Transmitter initial conditions

(comments #104 and #162)

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Summary of proposal

- Expand set of transmitter initial conditions for training

- "The closer the destination, the quicker the journey"

- An initial condition closer to the desired values reduces the number of iterations needed to complete training (manage start-up time)

- An initial condition closer to the desired values can also make start-up more robust

- Propose to change the control field of the Clause 162 training frame

- Propose values for transmitter initial conditions

Expand "Initial condition request" in Control Field

Bit(s)	Name	Description
15:14	Reserved	Transmit as 0, ignore on receipt
13:12	Initial condition request	13 12 1 1 = Preset 3 1 0 = Preset 2 0 1 = Preset 1 0 0 = Individual coefficient control
11:10	Reserved	Transmit as 0, ignore on receipt

Allocation for "Initial condition request" in 136.8.11.2

Proposed allocation for 162.8.11

Note — "Initial condition request" is extended to bit 11 rather than bit 14 because Fibre Channel uses bits 15 and 14 as a training frame marker extension to facilitate speed negotiation.

See INCITS 545-2019 − Fibre Channel – Framing and Signaling – 5 (FC-FS-5).

Bit(s)	Name	Description
15:14	Reserved	Transmit as 0, ignore on receipt
13:11	Initial condition request	13 12 11 1 1 1 = Reserved 1 1 0 = Reserved 1 0 1 = Preset 5 1 0 0 = Preset 4 0 1 1 = Preset 3 0 1 0 = Preset 2 0 0 1 = Preset 1 0 0 0 = Individual coefficient control
10	Reserved	Transmit as 0, ignore on receipt

Coefficient initial conditions (Table 162–10): Proposal 1

ic_req	c(−3)	c(−2)	c(−1)	c(0)	c(1)
preset 1[a]	0	0	0	1	0
preset 2	0 ± 0.0125	0 ± 0.0125	0 ± 0.0125	0.5 ± 0.0125	0 ± 0.0125
preset 3	0 ± 0.0125	0 ± 0.0125	−0.075 ± 0.0125	0.75 ± 0.0125	0 ± 0.0125
preset 4	0 ± 0.0125	0.05 ± 0.0125	−0.2 ± 0.0125	0.75 ± 0.0125	0 ± 0.0125
preset 5	0 ± 0.0125	0 ± 0.0125	−0.15 ± 0.0125	0.75 ± 0.0125	−0.1 ± 0.0125

[a] Preset 1 is the reference for the calculation of the normalized coefficients of the transmit equalizer (see 162.9.3.1.1). As a result, the normalized coefficients for preset 1 are these values by definition and do not include any tolerances.

- Also add the following text to 162.8.11

  Upon entry to the OUT_OF_SYNC state in the Training Frame lock state diagram, ic_req is set to "preset 1".

Notes
- Table 136−12 defines a separate initial condition for the OUT_OF_SYNC state of the "coefficient update state diagram".
- The OUT_OF_SYNC state includes a call to the UPDATE_IC function which needs a value of ic_req (see 136.8.11.4.2) but Table 136−12 defines a value of "N/A" for the OUT_OF_SYNC state (assumed to be preset 1?).
- The definitions may be redundant since 136.8.11.4.2 states that "the transmitter equalizer is set to preset 1 upon entry to the INITIALIZE state of the PMD control state diagram."
- The proposed table format and added text is a simple way to clarify the intended behavior.

Coefficient initial conditions (Table 162–10): Proposal 2

ic_req	$c(-3)$	$c(-2)$	$c(-1)$	$c(0)$	$c(1)$
preset 1[a]	0	0	0	1	0
preset 2	0 ± 0.0125	0 ± 0.0125	0 ± 0.0125	0.5 ± 0.0125	0 ± 0.0125
preset 3	0 ± 0.0125	0 ± 0.0125	−0.075 ± 0.0125	0.75 ± 0.0125	0 ± 0.0125
preset 4	0 ± 0.0125	0.05 ± 0.0125	−0.2 ± 0.0125	0.75 ± 0.0125	0 ± 0.0125
preset 5	−0.025 ± 0.0125	0.075 ± 0.0125	−0.25 ± 0.0125	0.65 ± 0.0125	0 ± 0.0125

[a] Preset 1 is the reference for the calculation of the normalized coefficients of the transmit equalizer (see 162.9.3.1.1). As a result, the normalized coefficients for preset 1 are these values by definition and do not include any tolerances.

- Also add the following text to 162.8.11

  Upon entry to the OUT_OF_SYNC state in the Training Frame lock state diagram, ic_req is set to "preset 1".

Additional changes

- Exception to 136.8.11.4.2 "Initial condition setting response process"

```
if ic_req = ind_ctl
   ic_sts = not_upd
else
   if ic_req = preset 1
      Set coefficients to preset 1
   else if ic_req = preset 2
      Set coefficients to preset 2
   else if ic_req = preset 3
      Set coefficients to preset 3
   else if ic_req = preset 4
      Set coefficients to preset 4
   else if ic_req = preset 5
      Set coefficients to preset 5
   end if
   ic_sts = updated
end if
```