading	1 path Rayleigh
	Doppler frequency [Hz]	5.6 , 56, 222
Power ratio of DPDCH/DPCCH		3dB
Power control	Dynamic range	unlimited (assume ideal power amplifier)
	Step size	± 1.0 dB
	Rate	1600Hz(1 gating=no gating), 800Hz(1/2 gating), 400Hz(1/4 gating)
	TPC error	4%
Channel estimation		WMSA

Table 1. Simulation parameters (uplink)

4.2 Simulation results

The difference of average RSSI between on-field and off-field pilot symbols is significant during gating. The exact RSSI value is depend on the power of DPCCH pilot symbols. The receiver can detect whether DPDCH transmitting or not by measuring relative energy ratio and then comparing certain threshold. Figure 2 shows the false alarm and missing probability of the results.

- False alarm : the probability to decide as DPDCH is transmitted even though DPDCH is not transmitted
- Missing : the probability to decide as DPDCH is not transmitted even though DPDCH is transmitted

The simulation results show pretty good results even we use a simple algorithm. Of cource, we can use a different algorithm to improve the performance more. This performance also can be improved if we have an assistance of CRC.
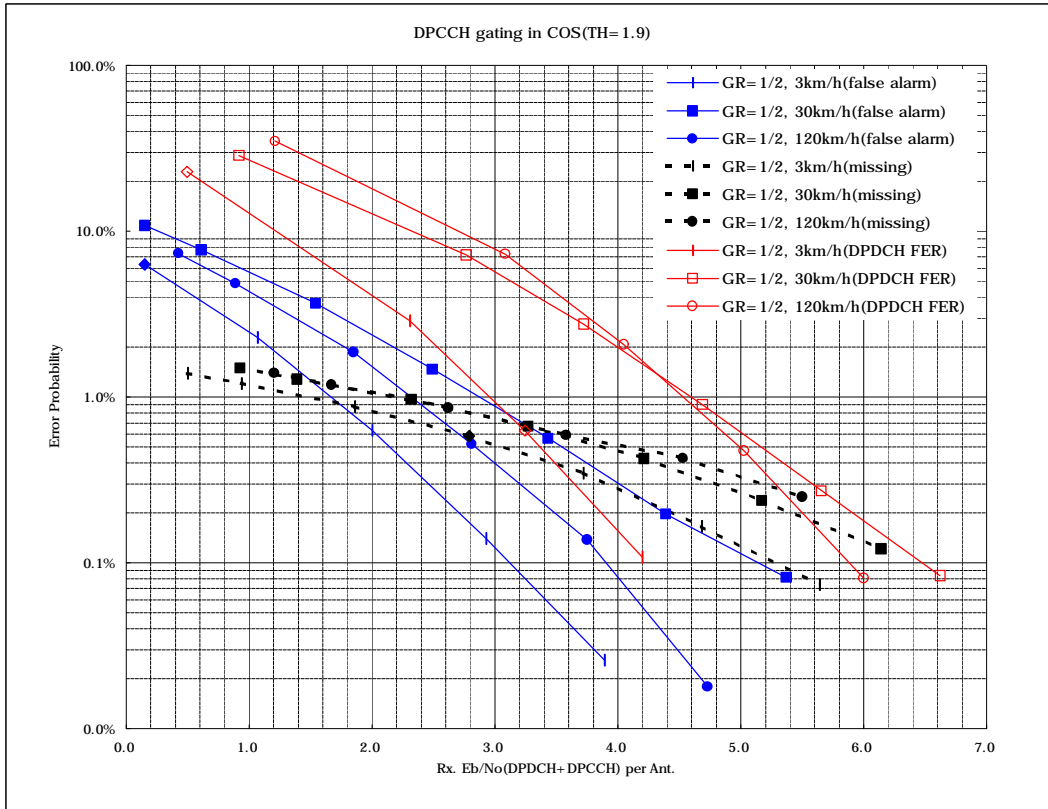
Figure 2. False alarm, missing probability, and DPDCH FER when transmitting DPDCH in COS

5   Conclusion

In this paper, we clarified the issues about TFCI how TFCI is working during DPCCH gating in COS. We can conclude that there is no significant defect for applying DPCCH gating in COS.

6   Reference

[1] TSGR1#4(99)669, "Performance evaluation of uplink/downlink DPCCH gating", SAMSUNG.
[2] 3GPP RAN 25.211 v2.1.0(1999-06), "Physical channels and mapping of transport channels onto physical channels".
[3] 3GPP RAN 25.214 v1.1.0(1999-06), "Physical layer procedures".

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