3GPP TSG-RAN WG1#8
New York, USA, 12-15 October 1999

TSGR1#8(99)h17

Agenda Item:

Source: Samsung Electronics Co.

Title: Text proposal regarding gated transmission in TS25.214

1. Introduction

In the last WG2#7 meeting, the COS(Control Only Substate) is removed from RRC state diagram for its clarification and changed into "Radio Bearer Suspended"[1] mode (R2-99B25 by NOKIA). During Radio Bearer Suspended mode, a dedicated physical channel is maintained between UE and UTRAN and it is permitted to transmit only DCCH which carries signalling messages. Since Radio Bearer Suspended mode has same meaning with COS from the perspective of WG2, no impact is induced by this change except minor WG1 text modification, replacing "COS" with "Radio Bearer Suspended mode"

Ericsson expressed some concerns and comments about hearing aid problem due to regular DTX of uplink DPCCH transmission in the 3GPP RAN1 E-mail reflector. Mitsubishi[2] submitted a proposal which uses time hopping of the period of gated transmission which they claim has less effect on hearing aid. This suggestion seems to be reasonable and can be added to the existing gating pattern. Therefore, we added random gating pattern on section 7.2 in TS 25.214 [3]

2. Text proposal on section 7.2 in TS 25.214

========== Start of Text Proposal ==========

7.2 Gated transmission in Radio Bearer Suspended Mode

[Note: Gated transmission in Radio Bearer Suspended Mode is WA, not agreement in R1.]

7.2.1 General

The gated transmission of DPCCH in Radio Bearer Suspended (RBS) Mode may be negotiated between UTRAN and UE to reduce the transmission rate of Pilot, TPC, TFCI or FBI, and to determine gating pattern.

7.2.2 DPCCH channel with gated transmission mode

The downlink and uplink DPCCH can be transmitted with the gated transmission mode enabled or disabled, as described in Figure 1.

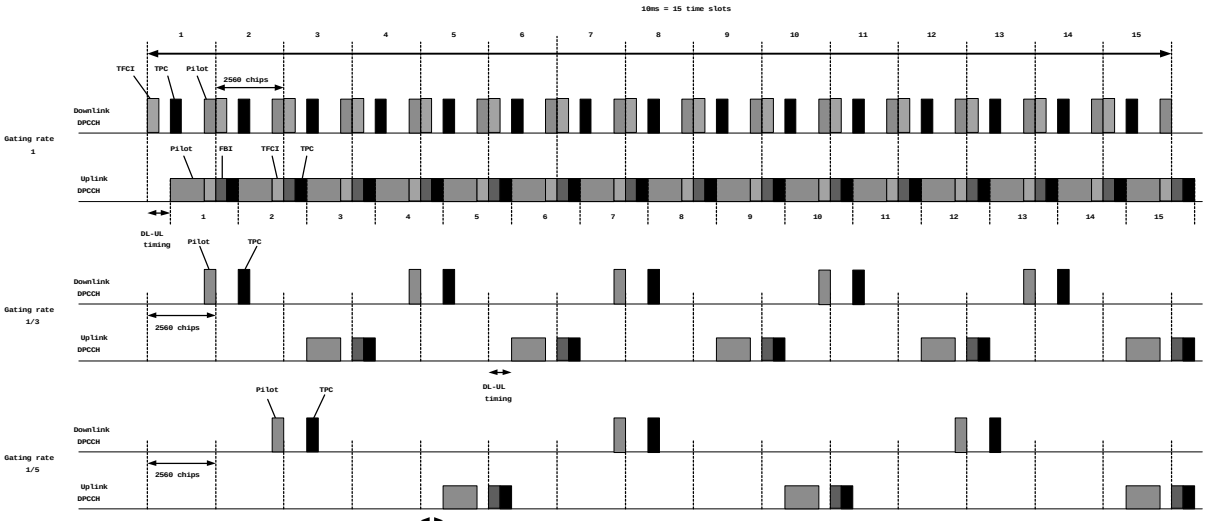

Figure 1 : Downlink and uplink DPCCH transmission timing with regular gating pattern

When the gated transmission mode is disabled (i.e. the gating rate =1), the UTRAN and UE shall transmit the DPCCH in every time slot. When the gated transmission mode is enabled, the UTRAN shall transmit the DPCCH only in the time slots that are gated on, as specified in Table 1. When the gated transmission mode is enabled, the UE shall transmit the DPCCH only in the time slots that are gated on, as specified in Table 2. The relative timings of the downlink and uplink DPCCH transmission with regular gating pattern when the gated transmission mode is enabled and disabled are depicted in Figure 1. When transmitting only on the DPCCH, the UTRAN and UE may gate off certain time slots of DPCCH at a rate specified by the gating rate which may be continuous(=1 rate), 1/3 rate, and 1/5 rate, and pattern specified in 7.2.2.1.

The downlink DPCCH allocations are given in Table 1, and the uplink DPCCH allocations are given in Table 2.

Table 1 : Downlink DPCCH allocations during gated transmission mode enabled

Gating Rate	Downlink DPCCH allocations (time slot numbers 0-14)	
	Pilot	TPC
1	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
1/3	0, 3, 6, 9, 12	1, 4, 7, 10, 13
1/3	random pattern	random pattern
1/5	1, 6, 11	2, 7, 12
1/5	random pattern	random pattern

Note: Random pattern is generated as specified in 7.2.2.1.

Table 2 : Uplink DPCCH allocations during gated transmission mode enabled

Gating Rate	Uplink DPCCH allocations (time slot numbers 0-14)	
	Pilot	FBI, TPC
1	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
1/3	2, 5, 8, 11, 14	2, 5, 8, 11, 14
1/3	random pattern	random pattern
1/5	4, 9, 14	4, 9, 14
1/5	random pattern	random pattern

Note: Random pattern is generated as specified in 7.2.2.1.

7.2.2.1 DPCCH Random Gating Pattern

Let gating group be the group consists of consecutive $1/(\text{gating rate})$ slots. Gating group is numbered $0,...,15\times(\text{gating rate})-1$. Figure 2 depicts an example of DPCCH random gating pattern generation method (gating rate = 1/5).

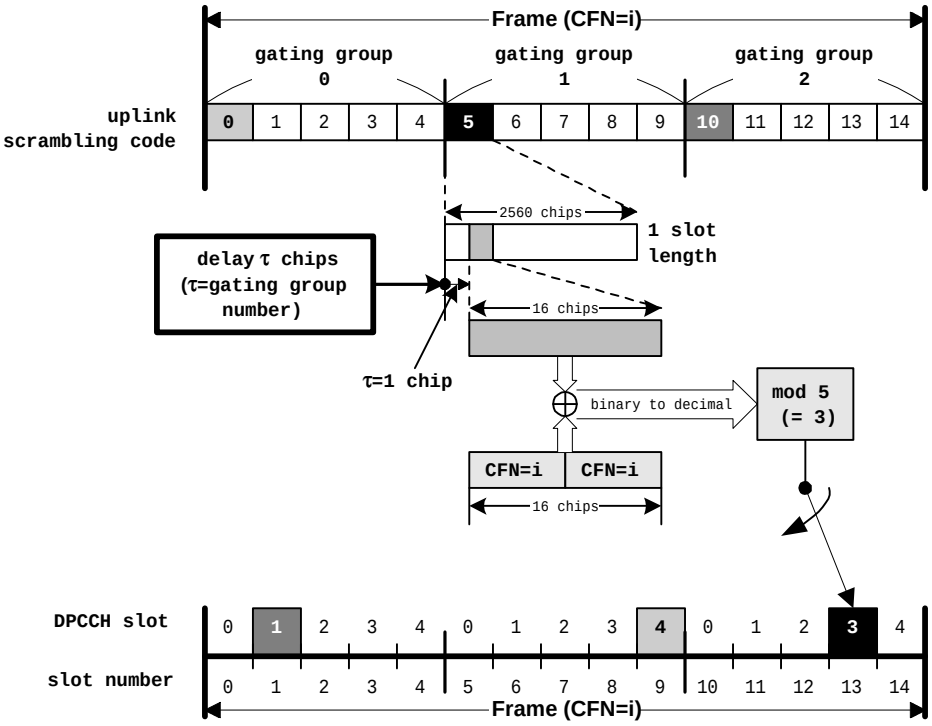

Figure 2. Random Gating Pattern Generation Method (e.g. 1/5 rate gating)

Then, the uplink and downlink DPCCH gate on slot of the next gating group shall be determined from uplink scrambling code and CFN corresponding to the current gating group. CFN is 8 bits long and its binary representation is $(c_0,c_1,...,c_7)_2$. CFN (Connection Frame Number) can be generated by modulo 256 addition of SFN(System Frame Number) and Time Offset which is specific to physical channel. If the current gating group is $i,\ 0\le i\le T-1,$ where $T=15\times(\text{gating rate})$ is the number of gating group in a frame, and CFN of current frame is $j,\ 0\le j\le 255,$ then the DPCCH gate on slot of the next gating group, $N(i,j)$, shall be calculated by

$$N(\text{gating group}=i,\text{CFN}=j)=\left\{\sum_{k=0}^{15}[a(i,k)\oplus b(j,k)]\times 2^{15-k}\right\}\bmod T,$$

where $b(j,k)$ is k^{th} bit of repeated binary representation of CFN $(c_0,c_1,...,c_7,c_0,c_1,...,c_7)_2$, and

$$a(i,k)=s\left(2560\times i\times\frac{15}{T}+i+k\right),\quad k=0,...,15$$

are 16 chips from uplink scrambling code $s(l),\ l=0,...,38399$, where the term $2560\times i\times\frac{15}{T}$ is the number of chips from current frame boundary to the boundary of current gating group, and the second term i is the chip delay from current gating group boundary. The resultant range of gated on slot of next gating group, $N(i,j)$, is $0,\ldots,T-1$. Figure 5 shows the uplink and downlink DPCCH gating with random gating pattern.

7.2.3 DPCCH gating during DPDCH transmission

Gating patterns for the downlink DPCCH with gating rate of 1, 1/3, and 1/5 are given in Table 3. Gating patterns for the uplink DPCCH with gating rate of 1, 1/3, and 1/5 are given in Table 4. Downlink DPCCH regular gating during DPDCH transmission is depicted in Figure 3. Uplink DPCCH regular gating during DPDCH transmission is depicted in Figure 4. When there is transmission on the DPDCH, the DPCCH shall be gated on (i.e. shall have a gating rate=1) for the duration of the active DPDCH frame, as given in Table 3 and Table 4. However, downlink TPC shall continue gate off with gating rate during downlink DPDCH transmission with pattern specified in 7.2.2.1. Uplink TPC and FBI shall continue gate off with gating rate during uplink DPDCH transmission with pattern specified in 7.2.2.1.

Table 3 : Downlink DPCCH allocations during DPDCH transmission

Gating Rate	Downlink DPCCH allocations (time slot numbers 0-14)	
	Pilot, TFCI	TPC
1	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
1/3	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	1, 4, 7, 10, 13
1/3	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	random pattern
1/5	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	2, 7, 12
1/5	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	random pattern

Note: Random pattern is generated as specified in 7.2.2.1.

Table 4 : Uplink DPCCH allocations during DPDCH transmission

Gating Rate	Uplink DPCCH allocations (time slot numbers 0-14)	
	Pilot, TFCI	FBI, TPC
1	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
1/3	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	2, 5, 8, 11, 14
1/3	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	random pattern
1/5	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	4, 9, 14
1/5	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	random pattern

Note: Random pattern is generated as specified in 7.2.2.1.

7.2.4 Combination of Gating Operation Mode

UTRAN and UE shall negotiate the combination of gating operation mode when they setup call. The parameters negotiated are gating rate, gating pattern, and direction as follows.

Gating Rate	1	1/3	1/5

Gating Pattern	Regular	Random

Direction	Downlink Only	Uplink and Downlink

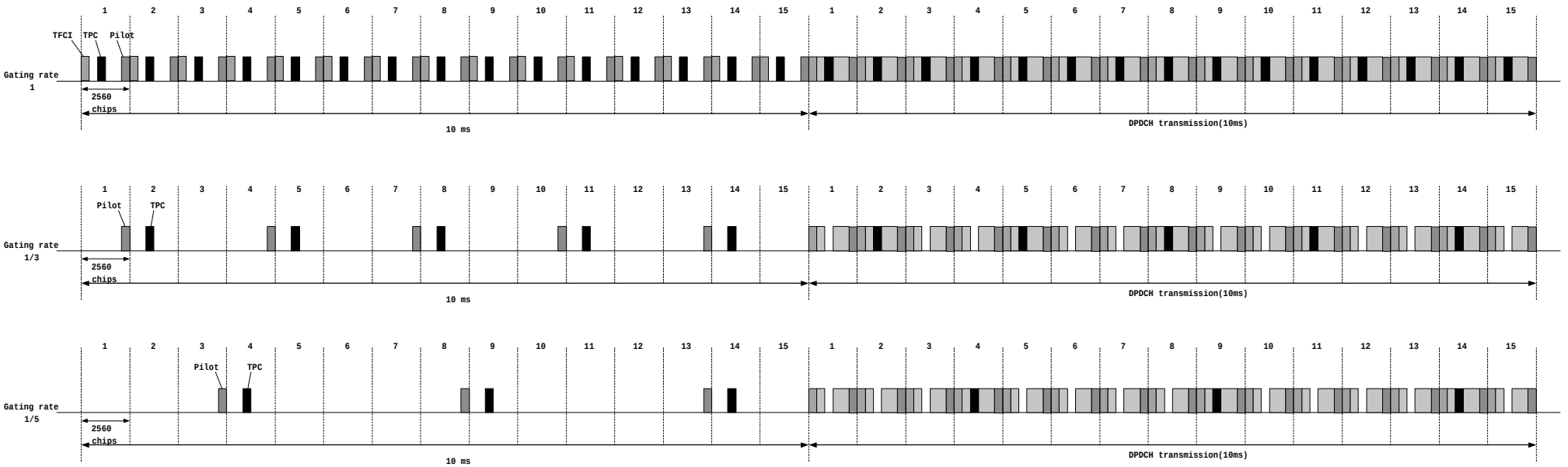

Figure 3 : Downlink DPCCH gating with regular gating pattern during DPDCH transmission

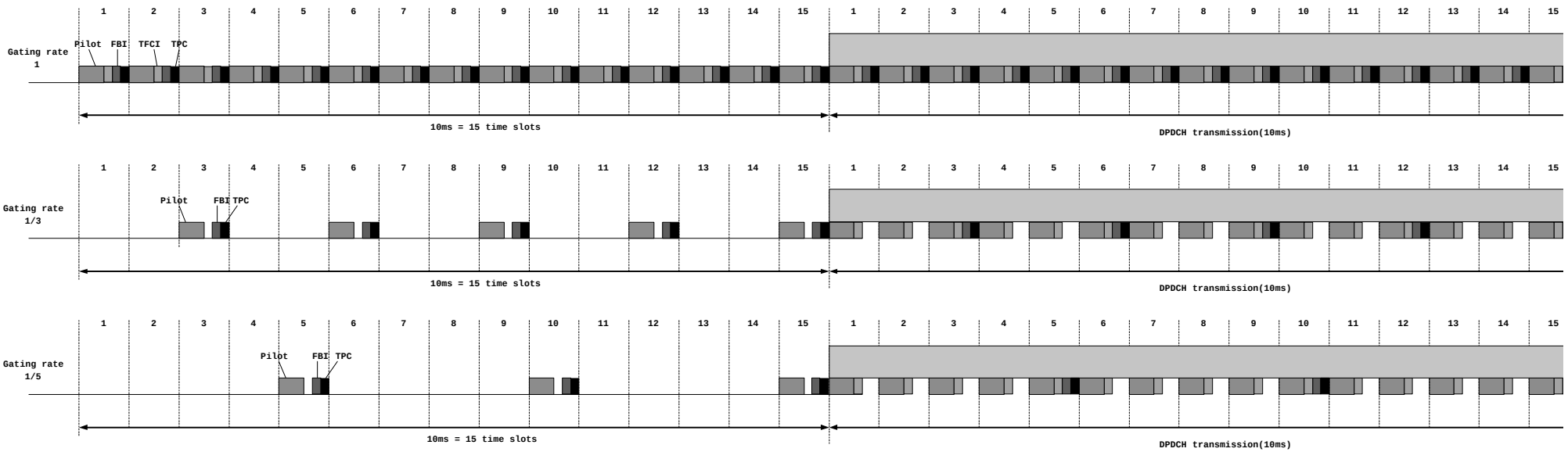

Figure 4 : Uplink DPCCH gating with regular gating pattern during DPDCH transmission

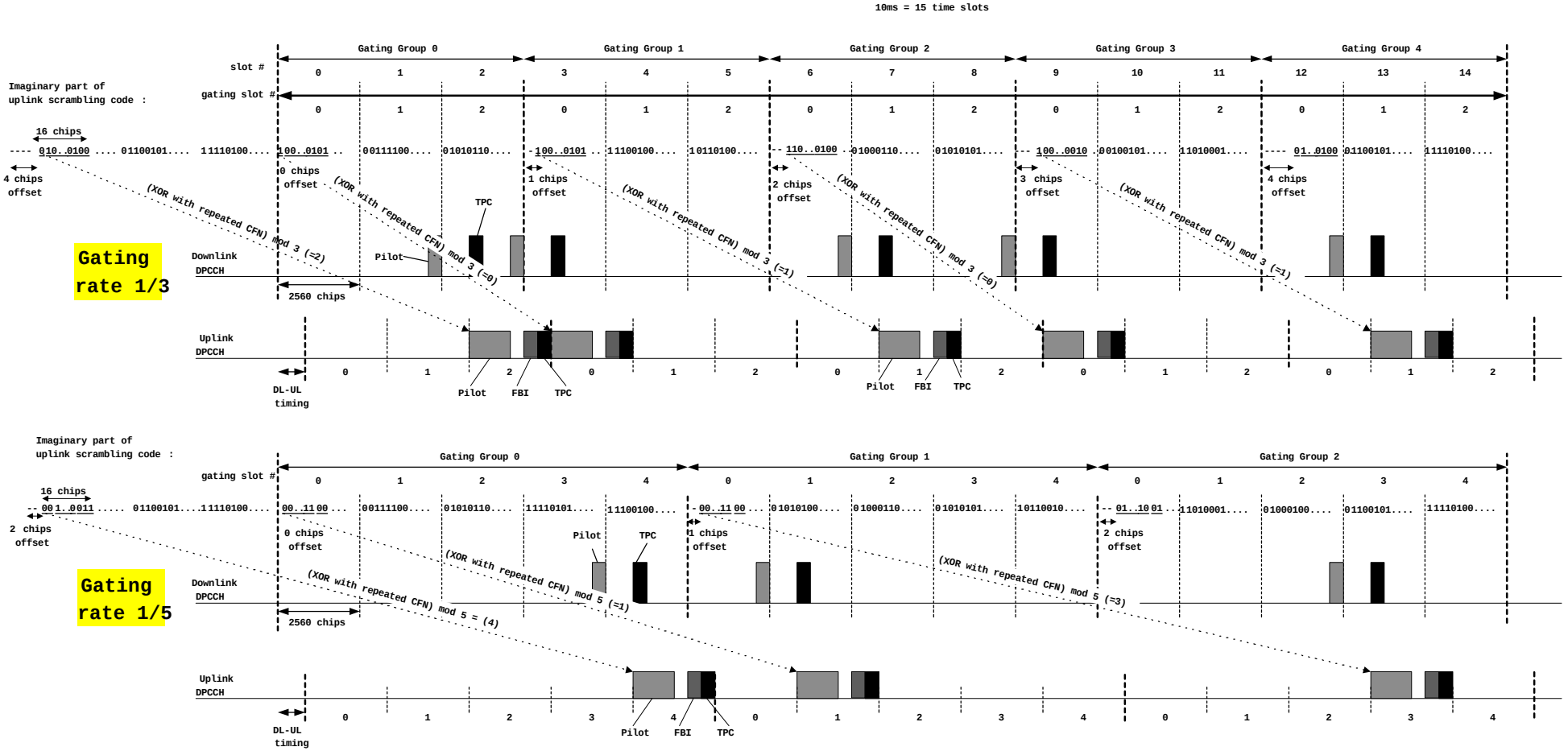

Figure 5. Uplink and Downlink DPCCH gating with random gating pattern

========= end of text proposal ==========

3. Reference

[1] TSGR2#7(99)b25, "Suspension of uplink user data transmission," Nokia, Malmo, 20~24 Sep. 1999.

[2] TSGR1#8(99)f43, "Reducing EMC problem in uplink DPCCH Gated mode," Mitsubishi

TSGR1#7(99)e20, 3GPP RAN TS 25.214 v1.3.0(1999-

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