

# USB 3.2 ENGINEERING CHANGE NOTICE

## Title: TSx Symbols 14 & 15 No Check Applied to: USB 3.2\_r1.0 Sep. 22, 2017

### Brief description of the functional changes:

A SRIS retimer may receive TSx with DC balance inserted on Symbols 14 & 15 from its link partner. This DC balance insertion may modify the running DC balance from more 1s than 0s to more 0s than 1s or visa versa. If the running DC balance the SRIS retimer receives from its link partner is >15 but <31, it may insert DC balance on only Symbol 15 only. This can lead to combinations of Symbol 14 and 15 which are invalid. This does not happen with the DC balance is generated locally to the retimer. Note that Figure E-5, indicates a RD monitor is present in the SRIS retimer. The failure seen is Compliance TD 7.26 failing as well as links dropping from USB3.2 gen2 to USB2.0 if receiver IP is checking Symbols 14 and 15 to determine if the TS Ordered Set is valid. This was seen in the transition from Recovery.Active to U0.

This ECN removes Symbols 14 and 15 from the checking for valid TS Ordered Sets. This will remove the interoperability issues that currently exist with SRIS retimers in the field.

### Legal DC Balance Combinations from Link Partner

DC Balance Condition	Symbol 14	Symbol 15
DC Balance > 31 and 0s greater	DFh	F7h
DC Balance > 31 and 1s greater	20h	08h
DC Balance > 15 and 0s greater	n/a	F7h
DC Balance > 15 and 1s greater	n/a	08h

### DC balance Combinations After Retimer

DC Balance Condition	Symbol 14	Symbol 15
DC Balance > 31 and 0s greater	DFh	F7h
DC Balance > 31 and 1s greater	20h	08h
DC Balance > 15 and 0s greater	None, DFh, or 20h (invalid)	F7h
DC Balance > 15 and 1s greater	None, 20h, or DFh (invalid)	08h

The specification defines the exit conditions in the following states to not check Symbols 14 & 15 of TS Ordered Sets

7.5.4.8.2: Exit from Polling.Active the receivers shall exclude Symbols 14 & 15

7.5.4.9.2: Exit from Polling.Configuration excluding Symbols 14 & 15

7.5.10.3.2: Exit from Recovery.Active excluding Symbols 14 & 15

7.5.10.4.2: Exit from Recovery.Configuration excluding Symbols 14 & 15.

### Benefits as a result of the changes:

This ECN improves the interoperability of retimers with receivers in the field. The vast majority of receivers do not check Symbols 14 and 15 when checking for valid TS Ordered Sets. Polling.Active, Polling.Configuration, Recovery.Active, and Recovery.Configuration states do not check Symbols 14 and 15 when exiting. This change simplifies the LTSSM and TS Ordered Set checking and remove the interoperability issue.

The failures seen were in transitioning from Recovery.Active to U0 and the link transitioning to eSS.disabled.

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

1. Some IP in the field may have implemented checking Symbols 14 and 15 when checking for valid TS Ordered Sets. This IP can be granted a waiver for some period of time or potentially changed in firmware.
2. No impact to IP which does not check Symbols 14 and 15 when checking for valid TS Ordered Sets.

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**An analysis of the hardware implications:**

All major IP vendors have confirmed they are not checking Symbols 14 and 15 DC balance symbols in the transition from Recovery.Active to U0.

**An analysis of the software implications:**

Firmware might need to be updated. No software implications.

**An analysis of the compliance testing implications:**

Compliance test TD 7.26 should be modified to remove the check of Symbols 14 and 15.

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## Actual Change

### (a). From Text : Section 6.4.1.2.2

Receivers may check Symbols 14 and 15 for the following values when determining whether a TS Ordered Set is valid: The appropriate TS Identifier Symbol after de-scrambling, or a valid DC Balance Symbol of DFh or 20h before de-scrambling for Symbol 14, or a valid DC Balance Symbol of F7h or 08h before de-scrambling for Symbol 15.

A new ordered set required for Gen 2 operation is the Start of Data Stream (SDS) Ordered set. This is only defined for Gen 2 operation and does not have a Gen 1 counterpart. It shall be transmitted during Polling.Idle, Recovery.Idle, and Hot Reset.Exit to define the transition from Ordered Set Blocks to a Data Stream. It shall not be transmitted at any other time. While not in the Loopback state, the Block following an SDS Ordered Set shall be a Data Block and the first Symbol of that Data Block is the first Symbol of the Data Stream.

### (a). To Text :Section 6.4.1.2.2

Receivers shall not check Symbols 14 and 15 when determining whether a TS Ordered Set is valid.

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