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Title	**FEC Parameterization for Data Transport**
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Re:	This document is intended for discussion on PHY open issues regarding parameters of the FEC mandatory schemes for burst communication.
Abstract	See above
Purpose	See above
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FEC Parameterization for Data Transport

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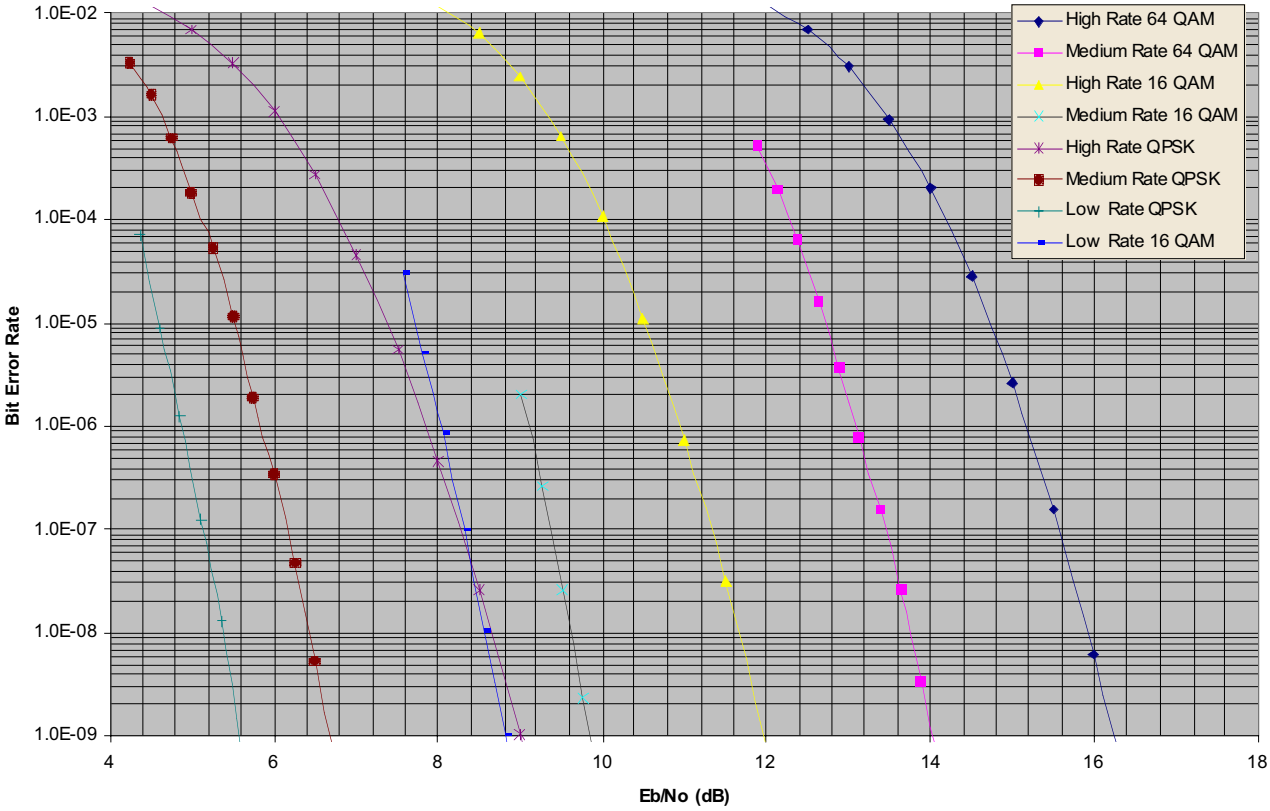
This paper presents 2 typical example of data transport using the current mandatory FEC schemes for burst communication as described in the current draft of 802.16.1. The main issue is to generate similar flexibility to the FEC scheme used in Mode A that is based on a RS code concatenated with a convolutional code (K=7) with various puncturing options. We will take into account the fact that 3 modulations schemes are possible (QPSK, 16QAM and 64QAM). A modulation choice coupled with a specific FEC choice defines a PHY mode that allows operation at a specific C/N and specific spectrum efficiency.

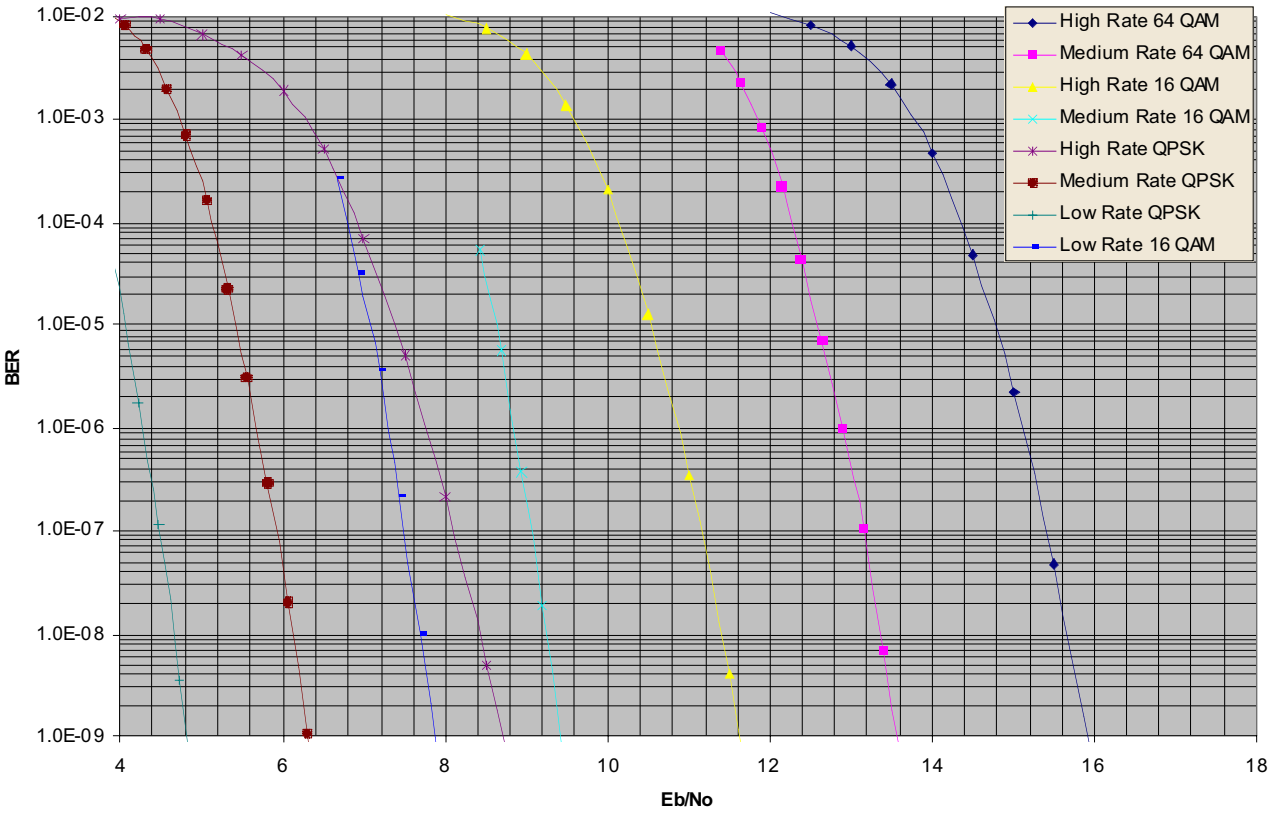
53 byte packet example

Mode	Modulation	Inner Code	Outer Code (R)	Code Rate	Bits/s/Hz	Req. C/N (dB)
1	64 QAM	None	10	.84	5.05	23.22
2	64 QAM	(9,8)	12	.72	4.35	20.38
3	16 QAM	None	10	.84	3.37	17.25
4	16 QAM	(9,8)	14	.70	2.81	14.32
5	16 QAM	(24,16)	21	.46	1.86	11.49
6	QPSK	None	7	.88	1.76	11.46
7	QPSK	(9,8)	10	.75	1.50	8.33
8	QPSK	(24,16)	21	.48	0.95	5.40


1.0E-02
1.0E-03
1.0E-04
1.0E-05
1.0E-06
1.0E-07
1.0E-08
1.0E-09
Bit Error Rate
4
6
8
10
12
14
16
18
Eb/No (dB)
High Rate 64 QAM
Medium Rate 64 QAM
High Rate 16 QAM
Medium Rate 16 QAM
High Rate QPSK
Medium Rate QPSK
Low Rate QPSK
Low Rate 16 QAM

188 byte packet example

Mode	Modulation	Inner Code	Outer Code (R)	Code Rate	Bits/s/Hz	Req. C/N (dB)
1	64 QAM	None	14	.93	5.58	23.40
2	64 QAM	(9,8)	18	.81	4.86	20.47
3	16 QAM	None	14	.93	3.72	17.30
4	16 QAM	(9,8)	20	.80	3.20	14.46
5	16 QAM	(24,16)	28	.57	2.28	11.37
6	QPSK	None	9	.95	1.90	11.45
7	QPSK	(9,8)	14	.83	1.66	8.48
8	QPSK	(24,16)	26	.59	1.17	5.48


1.0E-02
1.0E-03
1.0E-04
1.0E-05
1.0E-06
1.0E-07
1.0E-08
1.0E-09
BER
4
6
8
10
12
14
16
18
Eb/No
High Rate 64 QAM
Medium Rate 64 QAM
High Rate 16 QAM
Medium Rate 16 QAM
High Rate QPSK
Medium Rate QPSK
Low Rate QPSK
Low Rate 16 QAM

Analysis and Recommendations

Using the 3 inner code alternatives (none, (9,8) and (24,16)) we can easily generate up to 7 useful “PHY modes” with about 3 dB steps in C/N spanning spectrum efficiencies between 1 to 5 bps/Hz using all 3 modulation schemes. Note that the usefulness of a low rate 16QAM versus a high rate QPSK depends on other system impairments such as the actual amplifier back-off . In general it seems that the (24,16) code is useful for the case where a robust signal is required (i.e., extended range) mainly coupled with QPSK or in the case of control channel information (see relevant paper in this session). Note that the results in both examples do not take into account additional back-off of higher order modulation schemes. This should be taken into account in the system gain analysis.