TSG-RAN Working Group 1(Radio) meeting #8 *TSGR1#8(99) f48*
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Source : LGIC

Title : Simulation Results of Convolutional Code Puncturing with Initial Offset of '1'

Document for : Decision

1 Introduction

In WG1 #7 in Hannover, LGIC proposed to change the current initial offset value of rate matching algorithm for convolutional code[1]. It was considered interesting by AdHoc 5 members and AdHoc 5 requested more simulation data about this proposal[2].
In this contribution, we will provide some additional simulation data which show the effects of changing the initial offset to '1' for convolutional code, both in downlink and uplink.
From the simulation results, we cannot find any harmful effects of changed initial offset, and therefore we suggest that the initial offset value for convolutional code should be replaced as proposed.

2 Simulation Environments.

The environments of simulation are as follows.

- Block sizes: 160 for downlink and uplink.
- Encoder rate : 1/3 and 1/2 for downlink, 1/3 for uplink.
- Puncturing rates for downlink : 20 %, 15%, 10% 5%, 16.6666%(worst case of current initial offset).
- Amount of puncturing for uplink : 96, 72, 56, 24.
- trellis termination by '8' zero tail bits.
- Decoding algorithm: Viterbi Algorithm with full path memory.
- Number of frame errors: greater than 100.
- Column number of 1st MIL for uplink : 8 (80ms TTI).
- Channel model: static AWGN environements.
- $a = 2$ in the rate matching pattern determination algorithm.
- $a = 2$ for '557' arm and $a = 1$ for '663' arm in case of Nortel's method in downlink.
- $e_{ini} = 1$ for proposed initial offset in the downlink.
- $e_{ini} = N$ for current initial offset in the downlink.
- $e_{ini} = (2 * s(k) * y + 1) \bmod 2 * N$ for proposed initial offset in the uplink.
- $e_{ini} = (2 * s(k) * y + N) \bmod 2 * N \;\; if\,(e_{ini} = 0) \;\; e_{ini} = 2 * N$ for current initial offset in the uplink.

As you can see in the above, initial offset value for uplink can be described more simply in the case of our proposal because we can remove the additional if statement which is inevitable for the current initial offset.

3 Simulation Results

According to the environments stated above, LGIC have performed some simulations. From the simulation results, we cannot find any harmful effect of initial offset of '1' both in the uplink and downlink. Additionally, we can prevent the worst puncturing pattern which is inevitable for current initial offset for the downlink. For uplink, we can simplify the calculation process of initial offset by proposed method without any harmful effects to the performance, compared with current initial offset.

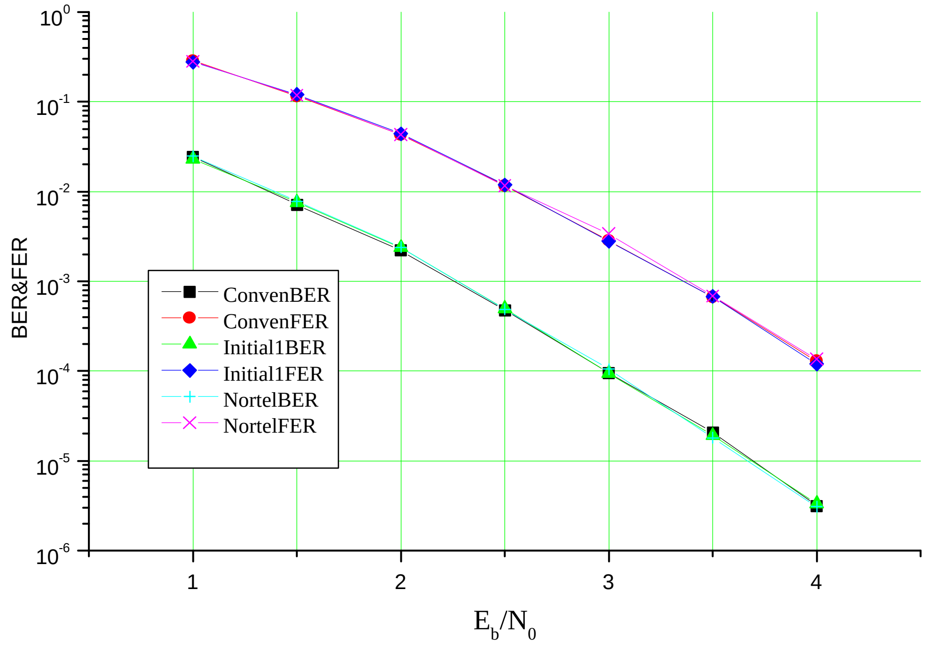

Figure 1. 160 bit frame length, 20 % puncturing for 1/3 rate convolutional code (downlink)

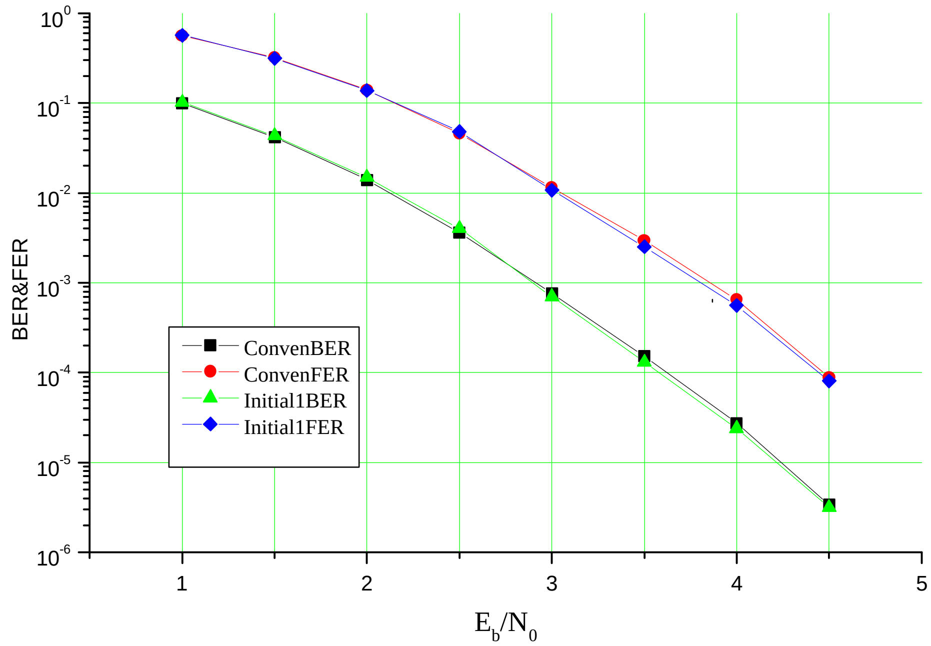

Figure 2. 160 bit frame length, 20 % puncturing for 1/2 rate convolutional code (downlink)

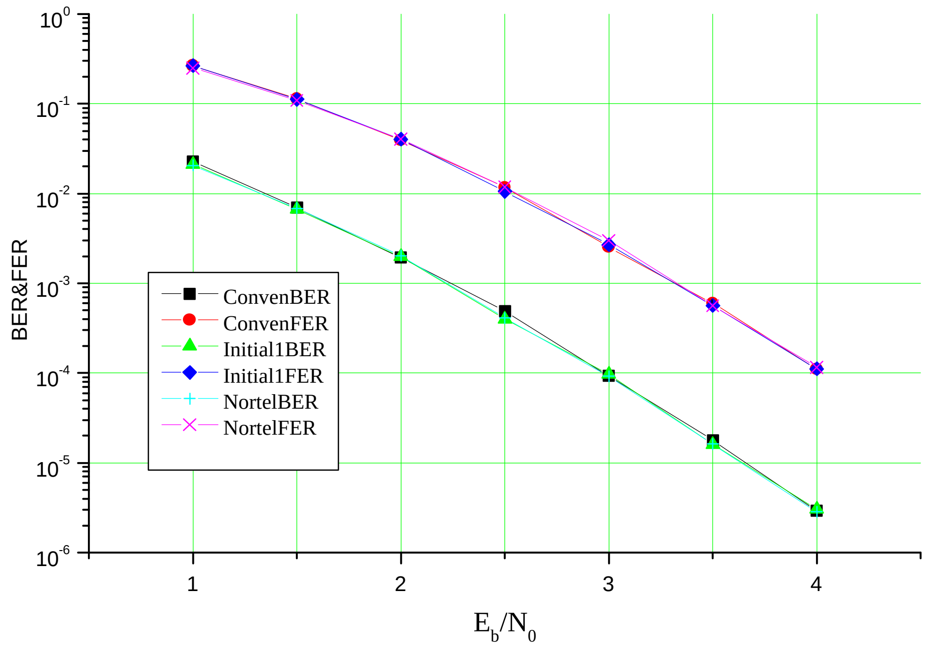

Figure 3. 160 bit frame length, 15 % puncturing for 1/3 rate convolutional code (downlink)

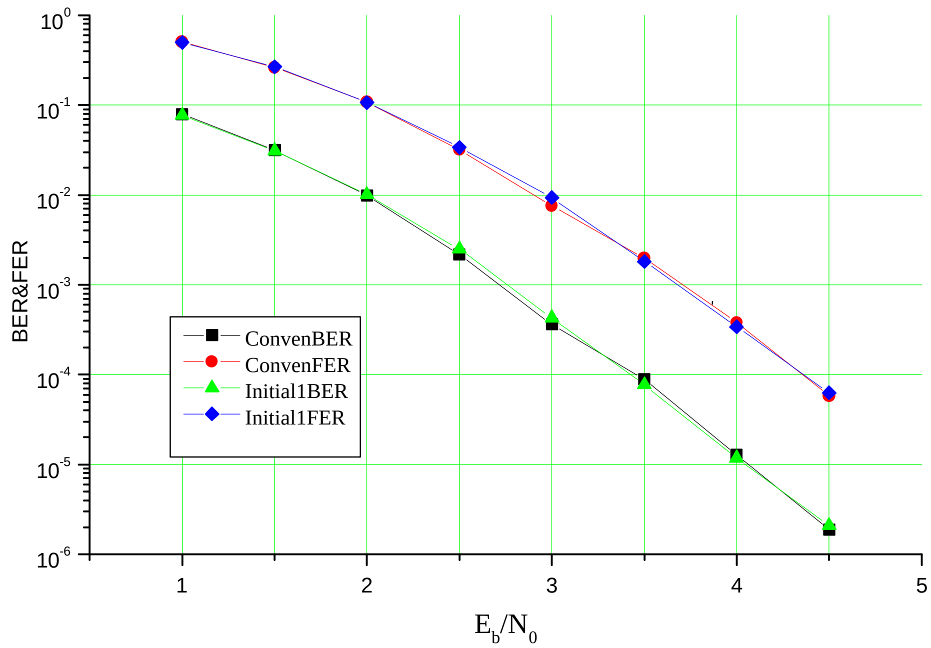

Figure 4. 160 bit frame length, 15 % puncturing for 1/2 rate convolutional code (downlink)

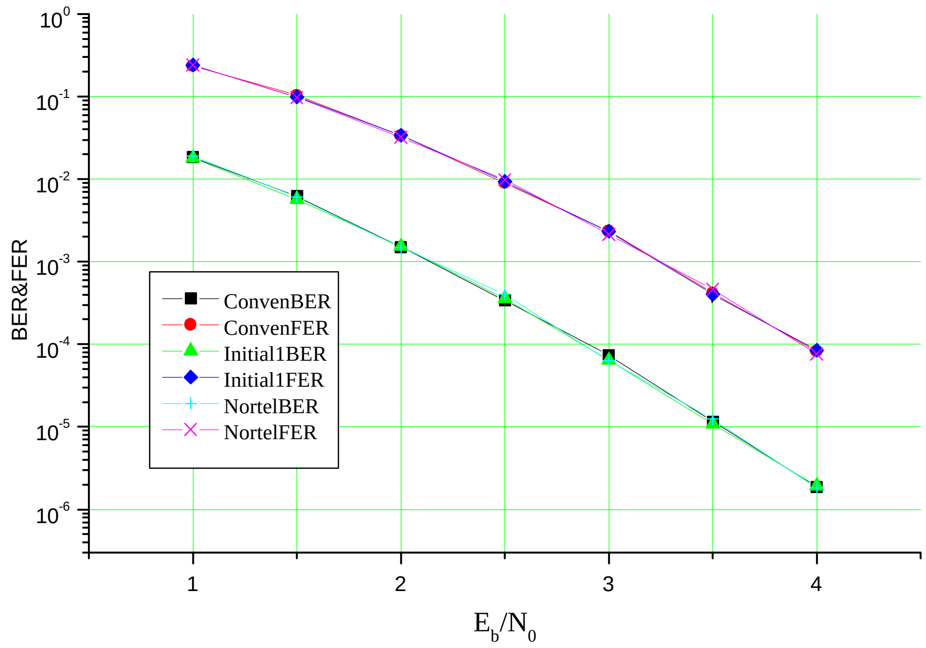

Figure 5. 160 bit frame length, 10 % puncturing for 1/3 rate convolutional code (downlink)

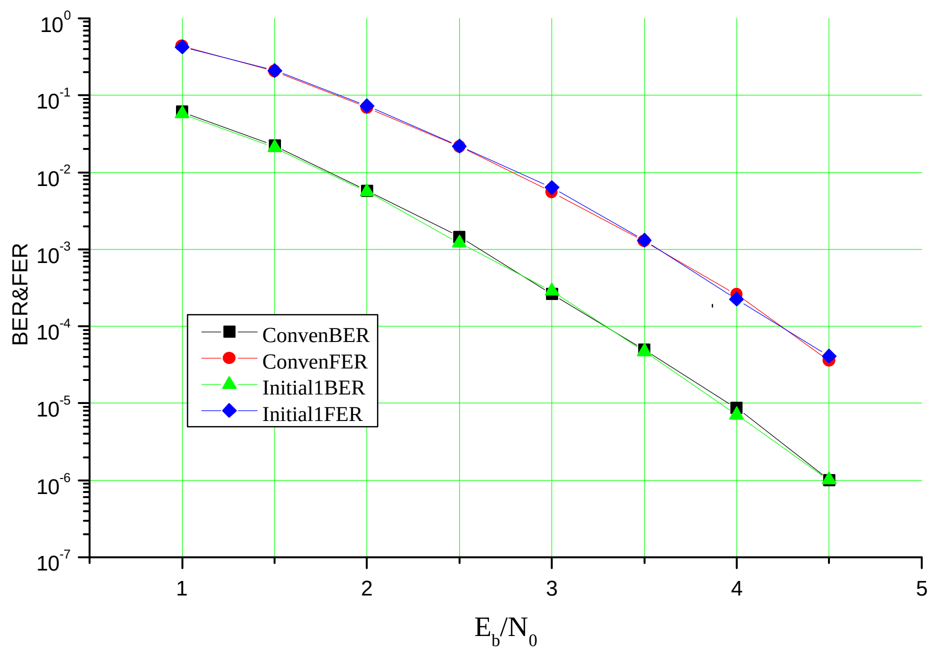

Figure 6. 160 bit frame length, 10 % puncturing for 1/2 rate convolutional code (downlink)

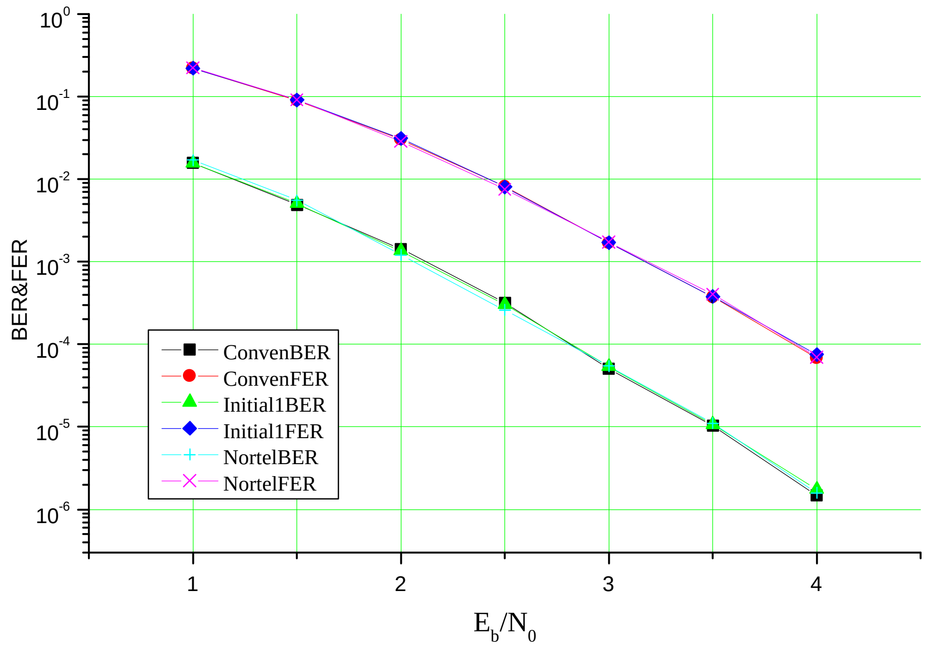

Figure 7. 160 bit frame length, 5 % puncturing for 1/3 rate convolutional code (downlink)

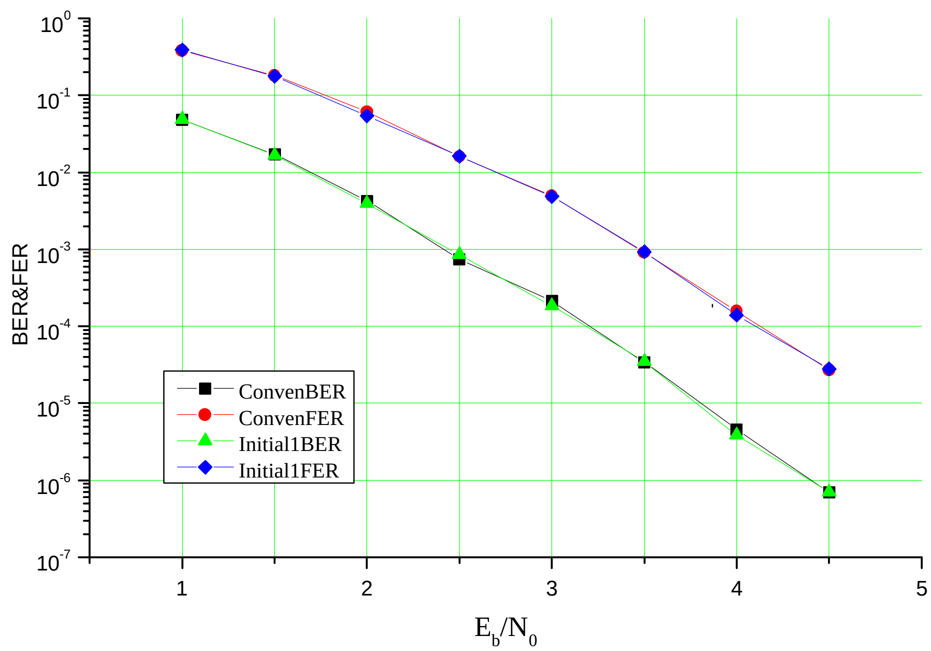

Figure 8. 160 bit frame length, 5 % puncturing for 1/2 rate convolutional code (downlink)

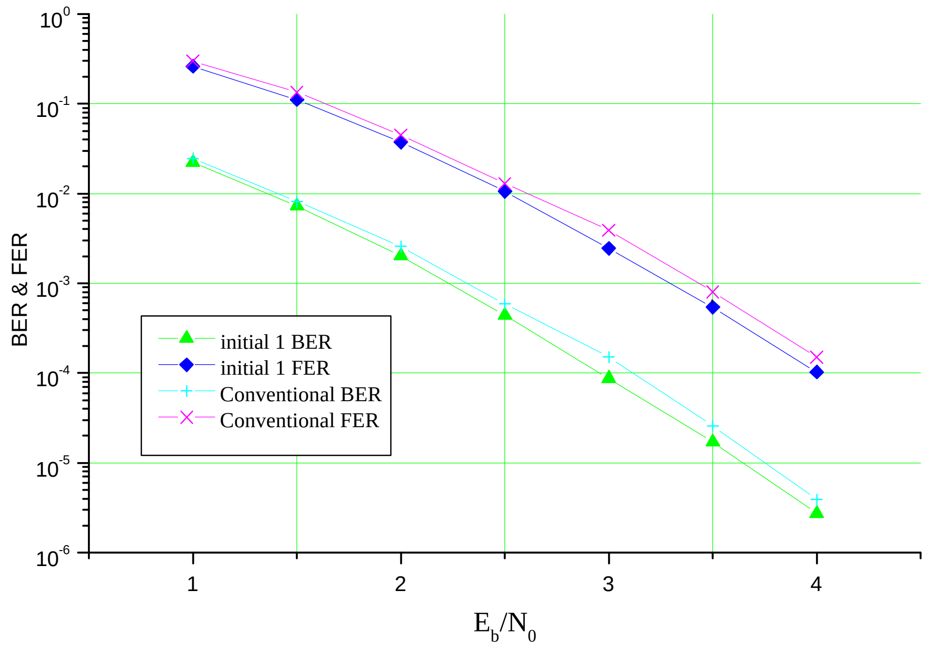

Figure 9. 160 bit frame length, 84 bit puncturing for 1/3 rate convolutional code (downlink)

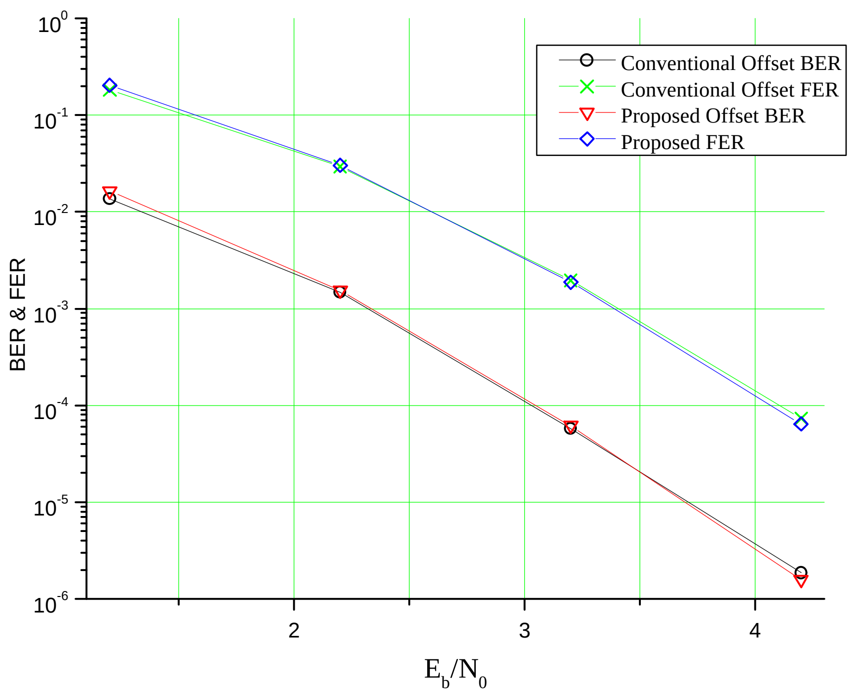

Figure 10. 160 bit frame length, 96 bit puncturing for 1/3 rate convolutional code (uplink)

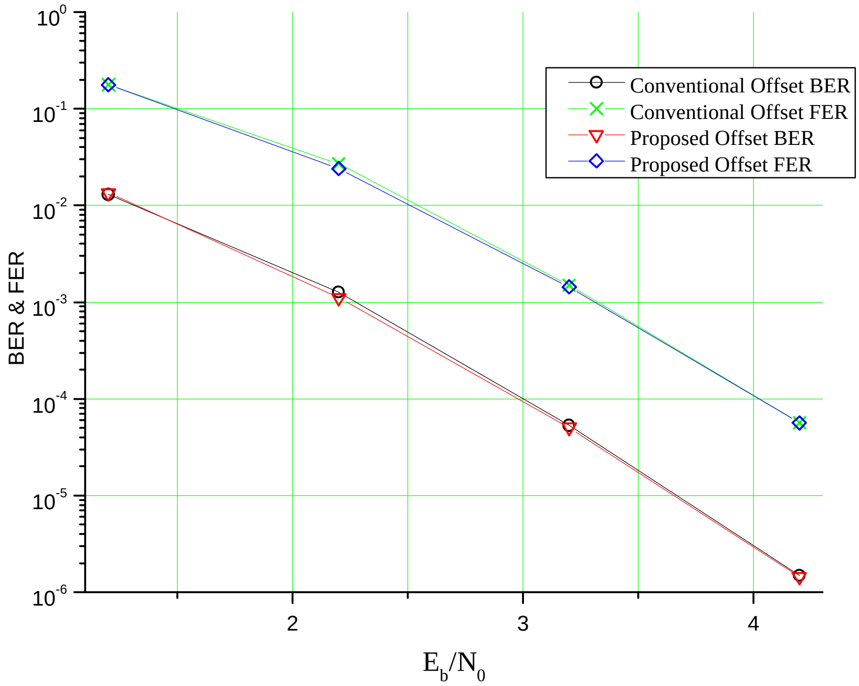

Figure 11. 160 bit frame length, 72 bit puncturing for 1/3 rate convolutional code (uplink)

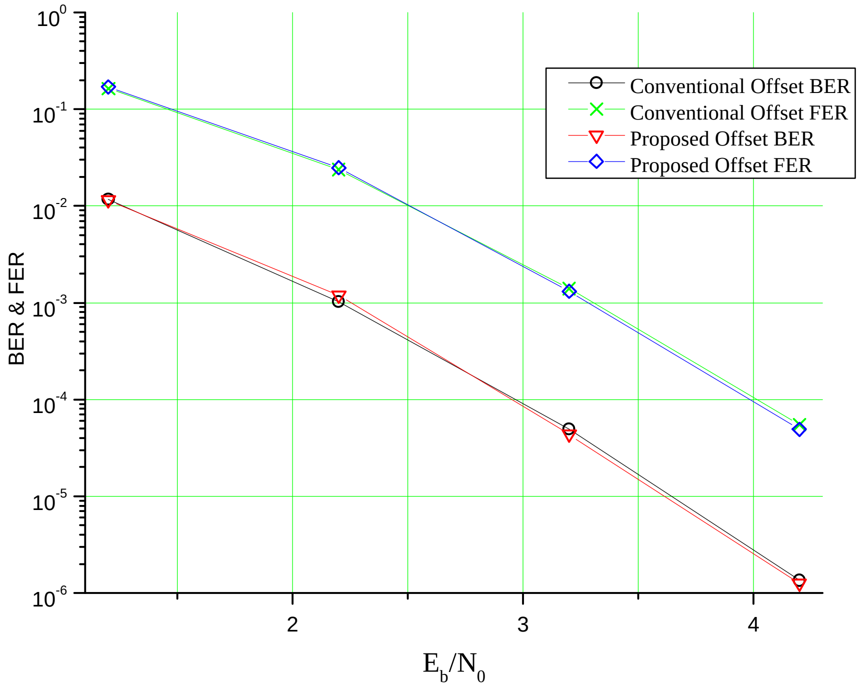

Figure 12. 160 bit frame length, 56 bit puncturing for 1/3 rate convolutional code (uplink)

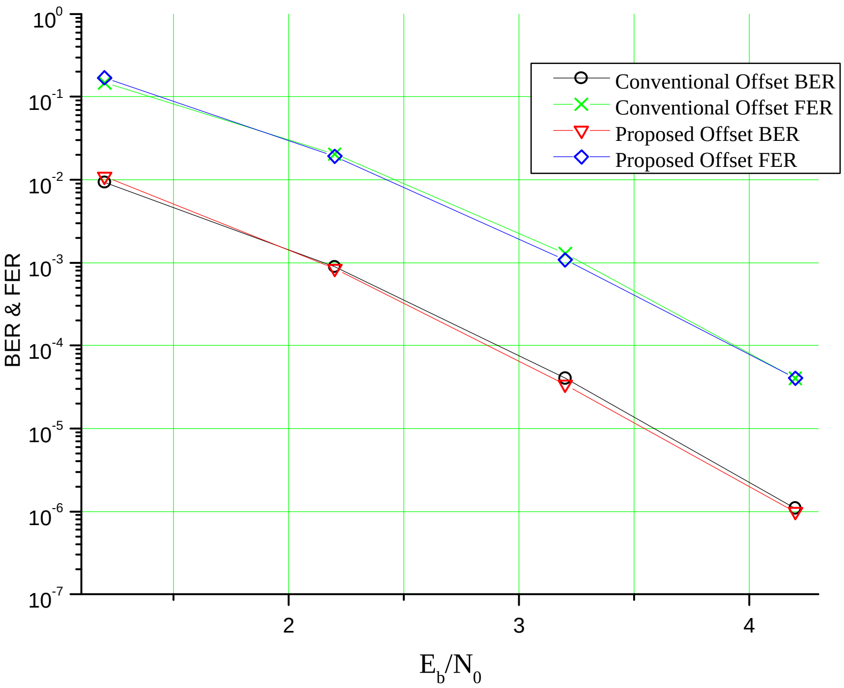

Figure 13. 160 bit frame length, 24 bit puncturing for 1/3 rate convolutional code (uplink)

4 Conclusion

According to the requests of AdHoc 5 in the WG1 #7, LGIC have performed some additional simulations to examine the effects of changing the initial offset value both in the uplink and downlink. We cannot find any harmful effects of proposed initial offset both in the downklink and uplink. Moreover, some additional advantage can be provided by the proposed offset in terms of complexity and performance. Therefore we strongly recommend that current initial offset value for convolutional code should be replaced with proposed initial offset.

5 Reference

[1] 3GPP TSG RAN WG1 R1-99b89 “Simulation Results of Puncturing Algorithms for Turbo Code”, Samsung & LGIC.

[2] 3GPP TSG RAN WG1 R1-99d46 “Report on AH5 Meeting of 31 August 1999”, AdHoc 5 Chairman.