

Metrics and Techniques for Evaluation of FEC Systems

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Purpose:

Assist the IEEE 802.16 Working Group in assessing candidate FEC systems by providing recommendations on pertinent metrics and techniques.

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Metrics and Techniques for Evaluation of FEC Systems

A Presentation of IEEE 802.16.1pc-00/25

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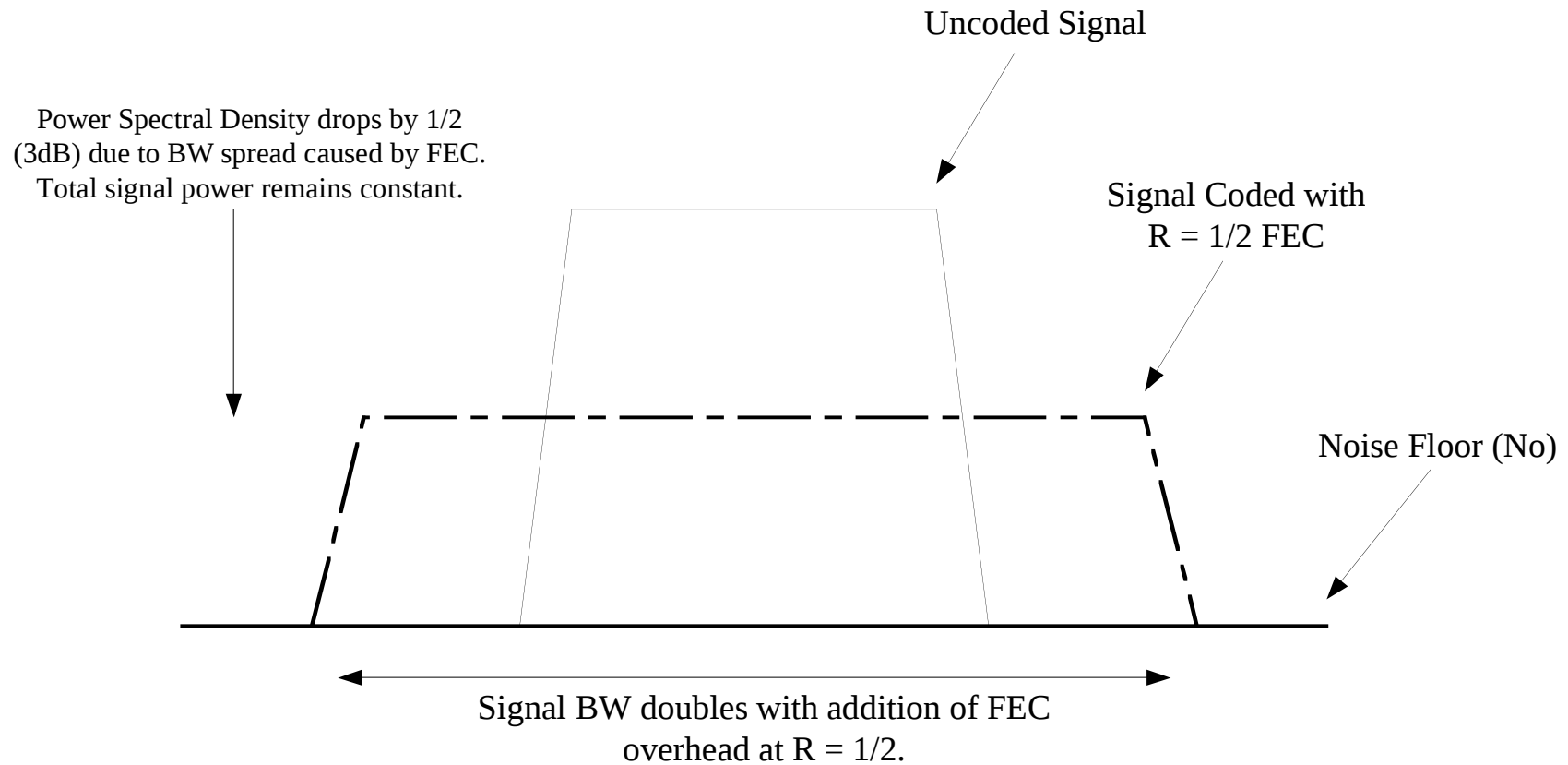
FEC Evaluation Metrics

- Error Performance
 - BER vs. E_b/N_0 curves.
 - Block or Packet Error Rate
 - Coding Gain - Distance from Coded to Uncoded
 - Distance from Channel Capacity
- Latency
 - 2x Interleaver or Block size.
 - Processing delay, additional buffering.
- Complexity
 - Gate count, Memory requirements.
 - “Gates are cheap”, may not be driving concern.

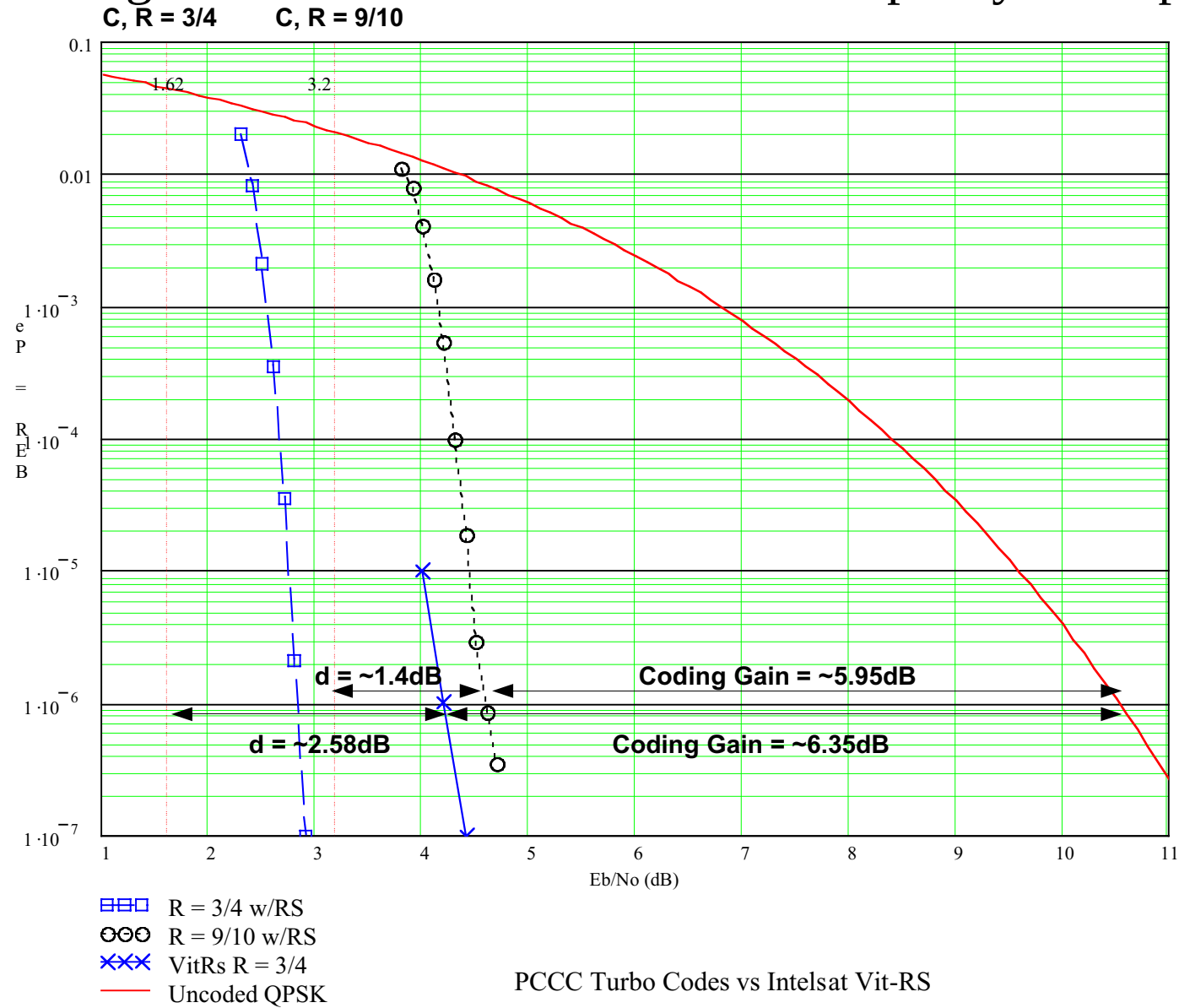
FEC Error Performance Metrics

- BER vs E_b/N_0
 - Best basis for Apples-Apples comparison.
 - Avoid mixing SNR, CNR, E_b/N_0 , BER, PER, etc.
 - Deals only with Power ratios, not bandwidth.
 - Focus is on payload information, not implementation.
- Coding Gain
 - Deals only with Power Efficiency, not BW.
- Distance from Channel Capacity
 - Measure of Channel Efficiency, rather than Power Efficiency (accounts for both power and bandwidth).

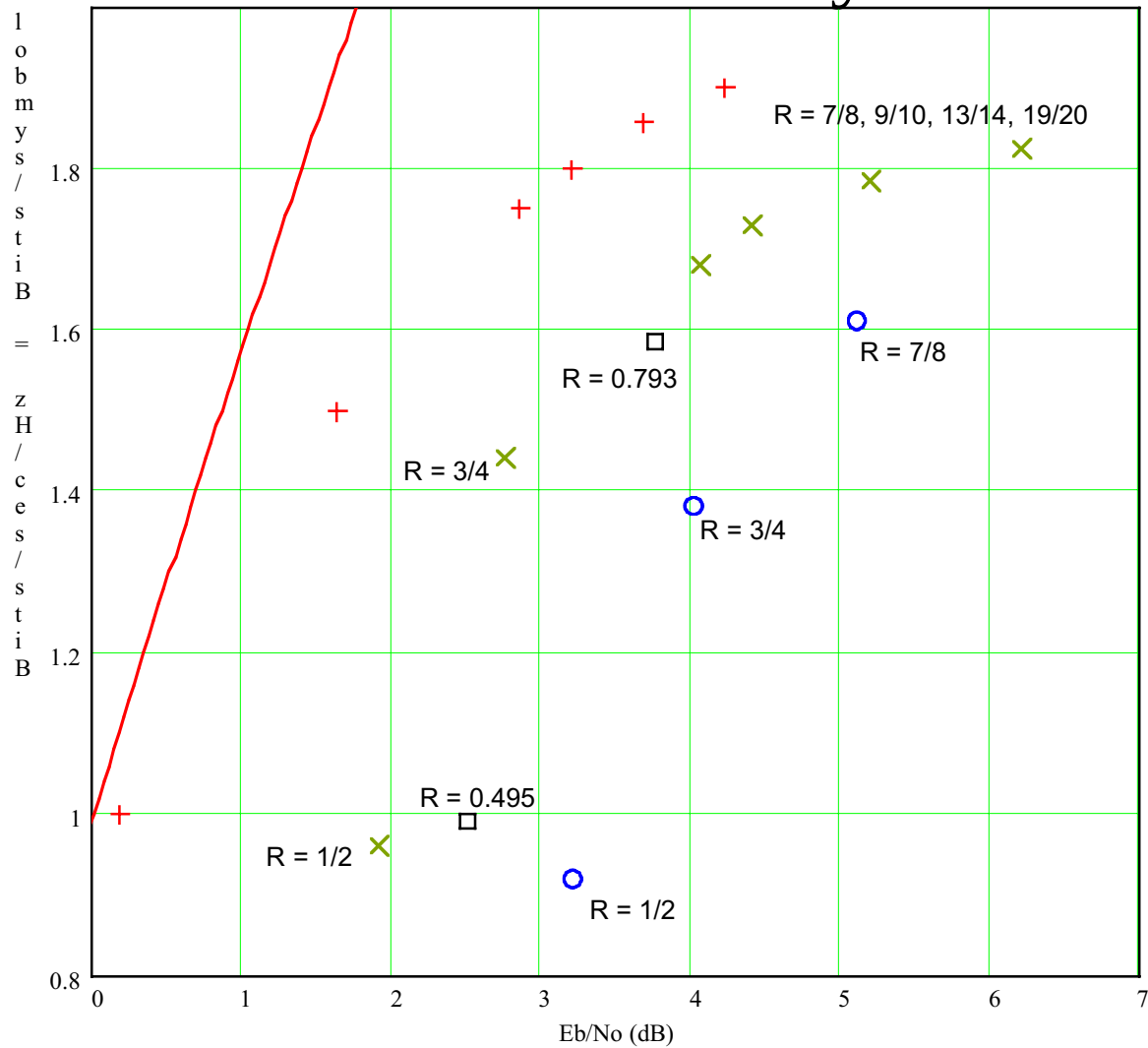
FEC Effect on Signal Spectrum



Coding Gain and Distance to Channel Capacity Example



Bandwidth Efficiency Plane



- Channel Capacity (CICO, QPSK)
- +++ Channel Capacity (BICO, QPSK)
- ooo IDR/IBS Vit-RS
- AHA TPC (+0.5db)
- xxx PCCC Turbo Code w/RS

Indicated are the power requirements and BW efficiencies for various codes using QPSK modulation to achieve $P_e = 10E-5$.

Tabular Comparison of Vit-RS and PCCC Turbo Code

All Figures for $P_e = 10E-6$.

Code	Viterbi-RS	PCCC TC
Code Rate	—	9/10
Coding Gain	6.35dB	5.95dB
Distance to C	2.58dB	1.4dB
E_b/N_o at $P_e = 10^{-6}$	4.2dB	4.6dB
Decoder Complexity	70k gates + 10kbit memory	250k gates + 16kbit memory
Latency ($T_x + R_x$)	20kbits	22kbits