

Burst CRC and FEC block CRC for 16m uplink and downlink data channel

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Venue:

Re : TGM SDD: Other (Reply to Call for comments (IEEE 80216m-08/040) on SDD (IEEE 80216m-08/003r5)

Base Contribution:

IEEE C802.16m-08/1386

Purpose:

To discuss and adopt the proposed text in the revision of the 802.16m SDD

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How many FEC blocks per burst?

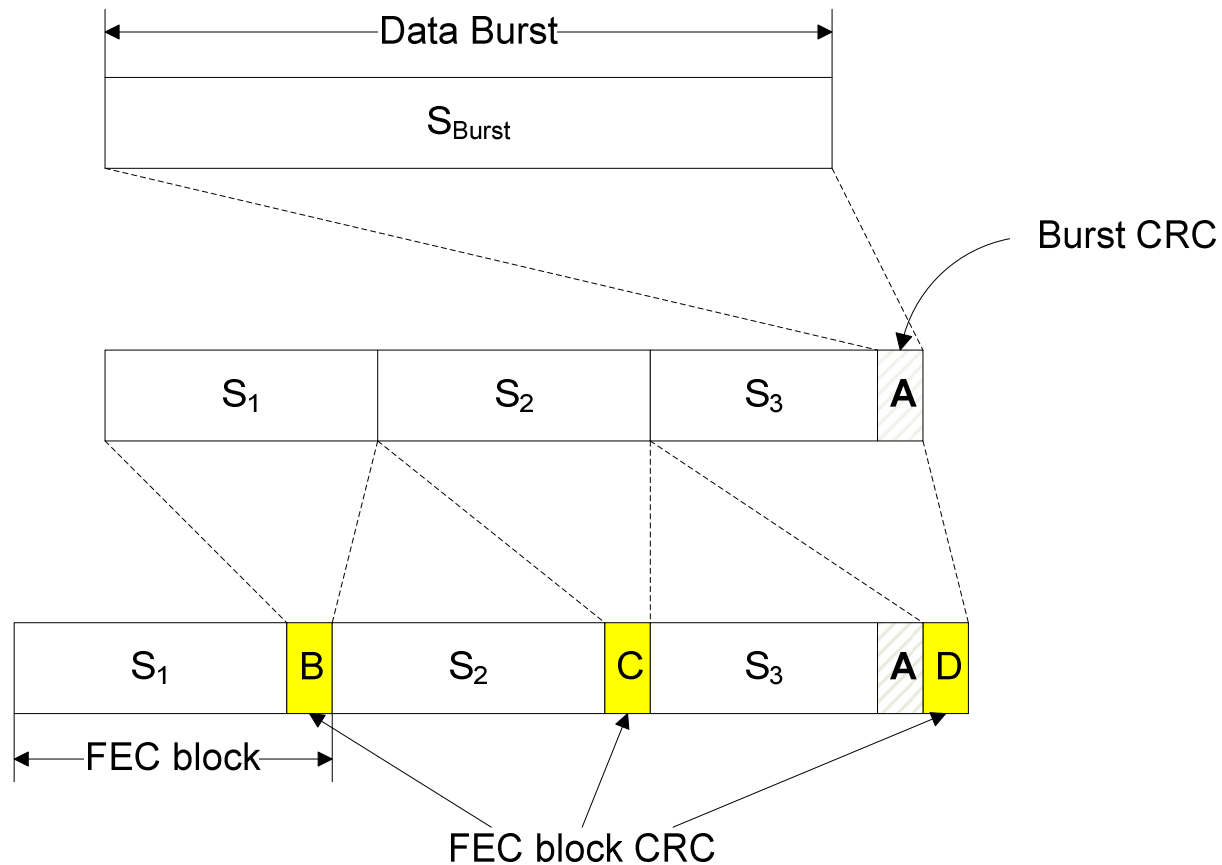
- Maximum FEC block size – 4800 bits
- Burst size depends on the data rate

Number of FEC blocks							
Data rate (Mbps)	10	20	50	100	200	500	1000
Burst size	6,250	12,500	31,250	62,500	125,000	312,500	625,000
Number of FEC blocks	2	3	7	14	27	66	131

- It is impractical to design the turbo decoder assuming 8 iterations per FEC block
- Sharing turbo decoding iterations among FEC blocks is important in reducing turbo decoder complexity
- Fast and accurate early stopping of turbo decoding iterations is critical

Burst CRC and FEC block CRC (1)

- Add FEC block CRC per FEC block in addition to Burst CRC
 - 16-bit FEC block CRC
 - 24-bit burst CRC

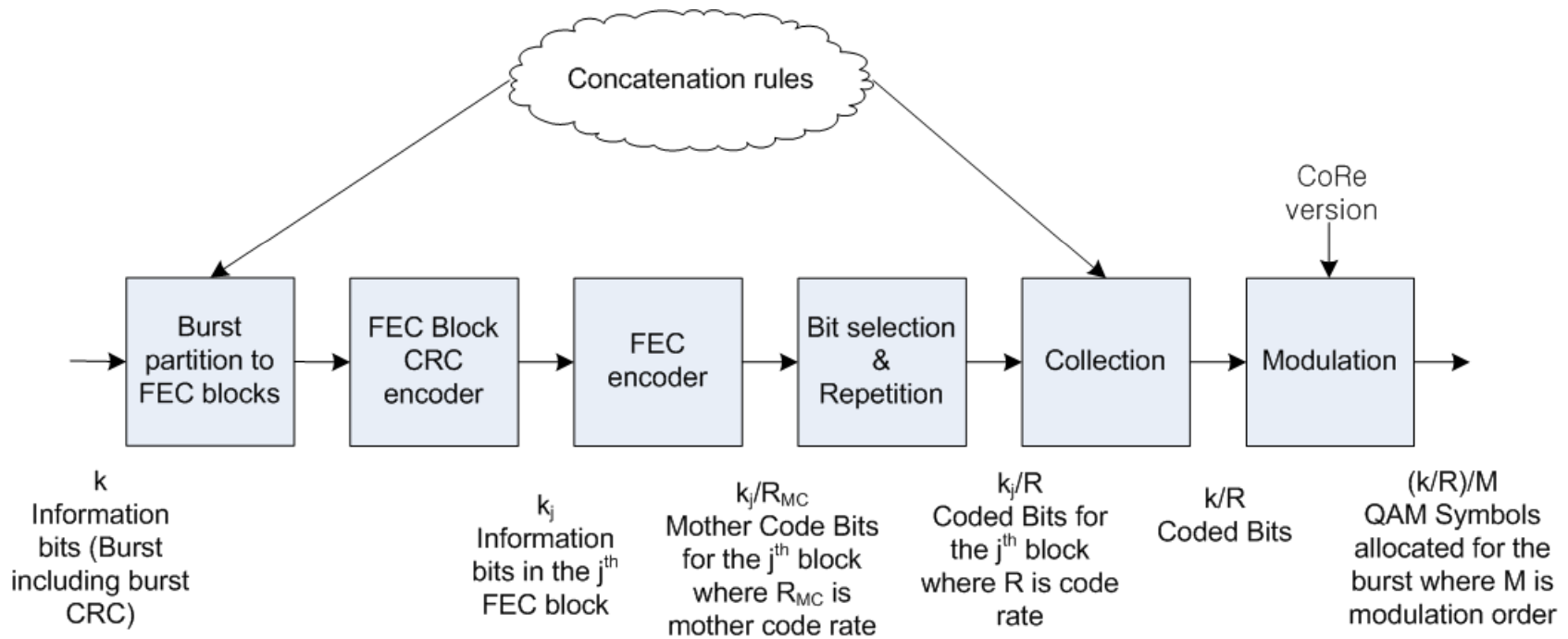


Burst CRC and FEC block CRC (2)

- FEC block CRC
 - 16-bit (CRC-CCITT)
 - $g(x) = x^{16} + x^{12} + x^5 + 1$
 - Miss detection rate $2^{-16} = 1.53 \times 10^{-5}$
 - Sufficient for early stopping of turbo decoding iterations
 - Complexity reduction and power saving
 - FEC block CRC checksum can be used as stopping criteria for turbo decoding
 - Receiver can stop decoding for the whole burst once an FEC block is in error
 - Reduce the average number of turbo decoding iterations → Reduce the decoder complexity
- Burst CRC
 - 24-bit (RFC-2440, MIL STD 188-184, 3GPP2 UMB, 3GPP LTE)
 - $g(x) = x^{24} + x^{23} + x^{18} + x^{17} + x^{14} + x^{11} + x^{10} + x^7 + x^6 + x^5 + x^4 + x^3 + x + 1$
 - Miss detection rate $2^{-24} = 5.96 \times 10^{-8}$
 - Sufficient for most voice and data applications
 - Studies shown that significant throughput degradation occur for high data rate TCP/IP based applications if physical layer packet loss rate exceeds $10^{-6} - 10^{-7}$ (3GPP R1-073741).

Proposed Text Change (1)

- Page 102, line 15,
 - Replace current block diagram by following figure;



Proposed Text Change (2)

- Page 102, line 15,
 - Replace current figure by following;
- Page 102, at the beginning of line 18,
 - Add “A 24-bit burst CRC is appended to a burst before the burst is further processed by burst partition. The generator polynomial of the burst CRC is $g_{\text{burst}}(x) = x^{24} + x^{23} + x^{18} + x^{17} + x^{14} + x^{11} + x^{10} + x^7 + x^6 + x^5 + x^4 + x^3 + x + 1$. The burst CRC is calculated based on all the bits in the burst.”
- Page 102, line 19, between “... is encoded separately.” and “The maximum FEC block ...”
 - Insert “If a burst is partitioned into more than one FEC blocks, a 16-bit FEC block CRC is appended to each FEC block before the FEC encoding. The generator polynomial of the FEC block CRC is $g_{\text{block}}(x) = x^{16} + x^{12} + x^5 + 1$. The FEC block CRC of an FEC block is calculated based on all the bits in that FEC block.”
- Page 102, line 21-22,
 - Delete the sentence “Error detection is provided at the end of the burst by appending a Cyclic Redundancy Check (CRC).”

Text after revision (1)

- 11.13.1.1 Block diagram

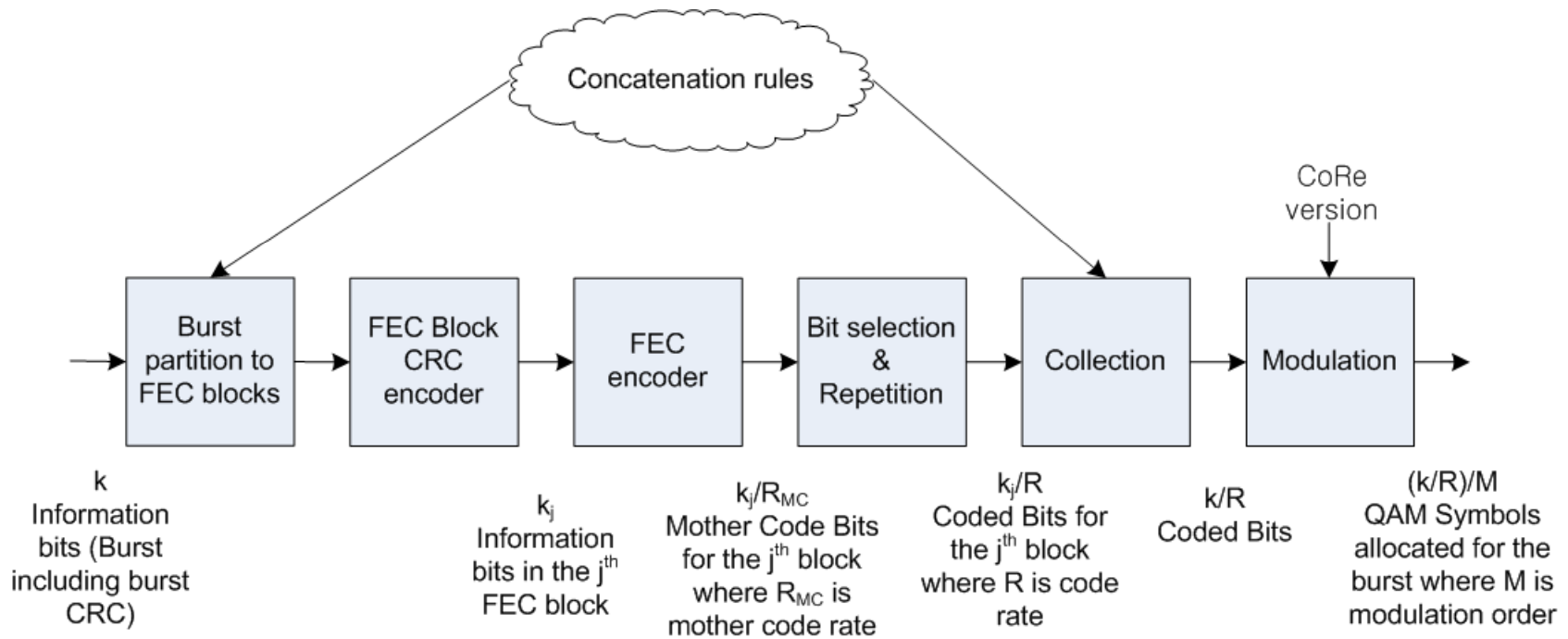


Figure 43 Channel coding block diagram

Text after revision (2)

- 11.13.1.2 Partition into FEC blocks
 - A 24-bit burst CRC is appended to a burst before the burst is further processed by burst partition. The generator polynomial of the burst CRC is $g_{\text{burst}}(x) = x^{24} + x^{23} + x^{18} + x^{17} + x^{14} + x^{11} + x^{10} + x^7 + x^6 + x^5 + x^4 + x^3 + x + 1$. The burst CRC is calculated based on all the bits in the burst. When the burst size exceeds the maximum FEC block size, the burst is partitioned into a number of smaller blocks, each of which is encoded separately. If a burst is partitioned into more than one FEC blocks, a 16-bit FEC block CRC is appended to each FEC block before the FEC encoding. The generator polynomial of the FEC block CRC is $g_{\text{block}}(x) = x^{16} + x^{12} + x^5 + 1$. The FEC block CRC of an FEC block is calculated based on all the bits in that FEC block. The maximum FEC block size is TBD. Concatenation rules are based on the number of information bits and do not depend on the structure of the resource allocation (number of LRUs and their size). The concatenation rules are FFS. ~~Error detection is provided at the end of the burst by appending a Cyclic Redundancy Check (CRC).~~