USB 3.1 ENGINEERING CHANGE NOTICE

Title: U1 Minimum Residency Time
Applied to: USB 3.1

Brief description of the functional changes proposed:
To specify minimum of 3-us U1 residency time once U1 is entered. It allows a port sufficient time to prepare itself entering U1 and getting ready for U1 exit. In addition added a clarification when a port shall initiate entry into Recovery due to bit errors if LPMA is corrupted. .

Benefits as a result of the proposed changes:
To prevent a port initiating U1 exit before its link partner is ready to respond, a potential interop reliability issue.

An assessment of the impact to the existing revision and systems that currently conform to the USB specification:
No.

An analysis of the hardware implications:
New implementations only

An analysis of the software implications:
No

An analysis of the compliance testing implications:
Additional compliance test will be added to check minimum U1 residency.

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Actual Change Requested

(a). From Text (and location): Section 7.2.4.2.1

Table 7-1. Link Flow Control Timers Summary

Timers	Timeout Value (µs)
PM_LC_TIMER	4
PM_ENTRY_TIMER	8
Ux_EXIT_TIMER	6000

(a). To Text (and location): Section 7.2.4.2.1

Table 7-2. Link Flow Control Timers Summary

Timers	Timeout Value (µs)
PM_LC_TIMER	4
PM_ENTRY_TIMER	8
Ux_EXIT_TIMER	6000
U1_MIN_RESIDENCY_TIMER	3

(b). From Text (and location): Section 7.2.4.2.1

A port shall operate the PM_ENTRY_TIMER based on the following rules:

- A port accepting the request to enter a low power link state shall start PM_ENTRY_TIMER after the last symbol of LAU is sent.
- A port accepting the request to enter a low power link state shall disable and reset PM_ENTRY_TIMER upon receipt of the last symbol of LPMA or detection of a TS1 ordered set at its receiver.

(b). To Text (and location): Section 7.2.4.2.1

A port shall operate the PM_ENTRY_TIMER based on the following rules:

- A port accepting the request to enter a low power link state shall start PM_ENTRY_TIMER after the last symbol of LAU is sent.
- A port accepting the request to enter a low power link state shall disable and reset PM_ENTRY_TIMER upon receipt of the last symbol of LPMA or detection of a TS1 ordered set at its receiver. Note that if LPMA is corrupted, the port may lose bit-lock at its receiver before PM_ENTRY_TIMER times out. Under this situation, the port shall not initiate entry to Recovery due to bit errors, but continue to remain in U0 until PM_ENTRY_TIMER times out.

(c). From Text (and location): Section 7.2.4.2.7

A Ux_EXIT_TIMER defined in Section 7.2.4.2.1 is only applied when a port is attempting an exit from U1 or U2. It shall not be applied when a port is initiating a U3 wakeup.

The exit from U1/U2 shall meet the following flow. The U3 wakeup follows the same flow with the exception that Ux_EXIT_TIMER is disabled during U3 wakeup.

- If a port is initiating U1/U2 Exit, it shall start sending U1/U2 LFPS Exit handshake signal defined in Section 6.9.2 and start the Ux_EXIT_TIMER.
- If a port is initiating U3 wakeup, it shall start sending U3 LFPS wakeup handshake signal defined in Section 6.9.2.
- A port upon receiving U1/U2 Exit or U3 wakeup LFPS handshake signal shall start U1/U2 exit or U3 wakeup by responding with U1/U2 Exit or U3 wakeup LFPS signal defined in Section 6.9.2.
- Upon a successful LFPS handshake before tNoLFPSResponseTimeout defined in Table 6-30, a port shall transition to Recovery.

(c). To Text (and location): Section 7.2.4.2.7

A Ux_EXIT_TIMER defined in Section 7.2.4.2.1 is only applied when a port is attempting an exit from U1 or U2. It shall not be applied when a port is initiating a U3 wakeup.

A U1_MIN_RESIDENCY_TIMER defined in Section 7.2.4.2.1 applies to a port in U1 only. For a port initiating U1 entry, it is measured at the connector side from when it sends LPMA to when it starts transmitting U1_LFPS_Exit signal. For a port accepting U1 entry, it is measured at the connector side from when it receives LPMA to when it starts transmitting U1_LFPS_Exit signal. If LPMA is corrupted, it is measured from when PM_ENTRY_TIMER times out, to when it starts transmitting U1_LFPS_Exit signal.

- A port shall not initiate the U1 exit until the U1_MIN_RESIDENCY_TIMER expires.

The exit from U1/U2 shall meet the following flow. The U3 wakeup follows the same flow with the exception that Ux_EXIT_TIMER is disabled during U3 wakeup.

- If a port is initiating U1/U2 Exit, it shall start sending U1/U2 LFPS Exit handshake signal defined in Section 6.9.2 and start the Ux_EXIT_TIMER.
- If a port is initiating U3 wakeup, it shall start sending U3 LFPS wakeup handshake signal defined in Section 6.9.2.
- A port upon receiving U1/U2 Exit or U3 wakeup LFPS handshake signal shall start U1/U2 exit or U3 wakeup by responding with U1/U2 Exit or U3 wakeup LFPS signal defined in Section 6.9.2.
- Upon a successful LFPS handshake before tNoLFPSResponseTimeout defined in Table 6-30, a port shall transition to Recovery.