Start-up Training Sequence Proposal

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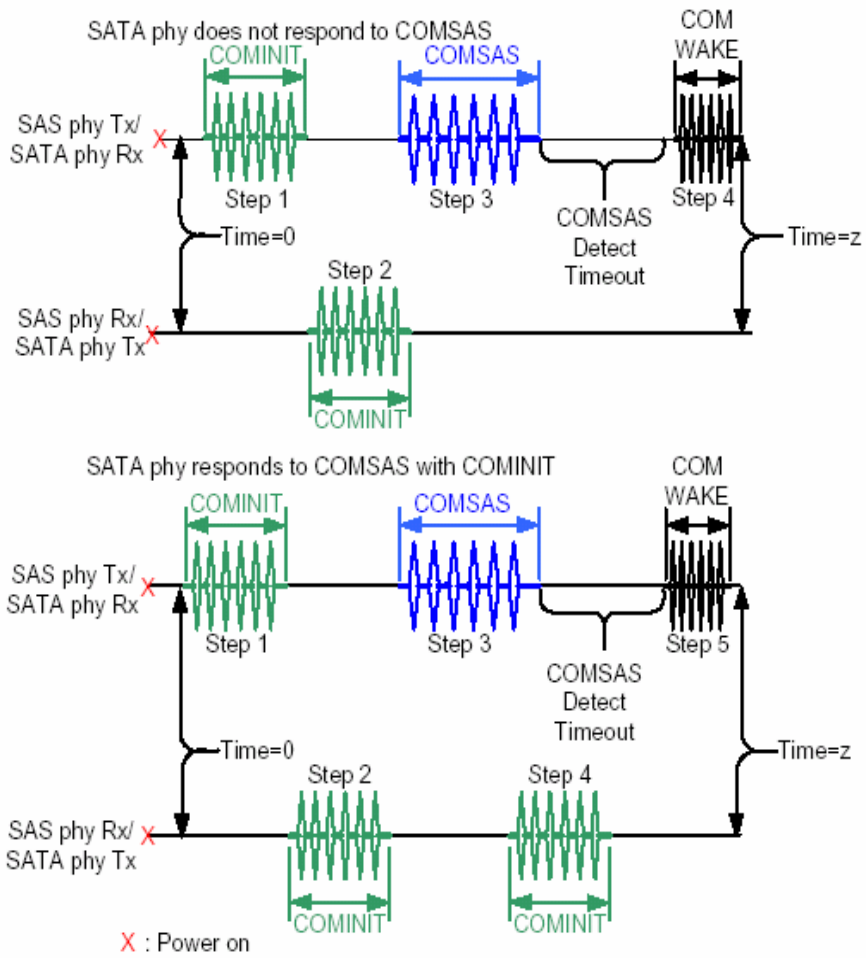
Infineon

Never stop thinking

Overview

- DFE receivers may require training before speed negotiation takes place.
- Applying a known pattern for training greatly improves time required for training.
- Ensure backwards compatibility.
- Use current protocol and modify where needed.
- Introduce training sequence only where needed.
- Leverage off existing spec based on DFE architecture.

OOB Sequence



Time 0: OOB sequence begins
Time z: Speed negotiation sequence begins

Figure 116 — SAS to SATA OOB sequence

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SATA Speed Negotiation (Training not required)

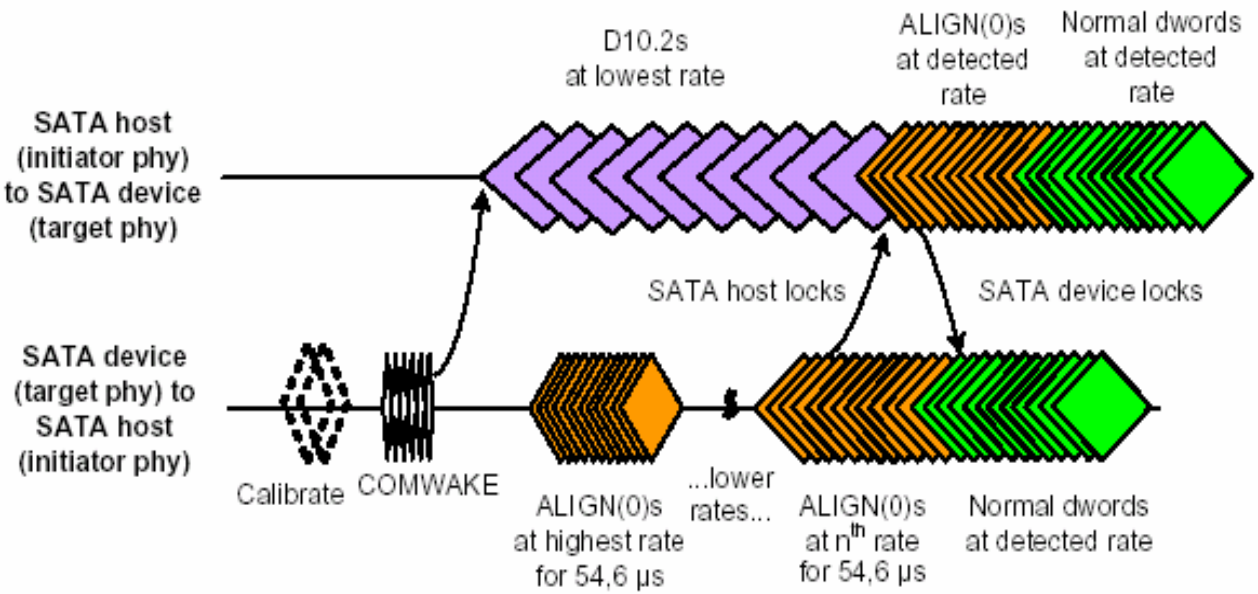

Figure 115 — SATA speed negotiation sequence

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SAS Speed Negotiation Window

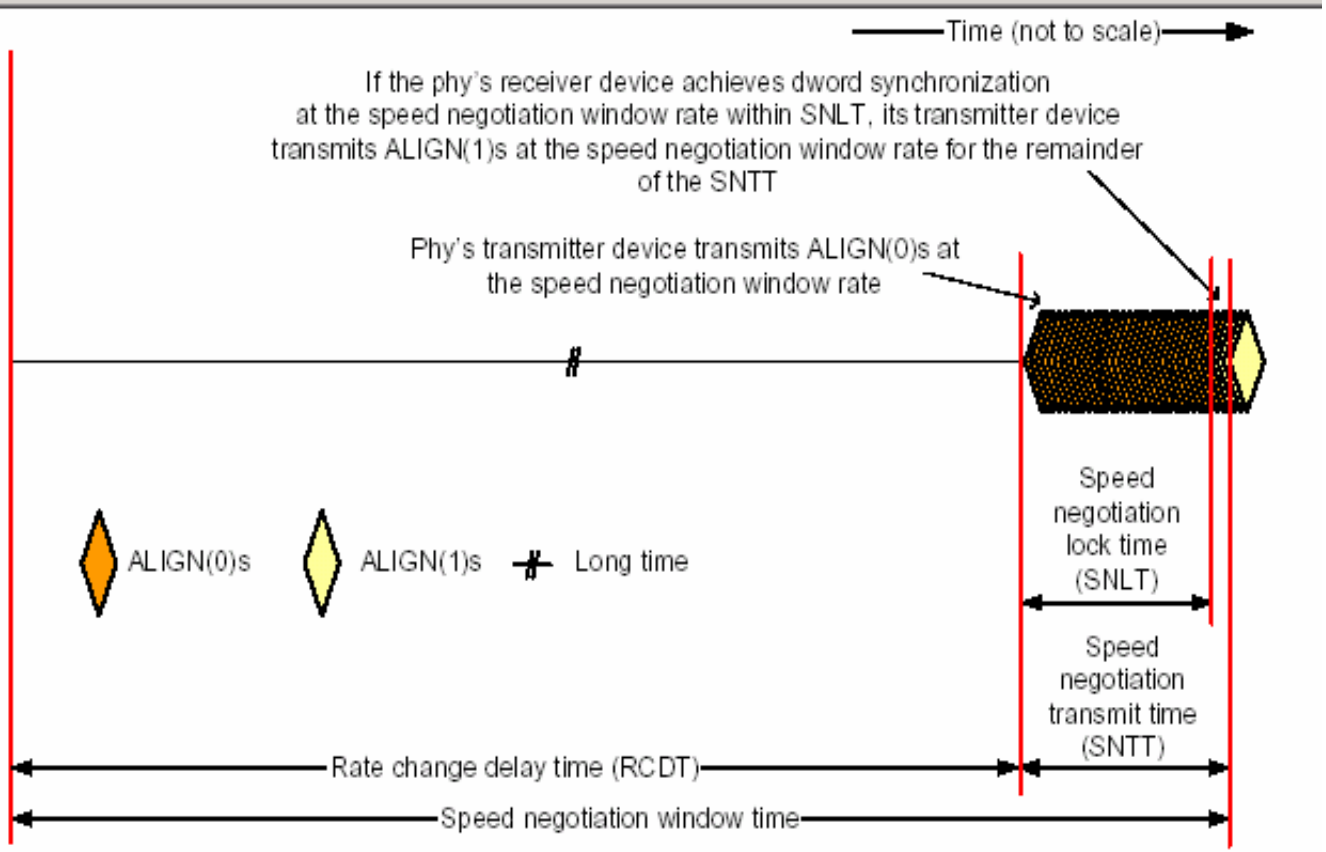

Figure 118 — SAS speed negotiation window

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SAS Speed Negotiation Table

Table 66 defines the timing specifications for the SAS speed negotiation sequence.

Table 66 — SAS speed negotiation sequence timing specifications

Parameter	Time	Comments
Rate change delay time (RCDT)	750 000 OOBI	The time the transmitter device shall transmit D.C. idle between rates during speed negotiation. 500µs
Speed negotiation transmit time (SNTT)	163 840 OOBI	The time during which ALIGN (0) or ALIGN (1) is transmitted at each physical link rate during the speed negotiation sequence. Derived from: OOBI x 4 096 x 40. 109µs
Speed negotiation lock time (SNLT)	153 600 OOBI	The maximum time during the speed negotiation window for a transmitter device to reply with ALIGN (1). Derived from: OOBI x 3 840 x 40 102µs
Speed negotiation window time	913 840 OOBI	The duration of a speed negotiation window. Derived from: RCDT + SNTT. 609µs

SAS Speed Negotiation Sequence (SAS1)

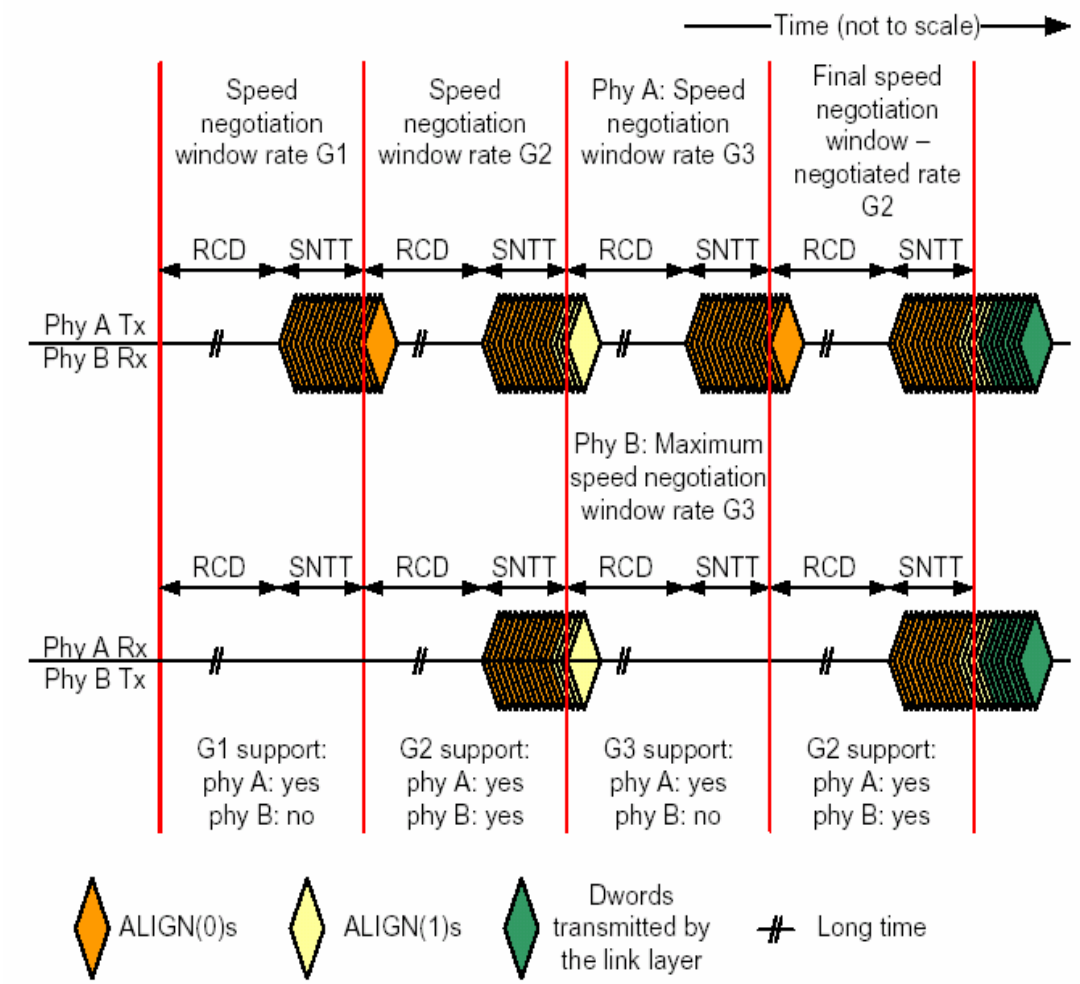

Figure 119 — SAS speed negotiation sequence (phy A: G1, G2, G3, phy B: G2 only)

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Training Sequence

Pattern	Purpose	Time
Primitive sent four times	160 bits - Status	26.6ns
Series of 00h bytes transmitted scrambled per the existing scrambler and 8B/10B encoder	1600 bits - pseudo-random Provide broad spectral content for a DFE to train.	266.7ns

D30.3 = 0111100011 1000011100b low frequency to provide an open eye.

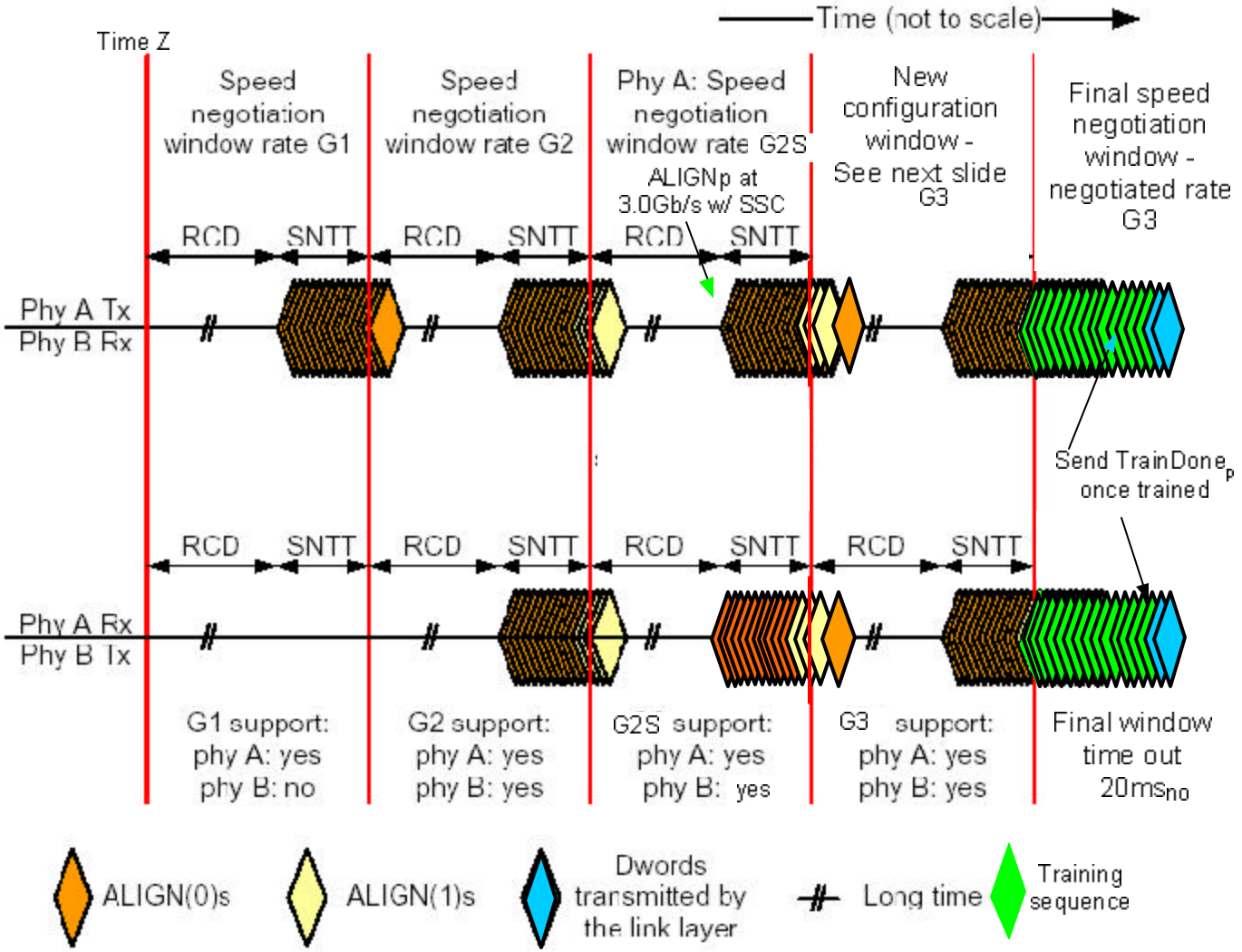
$Train_p$: training receiver K28.5 D30.3 D30.3 D30.3

$TrainDone_p$: training complete K28.5 D30.3 D30.3 D10.2

The number of bit is the requirement.
The time is for reference based on 6Gb/s operation.

Either running disparity is allowed.

New configuration window uses OOB signaling method to identify supported functions.



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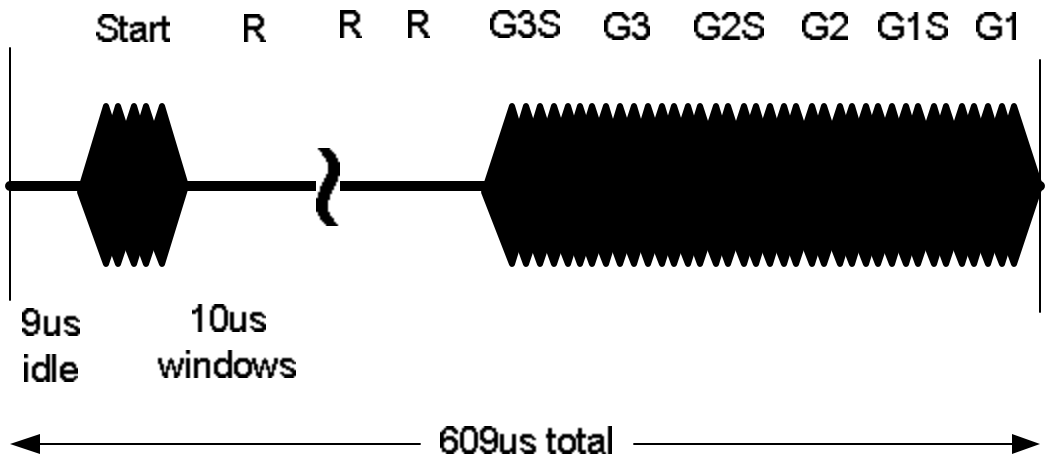
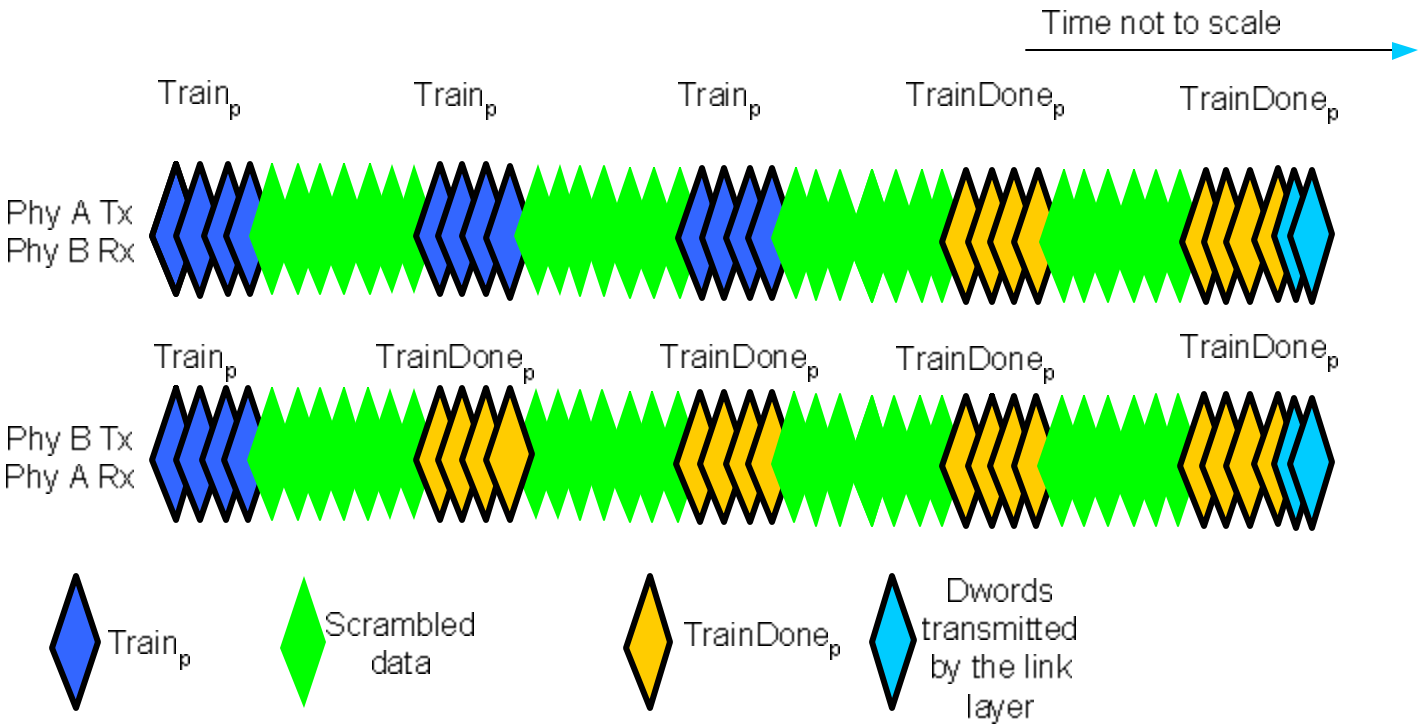
New configuration window.



This gives 59 configurations with only 6 used

Use OOB bursts for 10us to indicate each configuration supported.
Send the same as OOB at 1.5Gb/s.
Use threshold detector for decoding.

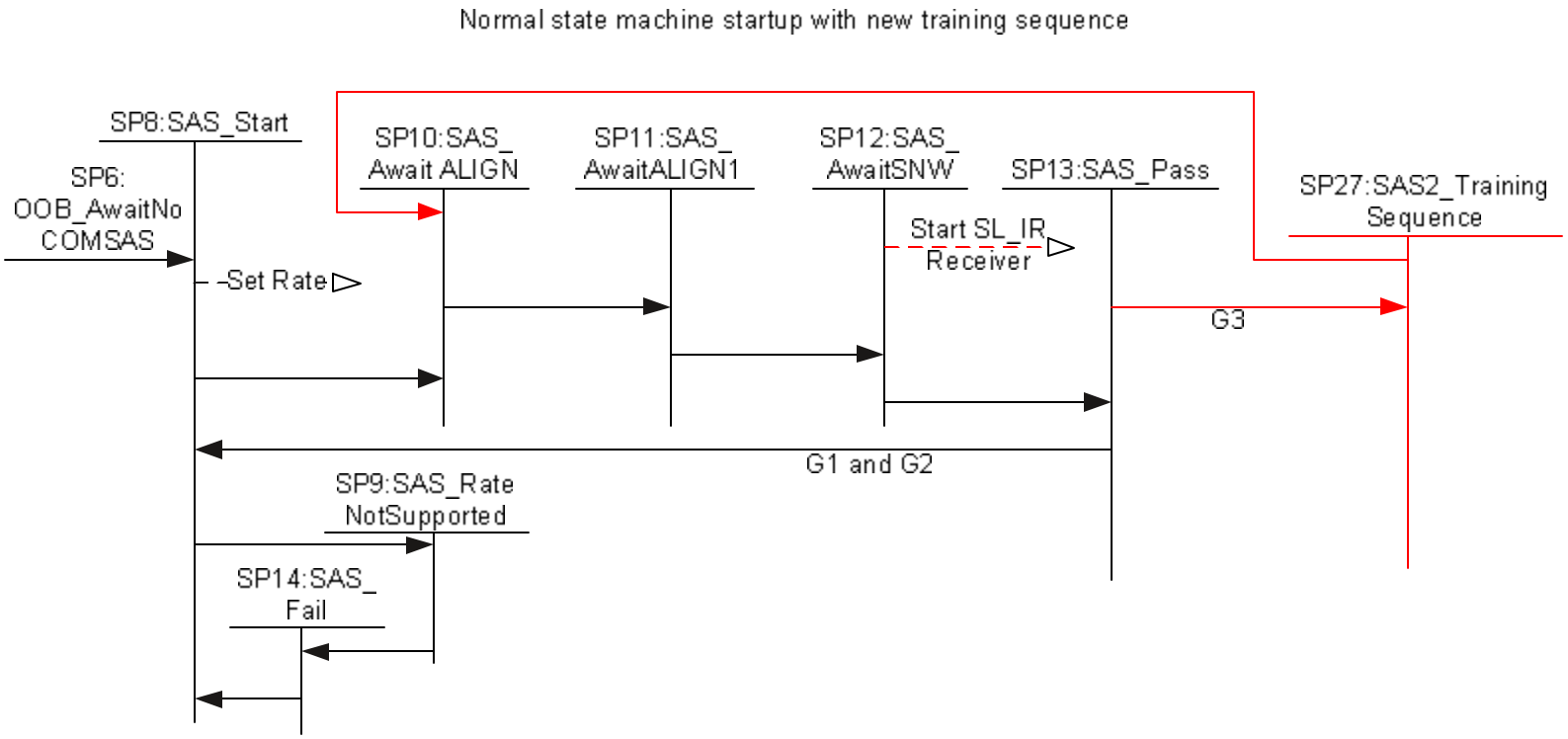
Final G3 Speed Negotiation Window Expanded



If a phy has not both transmitted and received TrainDone within 20 ms the OOB sequence restarts and the highest speed is not reported.

Note removal of final ALIGN(0) ALIGN(1) sequence at the end.
TrainDone$_p$ shall indicate Dword alignment and ready for communication.

Change to SAS Phy State Machine



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