

# USB 3.2 ENGINEERING CHANGE NOTICE

## Title: Requirement relaxation on datapath in gen1 pass-through loopback

Applied to: USB 3.2\_r1.0 Sep. 22, 2017

### Brief description of the functional changes proposed:

Currently in pass-through loopback mode, while operating in gen1, the re-timer is required to forward the data 'as is'. Meaning it is required to preserve the disparity of the 10 bit symbol and also forward bit error if such exists. This creates un-necessary difficulty in implementation. Today's test equipment can test the data in the 8b+k level and it's not required to follow the injected sequence bit-by-bit. Also Re-timer will substitute a symbol with a single bit error to the error symbol (K28.4) which enable the test equipment to check the receiver even if the re-timer is forwarding the data in 8b level.

### Benefits as a result of the proposed changes:

Re-timers that implement this ECR will be able to significantly relax their implementation without having any functional impact.

### An assessment of the impact to the existing revision and systems that currently conform to the USB specification:

1. No impact to USB 3.0 ecosystem.
2. No impact to any early USB3.1 implementation.
3. Test equipment will need to analyze return data stream in pass-through loopback in 8b+k level.

### An analysis of the hardware implications:

Any New Re-timers may choose to relax its implementation.

### An analysis of the software implications:

None

### An analysis of the compliance testing implications:

Update Rx compliance criteria:

If BERT detector receive more than a single K28.4 or 10b valid non D0.0 symbol the test fails.

- K28.4 generated when bit/bits error produced invalid 10b symbol at Re-timer Rx
- K28.4 treated as a single bit error
- Non D0.0 generated when bit/bits produce valid 10b non D0.0 symbol at Re-timer Rx

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## Actual Change

### (a). From Text : Section E.3.12.1.

- The re-timer shall not perform any error correction while looping through the traffic.

### (a). To Text :Section E.3.12.1

- The re-timer shall not perform any error correction while looping through the traffic. Additionally, in Gen 1 operation, it shall perform one of the following.
  - Forward all data as is including bit errors.
  - Replace an error symbol with K28.4. Note that the re-timer shall preserve the running disparity at its transmitter but is not required to use the same disparity as decoded by the remote receiver.

### (b). From Text : Section 7.5.11.3.1

- The loopback slave shall not modify the received symbols, other than lane polarity inversion if necessary, and SKP ordered set, which may be added or dropped as required.

Note: In Gen 1 operation this implies that the loopback slave should disable or bypass its own 8b/10b encoder/decoder and scrambler/descrambler. In Gen 2 operation this implies that the loopback slave should disable or bypass its own scrambler/descrambler.

### (b). To Text : Section 7.5.11.3.1

- ~~• The loopback slave shall not modify the received symbols, other than lane polarity inversion if necessary, and SKP ordered set, which may be added or dropped as required.~~

~~Note: In Gen 1 operation this implies that the loopback slave should disable or bypass its own 8b/10b encoder/decoder and scrambler/descrambler. In Gen 2 operation this implies that the loopback slave should disable or bypass its own scrambler/descrambler.~~

- In Gen 1 operation, the loopback slave shall retransmit the received data in one of the following methods.
  - Loopback in the 10b domain – The loopback slave shall retransmit the received 10b symbols exactly as they were received. It may perform the lane polarity inversion and add or remove SKP OS for clock offset compensation as necessary.  
Note: This implies that the loopback slave should disable or bypass its own 8b/10b encoder/decoder and scrambler/descrambler.
  - Loopback in the 8b domain – The loopback slave shall retransmit the decoded 8b symbols exactly as they were received. It shall replace any invalid 10b symbol with K28.4 and maintain the running disparity in its transmitter as describes in section 6.3.1. The loopback slave shall perform the lane polarity inversion and add or remove SKP OS for clock offset compensation as necessary.  
Note: This implies that the retransmitted symbol may not have the same disparity as the symbol received.  
In addition, for the loopback master a single bit error will appear as a whole symbol error.

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- In Gen 2 operation, the loopback slave shall retransmit all received blocks exactly as they were received without performing any error corrections. It may perform the lane polarity inversion and add or remove SKP OS for clock offset compensation as necessary.  
Note: This implies that the loopback slave should disable or bypass its own scrambler/descrambler.