KR, KX4 and KX LPI Parameters

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EEE timer and voltage values for BP PHYs

- Timing parameter for KX, KX4 and KR are defined in several tables.
- Some of the values are not consistent across tables and some are TBD.
- This presentation proposes consistent timing parameters and signal detect characteristics for the draft.
- Further investigation is needed to determine possible room for improved parameter values.

Clause 36 Transmitter LPI timing parameters (Table 36-3a)

Parameter	Description	Value	Units
T_{SL}	Local Sleep Time from entering TX_SLEEP state to transmit disable.	20	µs
T_{QL}	Local Quiet Time from Transmitter disabled to start of TX_REFRESH state.	2.5	ms
T_{UL}	Local Refresh Time from transmitter activated to TX_QUIET state	20	µs

Clause 36 Receiver LPI timing parameters (Table 36-3b)

Parameter	Description	Min	Max	Units
T_{QR}	The time the receiver wait for signal detect while in the RX_QUIET state before asserting a rx_fault	3	4	ms
T_{WR}	Time to wake remote link partner's receiver. TWR is set by the remote link partner during Auto-negotiation.	10	20	µs
T_{DA}	Time to deactivate receiver to handle debounce	1	2	µs

- Remote receiver can ask for four T_{WR} values: 10us, 13us, 17us and 20us.

Clause 48 Transmitter LPI timing parameters (Table 48-9)

Parameter	Description	Value	Units
T_{SL}	Local Sleep Time from entering TX_SLEEP state to transmit disable.	20	µs
T_{QL}	Local Quiet Time from Transmitter disabled to start of TX_REFRESH state.	2.5	ms
T_{UL}	Local Refresh Time from transmitter activated to TX_QUIET state	20	µs

Clause 48 Receiver LPI timing parameters (Table 48-10)

Parameter	Description	Min	Max	Units
T_{QR}	The time the receiver wait for signal detect while in the RX_QUIET state before asserting a rx_fault	3	4	ms
T_{WR}	Time to wake remote link partner's receiver. TWR is set by the remote link partner during Auto-negotiation.	8	18	µs
T_{DA}	Time to deactivate receiver to handle debounce	1	2	µs

- Remote receiver can ask for four T_{WR} values: 8us, 11us, 15us and 18us.

Clause 49 Transmitter LPI timing parameters (Table 49-2)

Parameter	Description	Value	Units
T_{SL}	Local Sleep Time from entering TX_SLEEP state to transmit disable.	5	µs
T_{QL}	Local Quiet Time from Transmitter disabled to start of TX_REFRESH state.	1.7	ms
T_{UL}	Local Refresh Time from transmitter activated to TX_QUIET state	17	µs

Clause 49 Receiver LPI timing parameters (Table 49-3)

Parameter	Description	Min	Max	Units
T_{QR}	The time the receiver wait for signal detect while in the RX_QUIET state before asserting a rx_fault	2	3	ms
T_{WR}	Time to wake remote link partner's receiver. TWR is set by the remote link partner during Auto-negotiation.	11	17	µs
T_{DA}	Time to deactivate receiver to handle debounce	1	2	µs

- Remote receiver can ask for four T_{WR} values: 11us, 13us, 15us and 17us.

Clause 72 Transmitter LPI timing parameters (Table 72-5a)

Parameter	Description	Value	Units
T_{QL}	Local Quiet Time from Transmitter disabled to start of TX_REFRESH state.	1.7	ms
T_{UL}	Number of training frames sent to refresh receiver	40	training frames

Clause 72 Receiver LPI timing parameters (Table 72-5b)

Parameter	Description	Min	Max	Units
T_{WR}	Time to wake remote link partner's receiver. TWR is set by the remote link partner during Auto-negotiation.	26	40	training frames
T_{DA}	Time to deactivate receiver to handle debounce	1	2	µs

- Remote receiver can ask for four T_{WR} values: 26, 30, 35 and 40 training frames.

Clause 70 Transmitter Characteristics for 1000BASE-KX (Table 70-4)

Parameter	Subclause reference	Value	Units
Differential peak-to-peak output voltage (min.) with TX enabled (V_{TW})	70.6.5	800	mV
Differential peak-to-peak output voltage (max.) with TX disabled (V_{TQ})	70.6.5	30	mV
Transmitter deactivation time from active (T_{TD}) for EEE	70.6.5	500	ns
Transmitter activation time from EEE quiet mode (T_{TA})	70.6.5	500	ns

Clause 71 Transmitter Characteristics for 10GBASE-KX4 (Table 71-4)

Parameter	Subclause reference	Value	Units
Differential peak-to-peak output voltage (min.) with TX enabled (V_{TW})	71.6.6	800	mV
Differential peak-to-peak output voltage (max.) with TX disabled (V_{TQ})	71.6.6	30	mV
Transmitter deactivation time from active (T_{TD}) for EEE	71.6.6	500	ns
Transmitter activation time from EEE quiet mode (T_{TA})	71.6.6	500	ns

Clause 72 Transmitter Characteristics for 10GBASE-KR (Table 72-6)

Parameter	Subclause reference	value	Units
Differential peak-to-peak output voltage (min.) with TX enabled (V_{TW})	72.6.5	90%*	mV
Differential peak-to-peak output voltage (max.) with TX disabled (V_{TQ})	72.6.5	30	mV
Transmitter deactivation time from active (T_{TD}) for EEE	72.6.5	500	ns
Transmitter activation time from EEE quiet mode (T_{TA})	72.6.5	500	ns

- 90% of the peak-to-peak transmitter output voltage during the active state.

Receiver Characteristics for KX, KX4 and KR

- V_{SA}, V_{SD}, T_{SD} and T_{SA} are not required to establish interoperability.
  - Transmitter voltage specifications are sufficient for receiver designs.
  - Delivered voltage at the receiver is a function of the transmitter and the channel. Specifying V_{SA} and V_{SD} constrains the channel, which is not consistent with the informative channel specified in the Backplane Ethernet standard.
  - T_{SD} and T_{SA} are subset of the refresh and debounce timers.
- Propose to remove these four receiver characteristic from Clause 70, Clause 71 and Clause 72.

Clause 78 Table 78-2

Protocol	Tw_phy usec		Ts usec		Tq usec		Tr usec	
	Min	Max	Min	Max	Min	Max	Min	Max
10GBASE-KR	26 training frames	40 training frames	4.5	5.5	1870	1530	36 training frames	44 training frames
10GBASE-KX4	8	18	18	22	2250	2750	18	22
1000BASE-KX	10	20	18	22	2250	2750	18	22

- 10% tolerance added to the SLEEP, QUIET and REFRESH timer values.

Thank You