100GBASE-KR4 and 100GBASE-CR4 PMD Control

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(Regarding Comments #265 and #266)

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Comment #265 / #266

- The draft says that each lane of this PMD shall use the same control function as 10GBASE-KR. However, the baud rate is different and Clause 72.6.10 has many explicit references to 10GBASE-KR UI.

- Use the same control function logic but change to the 25Gbaud signaling rate. I'm not entirely sure how to document it. Some possible options are:
  - Option 1: copy 72.6.10 PMD control function into draft and modify references to state 100GBASE-KR4/CR4 baud rates and UI.
  - Option 2: bring 72.6.10 PMD control function into draft and add clarifications for 100GBASE-KR4 at each instance (so that both 10GBASE-KR and 100GBASE-KR4/CR4 are listed)
  - Option 3: bring 72.6.10 PMD control function into draft and make generic references to new variables for each PMD type.

Issues

- Link training at 10GBASE-KR signaling rate for 100GBASE-KR4 and 100GBASE-CR4 is not ideal
  - Receiver will not be able to optimize performance over the backplane interconnect at the desired Baud rate
  - Seamlessly changing Baud rates between training and normal link operation is problematic
    - No integer clock divisor between rates

Example Text

- CI 72.6.10.2 Training Frame Structure
  - "The control channel is signaled using differential Manchester encoding (DME) at a signaling rate equal to one quarter of the 10GBASE-KR signaling rate. Since each DME symbol contains two DME transition positions and each transition position is four 10GBASE-KR UI, one control channel bit is transmitted every eight 10GBASE-KR UI."

- CI 72.6.10.2.1 Frame Marker
  - "Frames are delimited by the 32-bit pattern, hexadecimal FFFF0000 (ones transmitted first), as expressed in 10.3125 Gbd symbols. This pattern does not appear in the control channel or the training pattern and therefore serves as a unique indicator of the start of a training frame."

- Many other examples exist within Clause 72.6.10

Excerpts from IEEE P802.3bh Draft 3.1, section 5

Question:

- Is changing the training frame from 10GBASE-KR to 100GBASE-KR4/CR4 UI enough?
  - 10GBASE-KR UI = 96.97 psec
  - 100GBASE-KR4/CR4 UI = 38.79 psec

Assumptions

- Check with and without the TXFFE equalization
  - PRESET:no equalization
  - INITIALIZE: Rpre and Rpst values not yet determined for submitted channels, use KR values
- Set the Vpk-pk to 800mV
  - Match Cl 72.7.1.11 requirement for 1010 pattern
- All control channel cells set to 0b except:
  - Preset = 1b   (to observe single bit post channel)
  - Coef(+1), Coef(0), Coef(-1) status = 11b
    - Response to PRESET request from link partner
    - (to observe multi-bit pattern post channel)
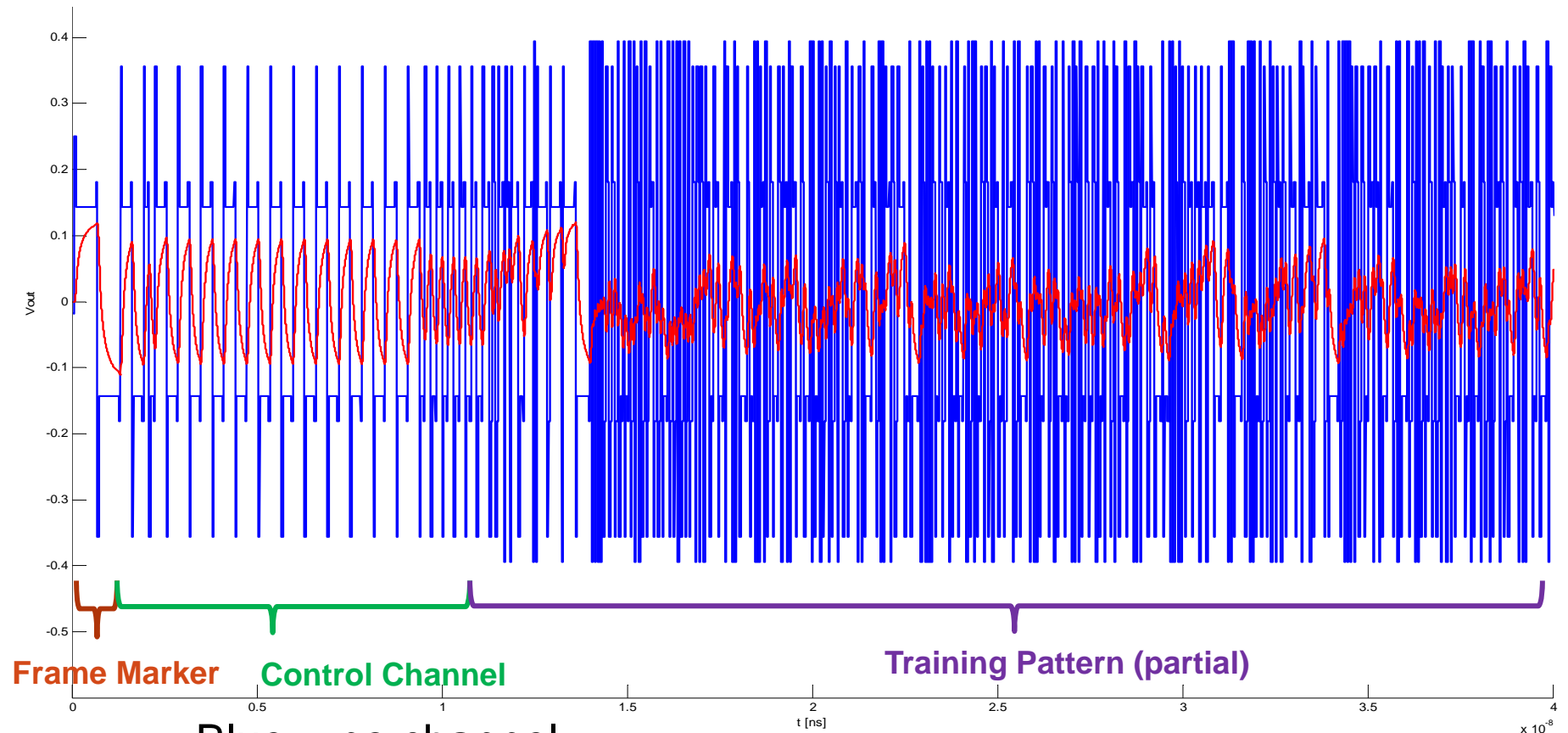
100GBASE-KR4 Example 1A
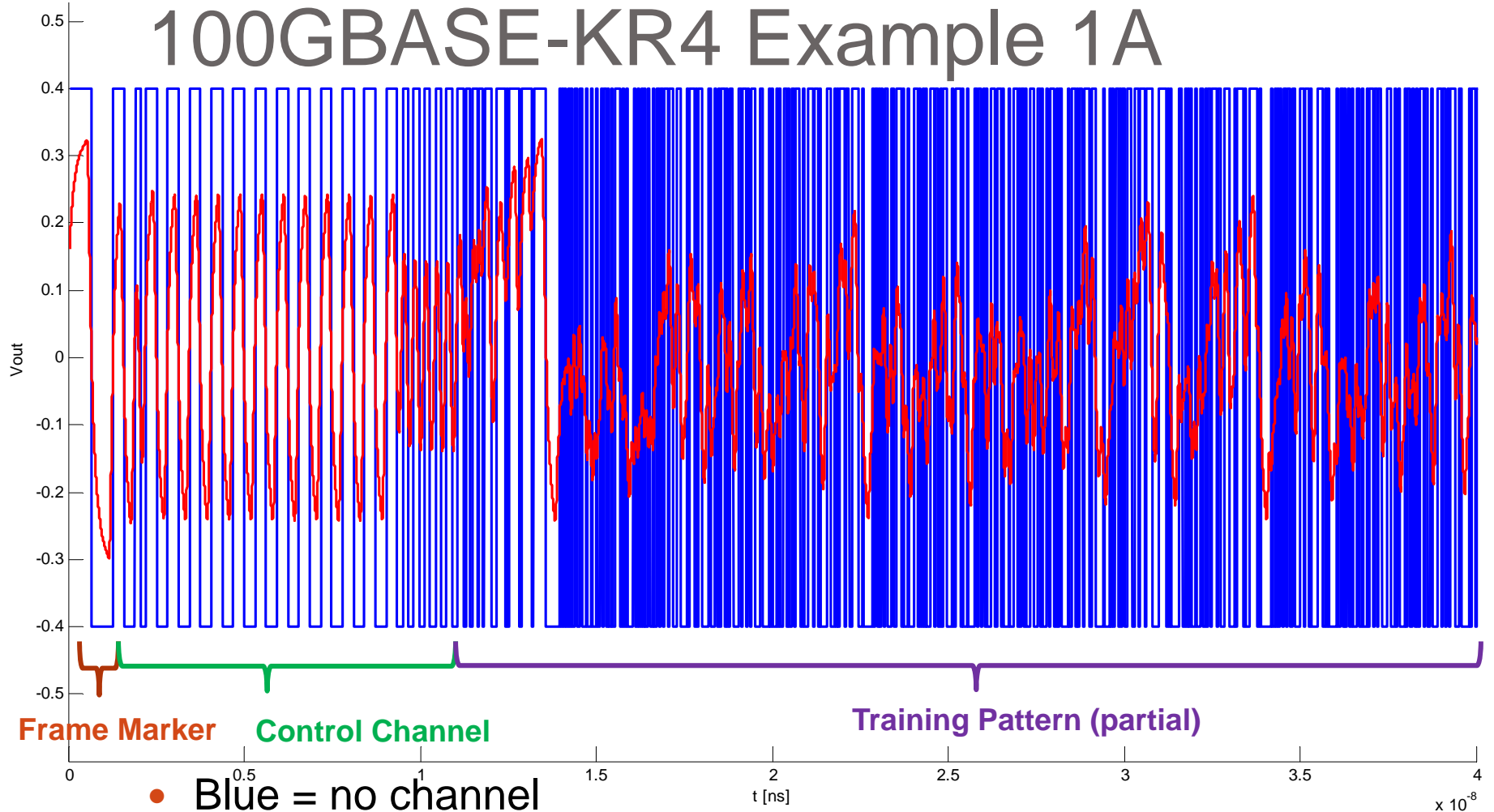
Frame Marker **Control Channel** **Training Pattern (partial)**

- Blue = no channel
- Red = after IL = ~33dB @ 13GHz channel (without TXFFE equalization)

Channel used "TEC_Whisper29p8in_Nelco6_THRU_C8C9" from
http://www.ieee802.org/3/100GCU/public/ChannelData/TEC_11_0428/shanbhag_03_0411.pdf
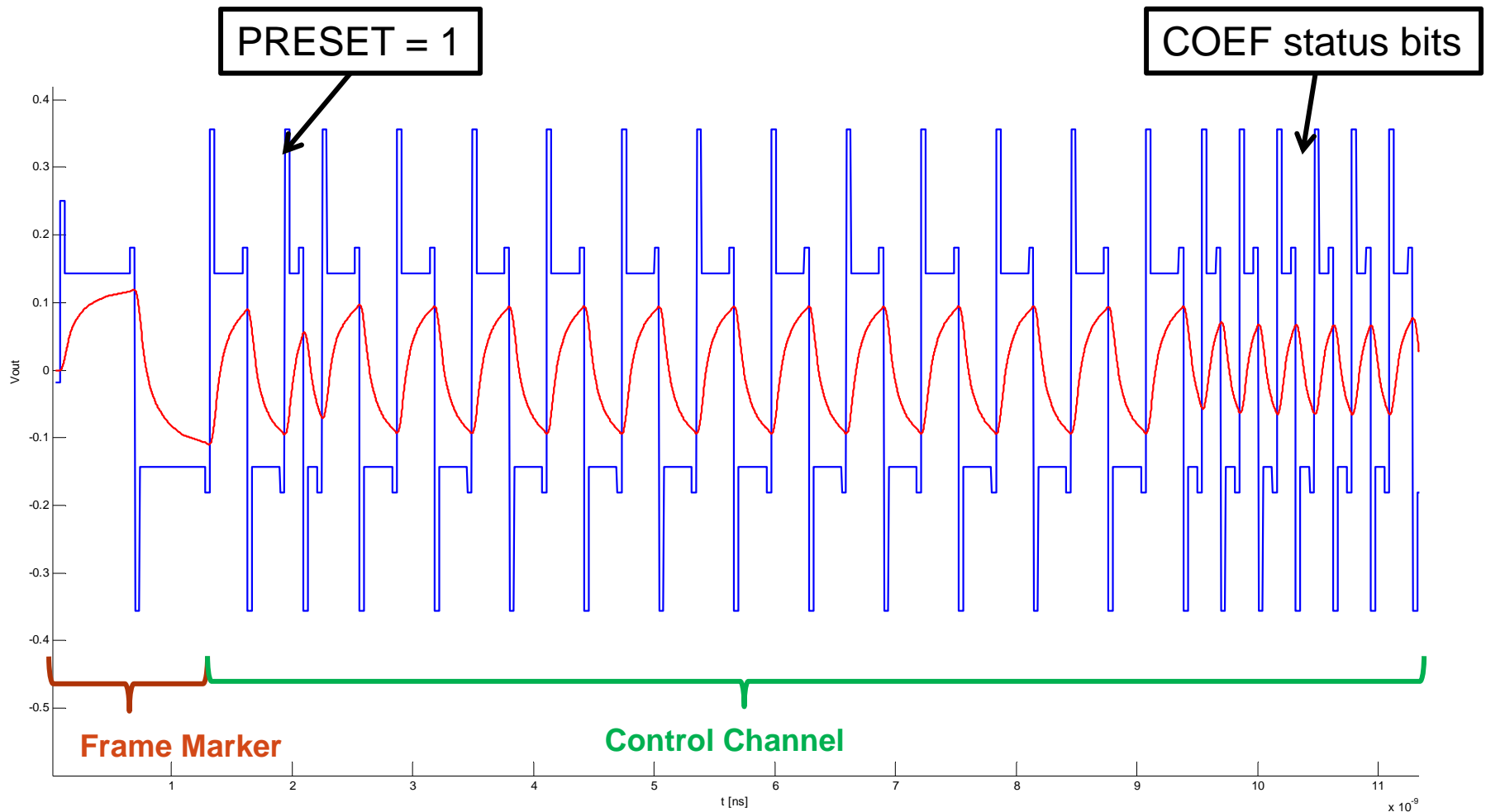
100GBASE-KR4 Example 1B

- Blue = no channel
- Red = after IL = ~33dB @ 13GHz channel (with "INITIALIZE" TXFFE equalization)
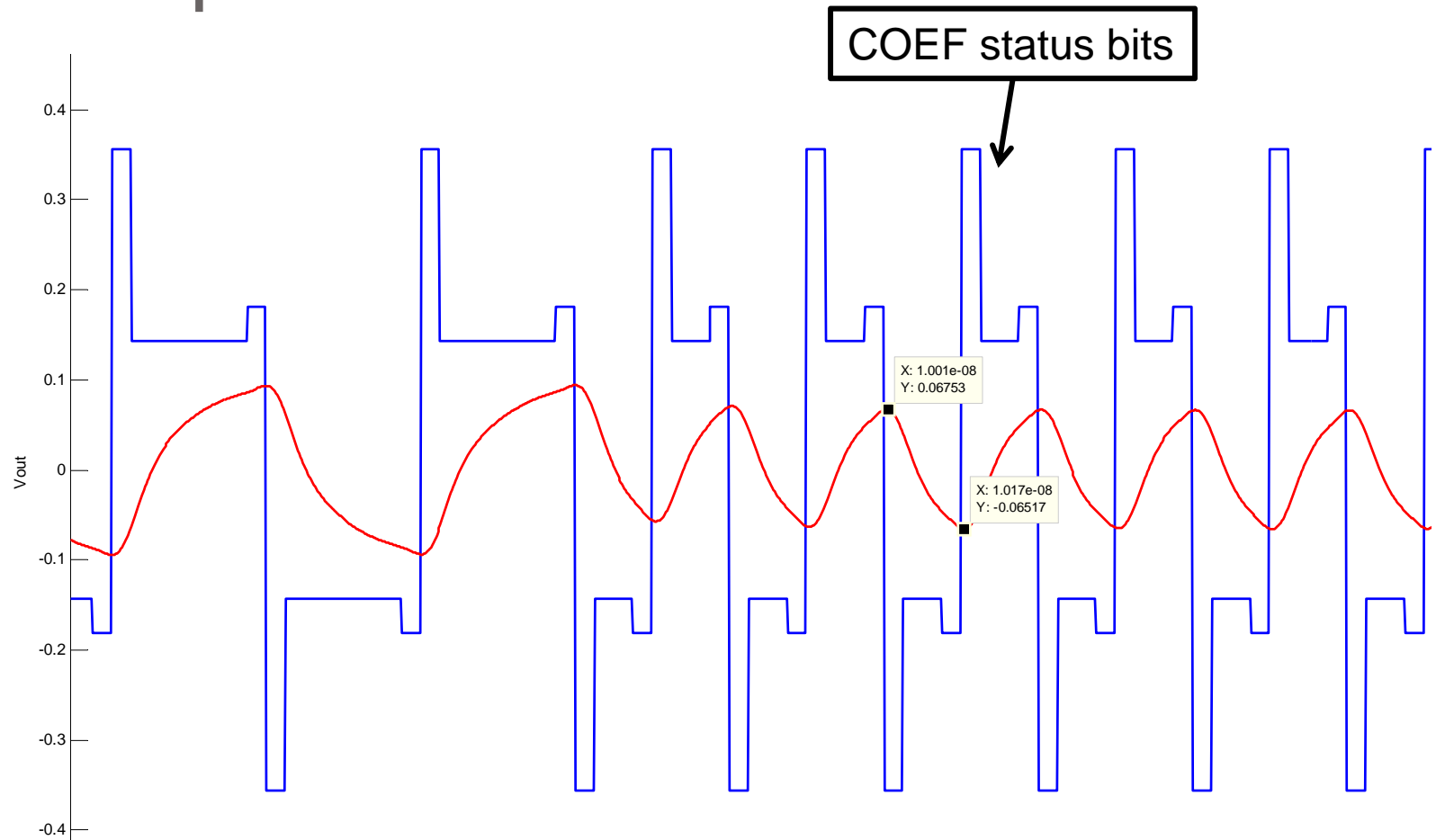
Channel used "TEC_Whisper29p8in_Nelco6_THRU_C8C9" from
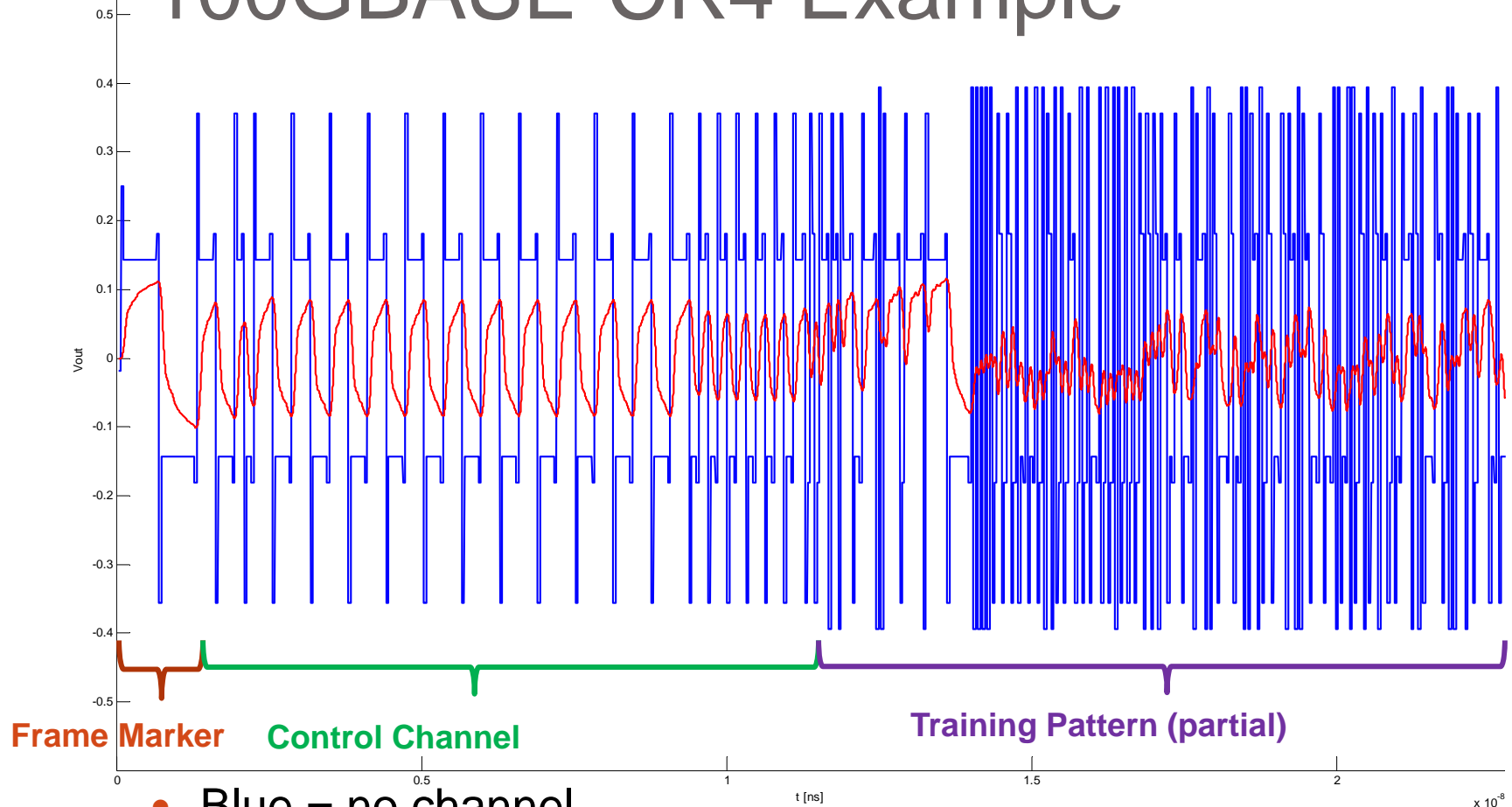http://www.ieee802.org/3/100GCU/public/ChannelData/TEC_11_0428/shanbhag_03_0411.pdf

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Example 1B Zoom

- Closer look at the control channel

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Example 1B Zoom #2

- ~130mVpk-pk signal available after channel

100GBASE-CR4 Example

Frame Marker **Control Channel** **Training Pattern (partial)**

- Blue = no channel
- Red = after IL = ~33dB @ 13GHz channel (with 'INITIALIZE' TXFFE equalization)

  Channel used "Bugg_02_0312_CableA_P1RX1_IL_P2TX1" from
  http://www.ieee802.org/3/bj/public/mar12/bugg_01a_0312.pdf

Summary

- Control channel is strong enough without equalization at 25 Gbaud on the channels investigated
  - Equalization further improves signal

- Use 8 UI for control channel cell width for 100GBASE-KR4 and 100GBASE-CR4 PMD control (i.e. link training)

- Use 32-bit pattern, hexadecimal FFFF0000 (ones transmitted first), as expressed in 25.78125 Gbd symbols

BACKUP

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100GBASE-KR4 Example 2

100GBASE-KR4 training on Emerson long channel
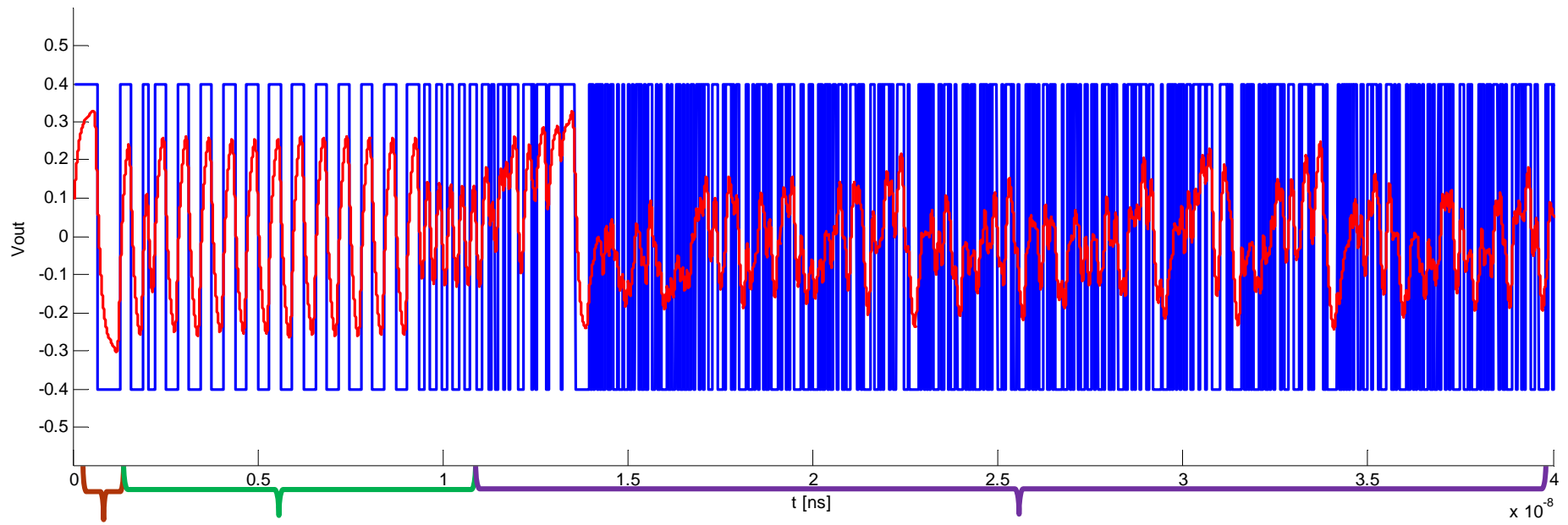
Frame Marker   **Control Channel**   **Training Pattern (partial)**
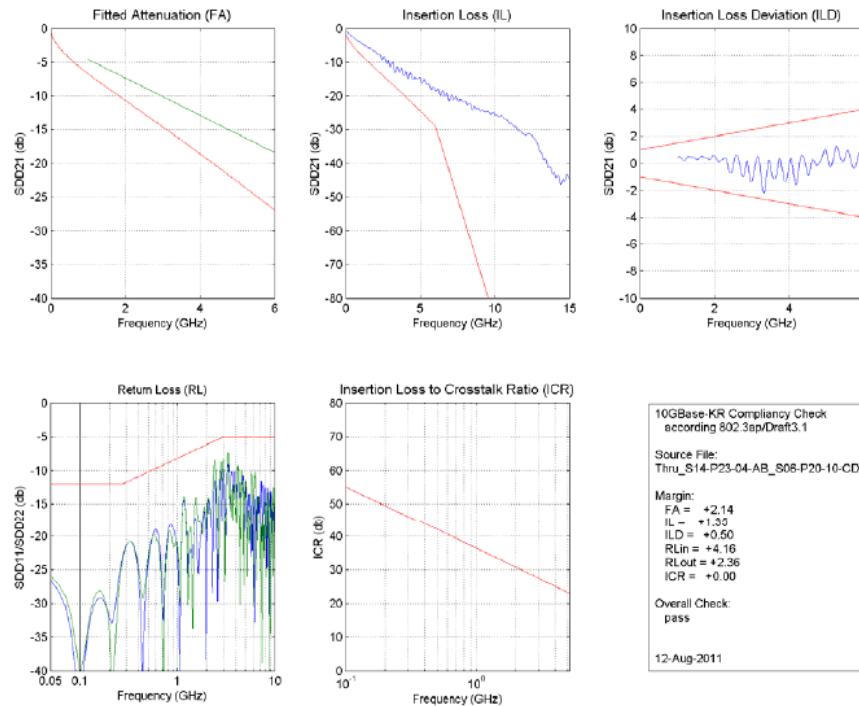
- Blue = no channel

- Red = after IL = ~30dB @ 13GHz channel (without TXFFE equalization)

  Channel used "Thru_S14-P23-04-AB_S06-P20-10-CD_NNN.s4p" from
  http://www.ieee802.org/3/100GCU/public/ChannelData/emerson_11_0928/meier_01_1011.pdf

Thru_S14-P23-04-AB_S06-P20-10-CD_NNN.s4p

http://www.ieee802.org/3/100GCU/public/ChannelData/emerson_11_0928/meier_01_1011.pdf

http://www.ieee802.org/3/100GCU/public/ChannelData/TEC_11_0428/shanbhag_03_0411.pdf