TSG-RAN Working Group 1(Radio) meeting #7 ***TSGR1#7(99)c57***
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Agenda Item:
Source: **Mitsubishi Electric Corporation**
Title: Simulation results for TG position and proposal
Document for: Discussion

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1. Introduction

In the current specification [1], for a single frame method, two types of transmission gap (TG) position, which are a fixed position and an adjustable position, are described. For the fixed position, it is noted that the transmission gap shall be located on the center of the compressed frame. As for interleaving property, it works well, since data bits are dispersed over 10ms. However, as for power control convergence property, TG position had better to be moved to backward of the frame concerning the impact of TPC error occurring due to TG. In this document, we simulated the performance of the compressed mode depending on the TG position and TGL.

2. Background

Concerning the impact of TPC error, transmission gap should be located to minimize the number of symbols within the convergence period. Figure 1 shows a simple example of how it affects the performance. In this figure, actual convergence period is assumed to be CP slots, transmission gap length is TGL slots, the number of slots after TG is x slots. Assuming that TGL=7 and CP=7, when x = 4, convergence period CP overlaps with 4 slots of the compressed frame and 3 slots of the following frame. The ratio between the data which is affected by the TPC error and whole data is 4/8 for the compressed frame, and 3/15 for the following frame. At a whole, 84/240 of the two successive frames is affected by TPC error. When x=0, this figure becomes 56/240. When only considering TPC aspects, TG shall be located at the end of the frame. However we cannot have no gain from interleaving if the position is there. Thus the TG position must be decided considering both TPC and interleaving aspects.

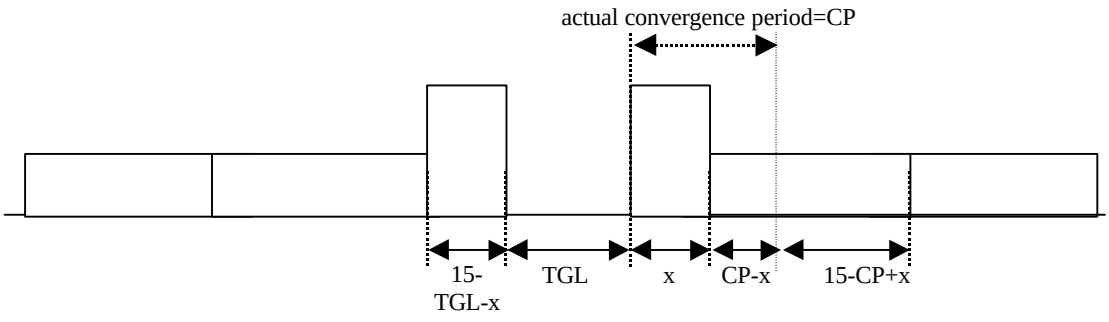


Figure 1. Impact of the convergence period

3. Simulation Results

Table 1 shows simulation parameters for TGL=7. Both speech(8kbps) and LCD(144kbps) are evaluated where fDTslot=0.00625/0.025/0.1(fD : maximum Doppler frequency). TPC step sizes are fixed to be 1dB, 2dB during 4 slots after TG which corresponds to half of TG, and 2dB during 7 slots after TG which equals to TG. These values correspond to the current assumption, but actual recovery period is still ffs. We evaluate required Eb/Io @ BER=1e-3 in link-level, where transmission gap positions changes as follows.

(1) TG locates after 5 slots from the beginning of compressed frame. This corresponds to the center of the frame. This is depicted by (5:7:4).

(2) TG locates after 7 slots from beginning of compressed frame. This is depicted by (7:7:2).

(3) TG locates after 9 slots from the beginning of compressed frame. This corresponds to the end of the frame. This is depicted by (9:7:0).

Table 2 shows simulation parameters for TGL=3. LCD(144kbps) is evaluated where fDTslot=0.00625/0.025/0.1. TPC step sizes are fixed to be 1dB and 2dB during 3 slots after TG which equals to TG. Transmission gap positions changes as follows.

(1) TG locates after 7 slots from the beginning of compressed frame. This corresponds to the center of the frame. This is depicted by (7:3:6).

(2) TG locates after 9 slots from beginning of compressed frame. This is depicted by (9:3:4).

(3) TG locates after 11 slots from the beginning of compressed frame. This is depicted by (11:3:2).

(4) TG locates after 11 slots from the beginning of compressed frame. This is depicted by (13:3:0).

Service	Speech (8kbps) / LCD (144kbps)
slots/frame	16
SIR	perfect estimation
fD Tslot	0.00625 / 0.025 / 0.1
TG position	(5:7:4) / (7:7:2) / (9:7:0) *1
TPC step size	1dB in normal transmission 1dB / 2dB(4slots) / 2dB(7slots) after TG

*1: (x:y:z) depicts the compressed frame in which y slots transmission gap is located after x slots compressed data.

Table 1. Simulation parameters for TGL=7

Service	LCD (144kbps)
slots/frame	16
SIR	perfect estimation
fD Tslot	0.00625 / 0.025 / 0.1
TG position	(7:3:6) / (9:3:4) / (11:3:2) / (13:3:0)
TPC step size	1dB in normal transmission, 2dB(3slots) after TG

Table 2. Simulation parameters for TGL=3

Figure 2 and figure3 show required Eb/No for 8kbps and 144kbps for TGL=7 respectively. Table 3 shows that for TGL=3. For TGL=7, especially at fDTslot=0.025, (7:7:2) pattern requires the smallest Eb/No within the all patterns. For TGL=3, the difference between each pattern is not so big.

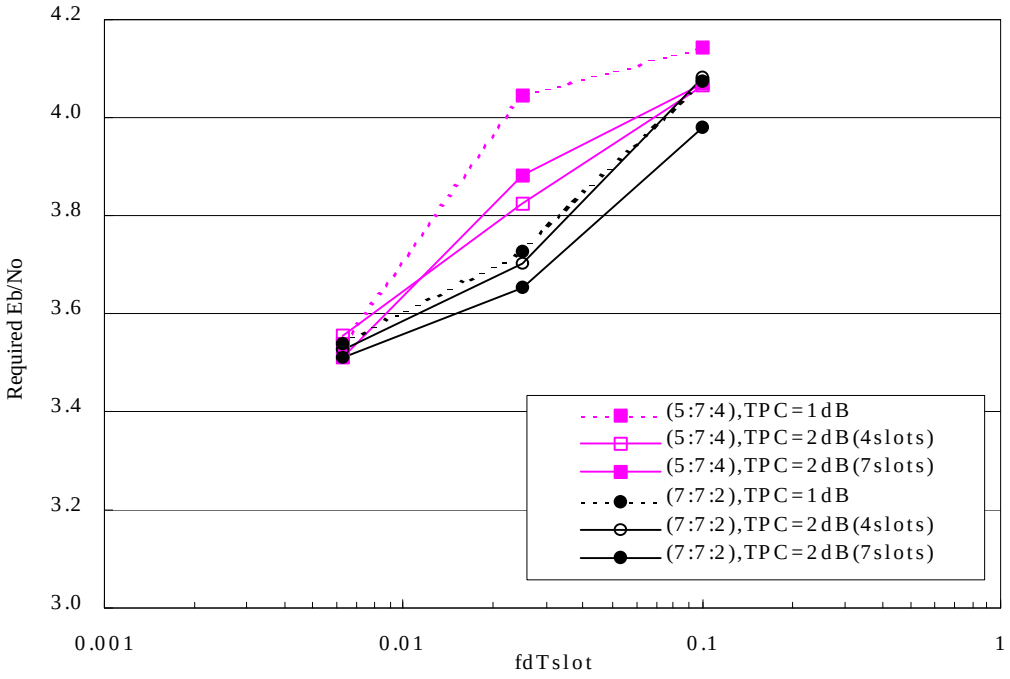


Figure 2 Required Eb/No for 8kbps.

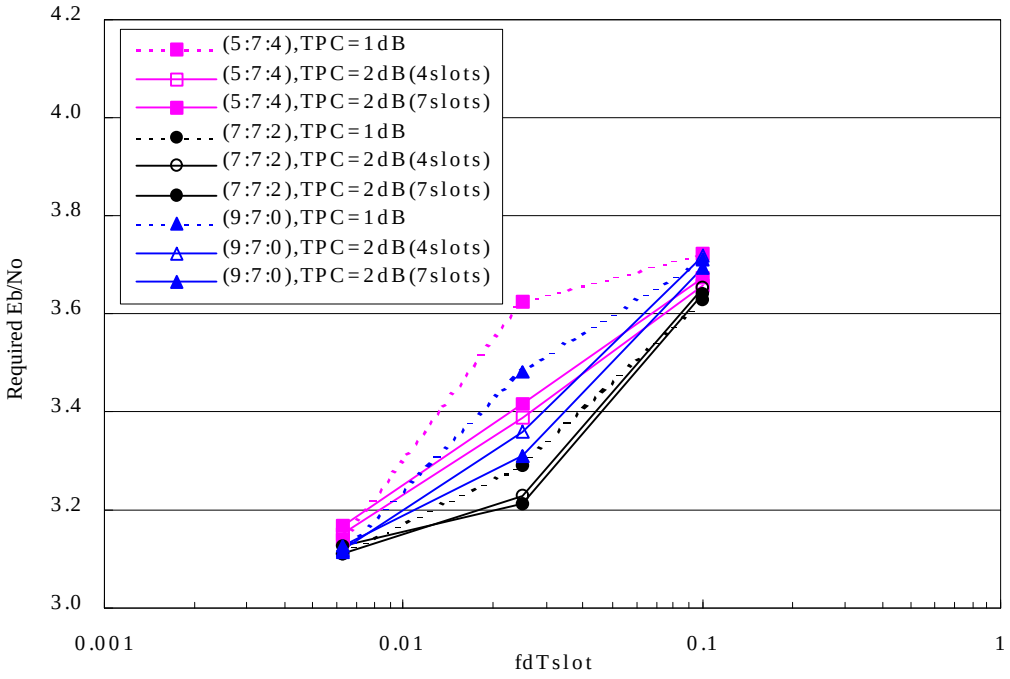


Figure 3 Required Eb/No for 144kbps.

	Required Eb/No @ BER=10-3			
fDTslot	(7:3:6)	(9:3:4)	(11:3:2)	(13:3:0)
0.00625	3.039	3.033	3.021	3.022
0.025	3.101	3.109	3.090	3.131
0.1	3.400	3.422	3.437	3.462

Table 3 Require Eb/Io for TGL=3

4. Conclusion

TG position for compressed mode should be decided considering effect of both TPC convergence and interleaving. In this document, we showed simulation results. From the results, we propose the following for single-frame fixed position.

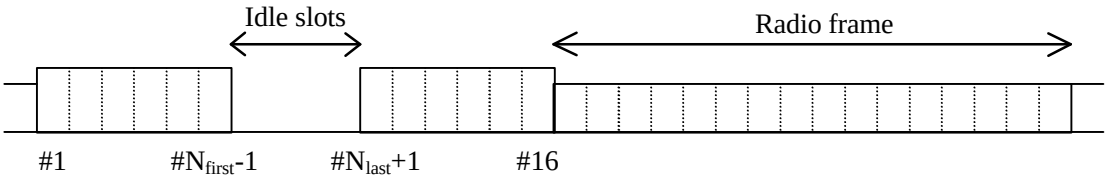
- For TGL=7, TG position shall be changed to be 7 slots after the beginning of compressed frame.
- For TGL=3, TG position shall be the center of the compressed frame.

[1] 3GPP RAN TS25.211 v1.1.0: "Multiplexing and channel coding (FDD)"

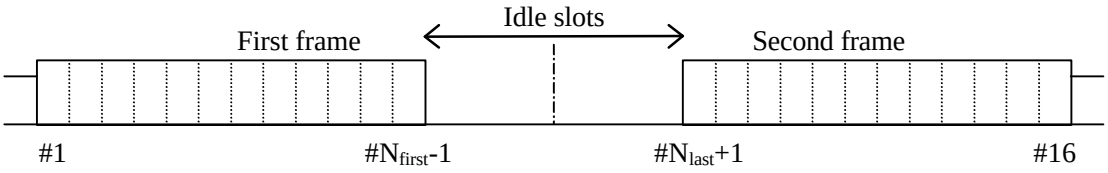
---------- Text Proposal ----------

4.4.3.1 Fixed transmission gap position

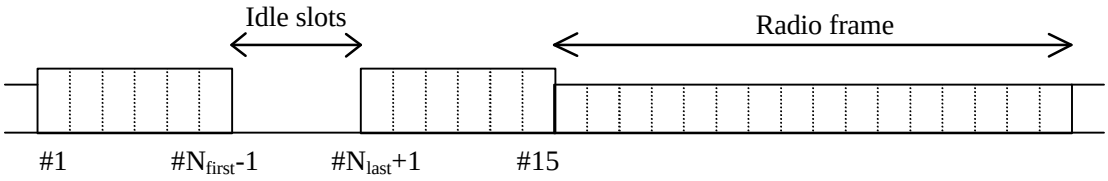
The transmission~~Transmission~~ gaps ~~lengths~~ can be placed onto~~on~~ fixed positions. When using single frame method, the fixed transmission gap is located within the compressed frame depending on the transmission gap length as shown in Figure 15 (1), When using double frame method, the fixed transmission gap is located on the center of two connected frames as shown in Figure 15 (2).~~The fixed transmission gap positions are located on the center of a frame or on the center of two connected frames as shown in Figure 15.~~ Table 1 shows the parameters for the fixed transmission gap position case.



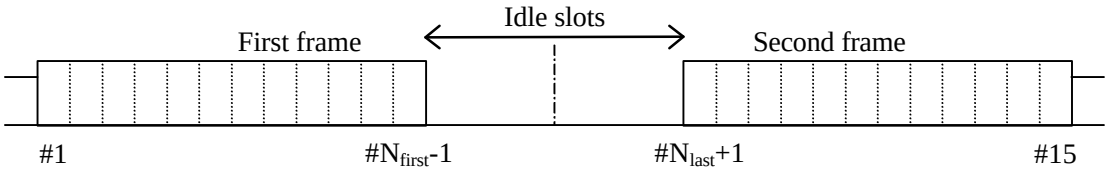
(1) Single-frame method



(2) Double-frame method



(1) Single-frame method



(2) Double-frame method

Figure 1: Fixed transmission gap lengths position

Table 1: Parameters for fixed transmission gap position

	~~Single-frame method~~		~~Double-frame method~~	
~~Transmission gap length (slot)~~	~~N_{first}~~	~~N_{last}~~	~~N_{first}~~	~~N_{last}~~
~~3~~	~~8~~	~~10~~	~~16 in first frame~~	~~2 in second frame~~
~~4~~	~~7~~	~~10~~	~~15 in first frame~~	~~2 in second frame~~
~~5~~	~~7~~	~~11~~	~~15 in first frame~~	~~3 in second frame~~
~~6~~	~~6~~	~~11~~	~~14 in first frame~~	~~3 in second frame~~
~~8~~	~~5~~	~~12~~	~~13 in first frame~~	~~4 in second frame~~
~~10~~	~~N.A.~~	~~N.A.~~	~~12 in first frame~~	~~5 in second frame~~
~~16~~	~~N.A.~~	~~N.A.~~	~~9 in first frame~~	~~8 in second frame~~

	Single-frame method		**Double-frame method**	
Transmission gap length (slot)	**N_{first}**	**N_{last}**	**N_{first}**	**N_{last}**
3	8	10	15 in first frame	2 in second frame
4	7	10	14 in first frame	2 in second frame

7	7	13	13 in first frame	4 in second frame
10	N.A.	N.A.	11 in first frame	5 in second frame
14	N.A.	N.A.	9 in first frame	7 in second frame