ACT Training Sequence Proposal

William Lo

January 22, 2025

General Training Sequence Proposal

- Keep as much of 802.3ch training sequence unchanged as possible
  - Same scrambling sequence
  - Same PHY Control and Link Monitor state diagrams
  - Same Infofield
  - Same Downstream Training Frame
  - Preserve the PFC24 increment rate in both directions
    - Not really required
- What is new
  - Upstream Training Frame

PMA_state = 00

octet 1	octet 2	octet 3	octets 4/5/6	octet 7	octets 8/9/10	octets 11/12
0xBB	0xA7	0x00	PFC24	Message	PHY Capability Bits	CRC16

Figure 149–27—Infofield TRAINING format

PMA_state = 01

octet 1	octet 2	octet 3	octets 4/5/6	octet 7	octets 8/9/10	octets 11/12
0xBB	0xA7	0x00	PFC24	Message	DataSwPFC24	CRC16

Figure 149–28—Infofield COUNTDOWN format

802.3ch Training Frame

- Training frame is continuous LFSR stream of 7200 bits or 1280ns, 2560ns, 5120ns in 10G, 5G, 2.5G
- A partial frame is defined to be 450 bits long. Each partial frame duration increments the PFC by 1.
- Training frame is aligned to the 16Nth partial frame boundary
- Infofield is 12 bytes or 96 bits XOR into the LFSR bit stream and aligned to the start of the 16N+15th partial frame. PFC24 field of Infofield starts at 15 and increments by 16 for each training frame
- The bits of the LFSR stream corresponding to the start of each partial frame is inverted as shown in red except at the infofield.
- Four Reed Solomon frames are aligned to each training frame boundary after training finishes.

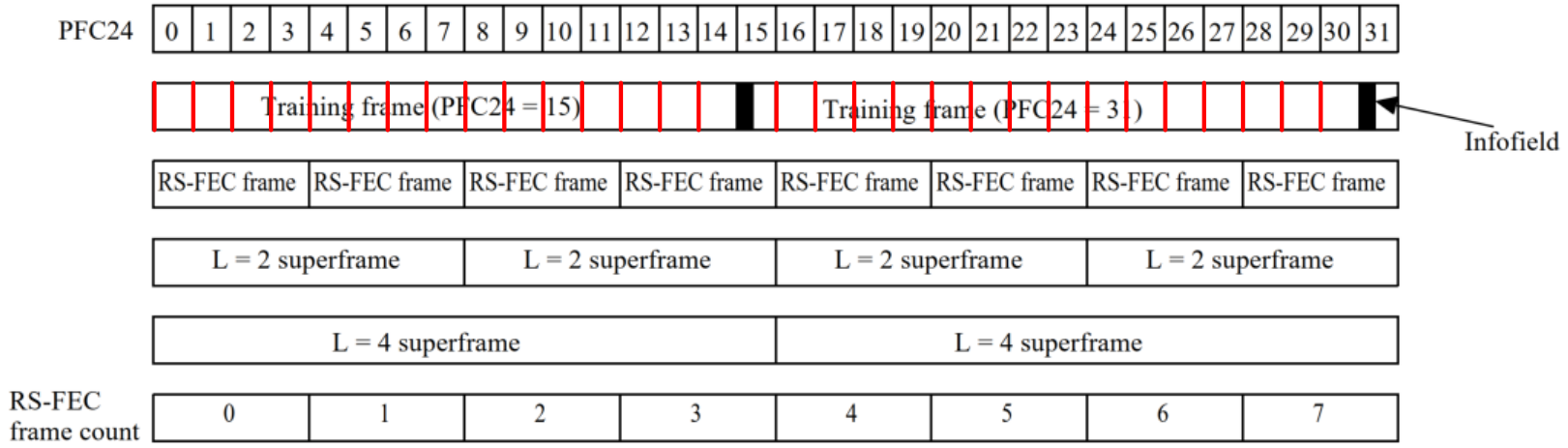
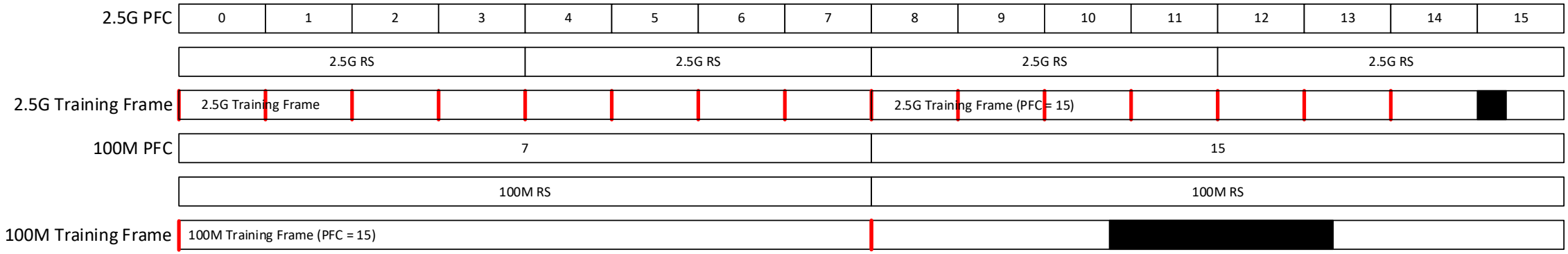


Figure 149–12—Timing relationship to PFC24

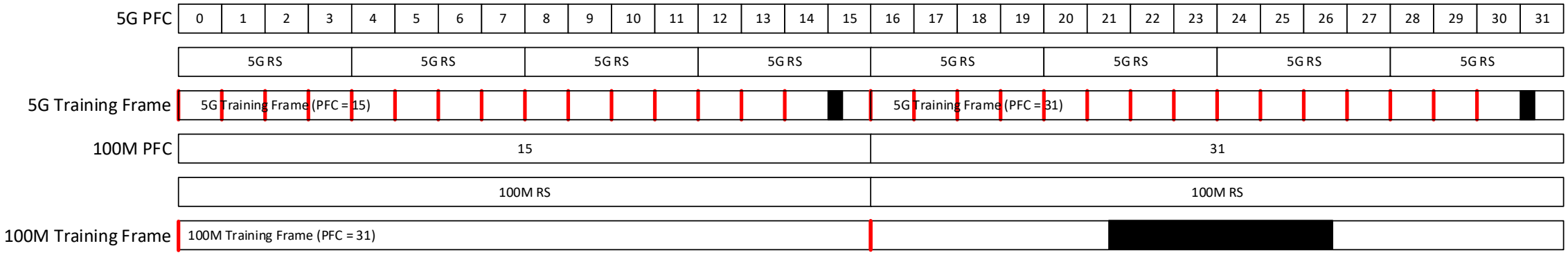
100M Training Frame in relationship to 2.5G

- 100M training frame duration same as 2.5G training frame at 5120ns
- 100M training frame is 600 bits or two RS(50, 46, GF(2^6)) frames
  - Each bit is DME encoded
- 100M partial frame duration = 300 bits
- Infofield definition is the same
- Infofield placed at bits 400 to 495 bits of training frame
  - Leaves about 100 bits either side of inversion
- The bits of the LFSR stream corresponding to the start of each partial frame is inverted as shown in red
- Partial frame count starts at 7 and increments by 8
  - PFC24 field is 16N+15 for the N^{th} training frame



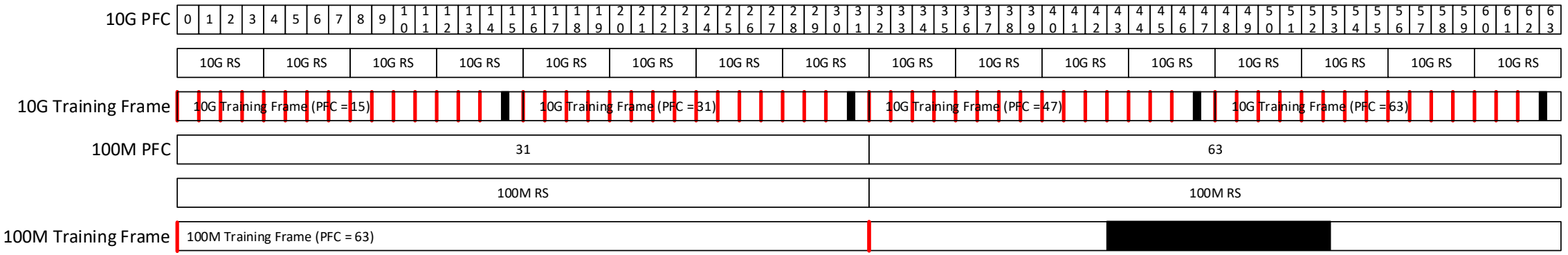
100M Training Frame in relationship to 5G

- No change to the 100M training frame in 2.5G except as discussed below
- 100M training frame duration same as two 5G training frame at 2 x 2560ns = 5120ns
- To keep pace with the 5G PFC24 count
  - Partial frame count starts at 15 and increments by 16
  - PFC24 field is 32N+31 for the N^{th} training frame



100M Training Frame in relationship to 10G

- No change to the 100M training frame in 2.5G except as discussed below
- 100M training frame duration same as four 10G training frame at 4 x 1280ns = 5120ns
- To keep pace with the 5G PFC24 count
  - Partial frame count starts at 31 and increments by 32
  - PFC24 field is 64N+63 for the Nth training frame



PHY Capabilities

- Some bits in Infofield changed to reserved
  - i.e. Interleave and Precoder does not apply to upstream receiver

Table 149–12—PHY capability bits

octet 8								octet 9								octet 10							
0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
VendorSpecificData																Reserved	InterleaverDepth		PrecodeSel		SlowWakeRequest	EEEen	OAMen

Core Text Describing Training Frame

- Use 802.3ch – unchanged for downstream

$$S_n = \begin{cases} Scr_n[0] \oplus InfoField_{(n \bmod 450)} & 6750 \le (n \bmod 7200) \le 6845 \\ Scr_n[0] \oplus 1 & \text{else if } (n \bmod 450) = 0 \\ Scr_n[0] & \text{otherwise} \end{cases} \quad (149\text{–}7)$$

- For upstream

$$S_n = \begin{cases} Scr_n[0] \oplus InfoField_{(\text{n mod } 100)} & 400 \le (n \bmod 600) \le 495 \\ Scr_n[0] \oplus 1 & \text{else if } (n \bmod 300) = 0 \\ Scr_n[0] & \text{otherwise} \end{cases}$$

Summary

- Preserve 802.3ch training mechanism
- Adjust the upstream training frame to fit the 100M timing
- Upstream training frame duration integer multiples of downstream training frame duration
- Preserves rate at which PFC24 increments
- Some adjustments may be required on PHY capability bits in Infofield

THANK YOU