TSG-RAN Working Group1 meeting #7
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Hanover, Germany

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Agenda Item: **Ad Hoc 15**

Source: **NTT DoCoMo**

Title: **Proposal for new slot structure of 30 ksps DL DPCH**

Document for: **Decision**

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1. Introduction

In table 9 of 25.211 ver. 2.1.1, only a slot structure with 4 pilot symbols per slot is specified for 30 ksps DL DPCH. On the other hand, CPICH was introduced according to OHG recommendations. Considering use of CPICH for channel estimation and TPC, required number of dedicated pilot symbols can be decreased. This document shows the simulation results of optimal number of dedicated pilot symbols in case of using CPICH for channel estimation and TPC, and proposes to add a new slot structure with 2 pilot symbols per slot, for 30 ksps DL DPCH.

2. Proposal

This document proposes to add a new slot structure with 2 pilot symbols per slot, for 30 ksps DL DPCH. The grounds of this proposal are;

1) The required number of pilot symbols can be decreased because CPICH can be used to assist channel estimation and TPC. The required number is studied in section 3 of this document.
2) Data field can be expanded. DL 30 ksps DPCH may not be enough for AMR voice service and DCCH, without substantial puncturing. With this proposal, 2 additional symbols can be used for data. Thus, we can avoid performance degradation due to puncturing, or we can expand DCCH rate.
3) Node B or UE can have longer processing time and still keep 1 slot TPC delay. Additional time of 2 symbols can be assigned to propagation delay or internal processing in UE and/or node B.

Conventional slot structure with 4 pilot symbols should be kept in the specification. The reasons are mentioned in section 4.

3. Simulation for the optimal number of pilot symbols per slot

3.1. Simulation conditions

Common pilot power	Ior*-12[dB]
TCH max power	Ior-3[dB](30ksps)
Rx_Ior/(Rx_Ioc*^{2}+No)	0, 6[dB]
Channel estimation for data modulation	Channel vectors using Common pilots(CP) and Dedicated pilots (DP) respectively are calculated according to: DP: Averaging 2 dedicated pilot blocks (previous 1 block and following 1 block) CP: Averaging 20 symbols (previous 10 symbols and following 10 symbols) Combined channel vector that is used for data modulation is calculated by averaging channel vector using CP and the vector using DP weighted by those averaged number of chips
SIR estimation for power control	Channel vector for SIR estimation is calculated by averaging previous 13 common pilot symbols. S: DPCCH symbols are demodulated for S estimation

	(maximum ratio combining). S power is calculated by averaging the DPCCH symbols over successive slots. Forgetting factor of the exponential weighted averaging is set to 0.75. I: I power of each path is calculated by averaging the power of difference between vector of each CP symbol and channel vector (Forgetting factor of the averaging is 0.9). Combined I power is calculated as the sum of I powers of each path weighted by the power of channel vector.
Channel profile	Vehicular-A(6paths)
Number of fingers	4fingers
Rx diversity	OFF
UL TPC command error	4%
Doppler frequency	5, 240[Hz]
Required quality	FER=2 %
Voice activity	50 %

*Rx_Ior : The total power density of the base station communicating with the mobile, measured at the mobile.
*[2] Rx_Ioc: The interference power density at a mobile due to all the base stations not communicating with the mobile.

3.2. Frame format

Chip rate	3.84Mcps
Symbol rate	30ksps(SF=128)
Information bit rate	14.6kbps
1st Interleaving	20ms modified MIL
Information bits	292bit/20ms
Coding	CC(R=1/3, K=9) (292+8)x3=900
Rate matching	900>1140(PLT0s) 900>1080(PLT1s) 900>1020(PLT2s) 900>960(PLT3s) 900>900(PLT4s)
The number of symbols for PLT/TPC/TFCI/DATA per slot	0/1/0/19 1/1/0/18 2/1/0/17 3/1/0/16

3.3. Simulation results

Figure 1 shows the simulation results in case of Rx_Ior/(Rx_Ioc+No) =0 and 6[dB]. Vertical line is the ratio of Tx_Ic and Tx_Ior. Tx_Ic denotes the average energy per chip for a particular physical channel, measured at the base station. Tx_Ior denotes the total power density of the base station communicating with the mobile, measured at the base station. Therefore, the vertical line means amount of power allocation to a particular physical channel in the base station. Inverse value of this is in proportion to DL capacity. Voice activity is taken into account for calculation of Tx_Ic.
As you can see, optimal number of pilot symbols is 1 symbol. However, there is not so big difference between the number of pilot symbols of 1 and 2.
Considering antenna verification accuracy of Tx diversity and gain of Tx diversity, **2 pilot symbols should be selected**.

4. Usage of two kinds of slot structure for 30 ksps DL DPCH

If this proposal is accepted, there are two kinds of slot structure for 30 ksps DL DPCH, new slot structure with 2pilot symbols and conventional one with 4 pilot symbols. Conventional slot structure can be used in case of not using CPICH for channel estimation and TPC, e.g. use of array antenna. However, new slot structure can be also used in case of not using CPICH if node B can use power offset between pilot symbols and data symbols. It is estimated that the power offset of more than 3 dB is needed for the new slot structure compared with the conventional one in case of not using CPICH. In large-scale node B, this power offset seems not to have a serious impact on peak-to-average ratio of the amplifier due to multiplexing of many physical channels and random frame timing. In small-sized node B, however, this power offset is not preferable for the amplifier. Below is summary of the usage of two kinds of slot structures.
(1) In case of using CPICH for channel estimation and TPC: slot structure with 2 pilot symbols

(2) In case of not using CPICH for channel estimation and TPC, and in large-scale node B: slot structure with 2 pilot symbols
(3) In case of not using CPICH for channel estimation and TPC, and in small-sized node B: slot structure with 4 pilot symbols

Conclusion

In this document, it was proposed to add new slot structure with 2 pilot symbols per slot for 30 ksps DL DPCH considering use of CPICH for channel estimation and TPC. Conventional slot structure with 4 pilot symbols per slot is kept as it is. Text proposal for this proposal is described below.

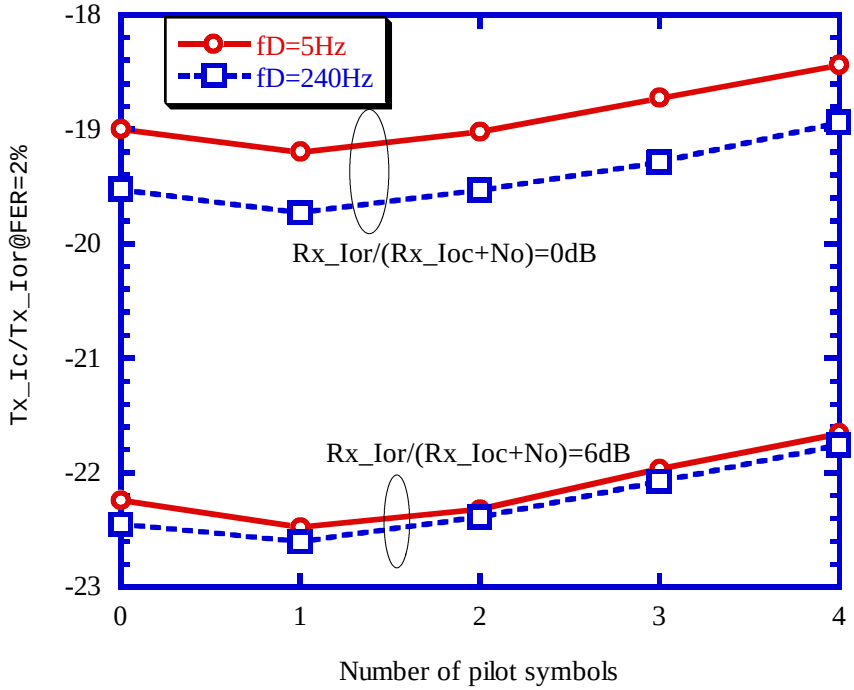

Figure 1 Simulation results

Text proposal

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Table 1: DPDCH and DPCCH fields

Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/Frame			Bits/ Slot	DPDCH Bits/Slot		DPCCH Bits/Slot		
			DPDCH	DPCCH	TOT		N_{Data1}	N_{Data2}	N_{TFCI}	N_{TPC}	N_{Pilot}
15	7.5	512	60	90	150	10	2	2	0	2	4
15	7.5	512	30	120	150	10	0	2	2	2	4
30	15	256	150	150	300	20	2	8	0	2	8
30	15	256	120	180	300	20	0	8	2	2	8
60	30	128	510	90	600	40	10	24	0	2	4
60	30	128	480	120	600	40	8	24	2	2	4
60	30	128	450	150	600	40	6	24	0	2	8
60	30	128	420	180	600	40	4	24	2	2	8
120	60	64	900	300	1200	80	4	56	8*	4	8
240	120	32	2100	300	2400	160	20	120	8*	4	8
480	240	16	4320	480	4800	320	48	240	8*	8	16
960	480	8	9120	480	9600	640	112	496	8*	8	16
1920	960	4	18720	480	19200	1280	240	1008	8*	8	16