Agenda item   :
Source   : CSELT[1]
Title   : **Impact of the number of pilot bits on the uplink**
                    performance
Document for :

In this document we consider the uplink performance as a function of the number of pilot bits transmitted on the DPCCH. The purpose of this study is to assess the degradation in terms of Eb/No (Eb=Energy per information bit, No=noise power spectral density) when one or more pilot bits are replaced with the control bits for the feedback field (FBI).

The parameters of the simulated radio chain are listed in Tab. 1. The 8 kbit/s voice service has been considered.

Parameter	Uplink
...ce	Voice 8 kbit/s
...ber of information bits per frame	80
...ber of CRC and tail bits	8+8
...olutional coding	rate 1/3, constraint length 9
...nomial generators (octal)	557 663 711
...ual repetition	9 -> 10
...eaving	20 ms (32x20 bit)
...er frame	16
...ber of bits in the DPCCH (pilot /TPC/TFI)	8-X/2/X X=0, 2, 3, 4
...ber of bits in the DPDCH per each slot	20
...ading factor (DPDCH)	128
...essing gain (DPDCH)	512
...ading factor (DPCCH)	256
...CH power with respect to DPDCH [dB]	-3
...lation	QPSK
...Bandwidth	4.096 MHz
...ing filter	Raised cosine (roll-off 0.22)
...er amplifier	Ideal
...ror probability on TPC bits	5%
...d trip delay	1 slot (0.625 ms)
...er control dynamic	unlimited
...er control step	± 0.5 dB
...er frequency	2 GHz
...agation channel	Vehicular A
...le Speed	25, 120 km/h
...er Rake's fingers	3
...nna diversity	yes
...nel phase estimation	Linear interpolation on two consecutive time slots

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Tab. 1 Parameters of the simulated radio chain (8 kbit/s voice)

In Fig. 1 the system working point (in terms of Eb/No at BER=10^{-3}) as a function of the number of pilot bits is given. The Eb/No ratio is calculated taking into account all the transmission overheads (Pilot, TPC, TFI, tail bits, coding, rate matching, etc.) and the possible offset introduced by the closed loop power control on the received power.

Fig. 1   System working point as a function of the number of pilot bits (uplink, Vehicular channel A)

From the figure it comes out that a little degradation (less than 0.2 dB) is introduced when the number of pilot bits is reduced from 6 to 5. Therefore the idea of stealing one pilot bit to transmit the FBI field seems to be feasible at least in terms of performance degradation.