



Dave Estes – Spirent

Frame Error Ratio (FER) for BASE-T

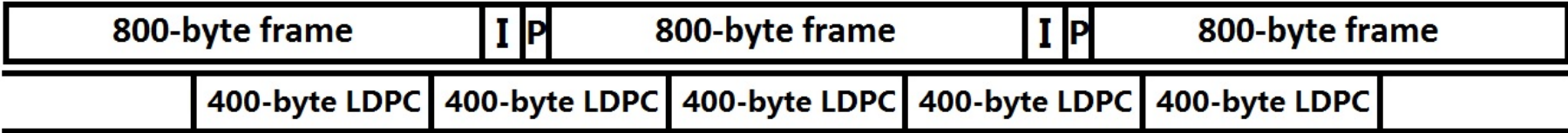
Clause 55 BER vs frame error ratio



- 55.5.4.1 states the requirements:
 - $BER < 10^{-12}$
 - Frame error ratio $< 9.6 \times 10^{-9}$ for 800 octet frames with minimum IPG or greater than 799 octet IPG
- This is not a direct conversion due to the 400-byte LDPC frames.
- If it were a direct conversion the frame error ratio would be:
 - $10^{-12} * 8 \text{ bits per byte} * 800 \text{ bytes per frame} = 6.4 \times 10^{-9}$



Clause 55 frame error ratio



Min IPG case - ~50% (actual is 46%) of the LDPC frames will corrupt 2 MAC frames, so a factor of 1.5 can be applied to the frame error ratio calculation

$$10^{-12} * 8 \text{ bits per byte} * 800 \text{ bytes per frame} * 1.5 = 9.6 \times 10^{-9}$$



Large IPG case – Each MAC frame requires 3 valid LDPC frames, totaling 1200 bytes of data

$$10^{-12} * 8 \text{ bits per byte} * 1200 \text{ bytes per frame} = 9.6 \times 10^{-9}$$

Clause 126 BER vs frame error ratio



- Clause 126 has the same BER but the LDPC frame size is 200 bytes.
- There are two options to accommodate this:
 - 1) Switch to 400-byte MAC frames
 - a) In the min ipg case there is a 43% chance that one LDPC frame will corrupt two MAC frames
 $10^{-12} * 8 \text{ bits per byte} * 400 \text{ bytes per frame} * 1.43 = \mathbf{4.6 \times 10^{-9}}$
 - b) An IPG of at least 220 bytes will ensure that one LDPC frame will only corrupt one MAC frame
 $10^{-12} * 8 \text{ bits per byte} * 600 \text{ bytes per frame} = 4.8 \times 10^{-9}$
 - 2) Keep 800-byte MAC frames and redo the math
 - a) In the min ipg case there is a 22% chance that one LDPC frame will corrupt two MAC frames
 $10^{-12} * 8 \text{ bits per byte} * 800 \text{ bytes per frame} * 1.22 = \mathbf{7.8 \times 10^{-9}}$
 - b) An IPG of at least 220 bytes will ensure that one LDPC frame will only corrupt one MAC frame
 $10^{-12} * 8 \text{ bits per byte} * 1000 \text{ bytes per frame} = 8.0 \times 10^{-9}$