USB Type-C ENGINEERING CHANGE NOTICE

Title: AC Coupling Requirements for Alternate Modes
Applied to: USB Type-C Specification Release 1.1

Brief description of the functional changes:
Correct a spec error concerning which pins in the plug of an Alternate Mode adapter cable or direct connect system need to use AC cap. Add further explanatory text and figures.

Benefits as a result of the changes:
Avoid incorrect implementations and reduce risk of consequent damage.

An assessment of the impact to the existing revision and systems that currently conform to the USB specification:
Any incorrect implementations will need to be updated.

An analysis of the hardware implications:
Any incorrect implementations will need to be updated.

An analysis of the software implications:
None

An analysis of the compliance testing implications:
Test fixtures etc that have incorrect implementations will need to be updated.

Actual Change

Section 5.1.2.2 Alternate Mode Electrical Requirements

From Text:

5.1.2.2 Alternate Mode Electrical Requirements

Signaling during the use of Alternate Modes shall comply with all relevant cable assembly, adapter assembly and electrical requirements of Chapter 3.

Two requirements are specified in order to minimize risk of damage to the USB SuperSpeed transmitters and receivers in a USB host or device:

- When operating in an Alternate Mode and pin pairs A2, A3 (TX1) and B2, B3 (TX2) are used, these shall be AC coupled in or before the plug.
- Alternate Mode signals being received at the USB Type-C receptacle shall not exceed the value specified for VTX-DIFF-PP in Table 6-17 of the *USB 3.1* specification.

When in an Alternate Mode, activity on the SBU lines shall not interfere with *USB PD* BMC communications or interfere with detach detection.

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Signaling during the use of Alternate Modes shall comply with all relevant cable assembly, adapter assembly and electrical requirements of Chapter 3.

Two requirements are specified in order to minimize risk of damage to the USB SuperSpeed transmitters and receivers in a USB host or device:

- When operating in an Alternate Mode and pin pairs A11, A10 (RX1) ~~A2, A3 (TX1)~~ and ~~B2, B3 (TX2)~~B11, B10 (RX2) are used, these shall be AC coupled in or before the USB Type-C plug.
- When operating in an Alternate Mode then the DC blocking capacitors in the system used on pin pairs A2, A3 (TX1) and B2, B3 (TX2) for USB Superspeed signaling shall also be used for Alt Mode signaling.
- Alternate Mode signals being received at the USB Type-C receptacle shall not exceed the value specified for VTX-DIFF-PP in Table 6-17 of the *USB 3.1* specification.

When in an Alternate Mode, activity on the SBU lines shall not interfere with *USB PD* BMC communications or interfere with detach detection.

The AC coupling requirement results from the use of AC coupling in the *USB 3.1* specification. This requires that the TX signals are AC coupled within the system before the physical connector, but that the RX signals are DC coupled within the system. There is thus just one DC blocking capacitor in each connection between the Superspeed transmitter PHY and the Superspeed receiver PHY. Figure 5-XX shows the key components in a typical Alternate Mode implementation using a Type-C to Type-C full featured cable. This implementation meets the AC coupling requirements, as the capacitors required to be in or before the USB Type-C plug are implemented behind the TX pins in the port partner.

It should be noted that the AC capacitor is placed in the system next to the Type-C receptacle, so that the system components (the orientation switch, the Alternate Mode selection multiplexor, and other system components) operate within the common mode limits set by the local PHY. This applies, in the USB Superspeed operation, to both the transmit path and the receive path within the local system. The receive path is isolated from the common mode of the port partner by the AC cap that is implemented on the TX path in the port partner.

Figure 5-XX Alternate Mode Implementation using a Type-C to Type-C cable

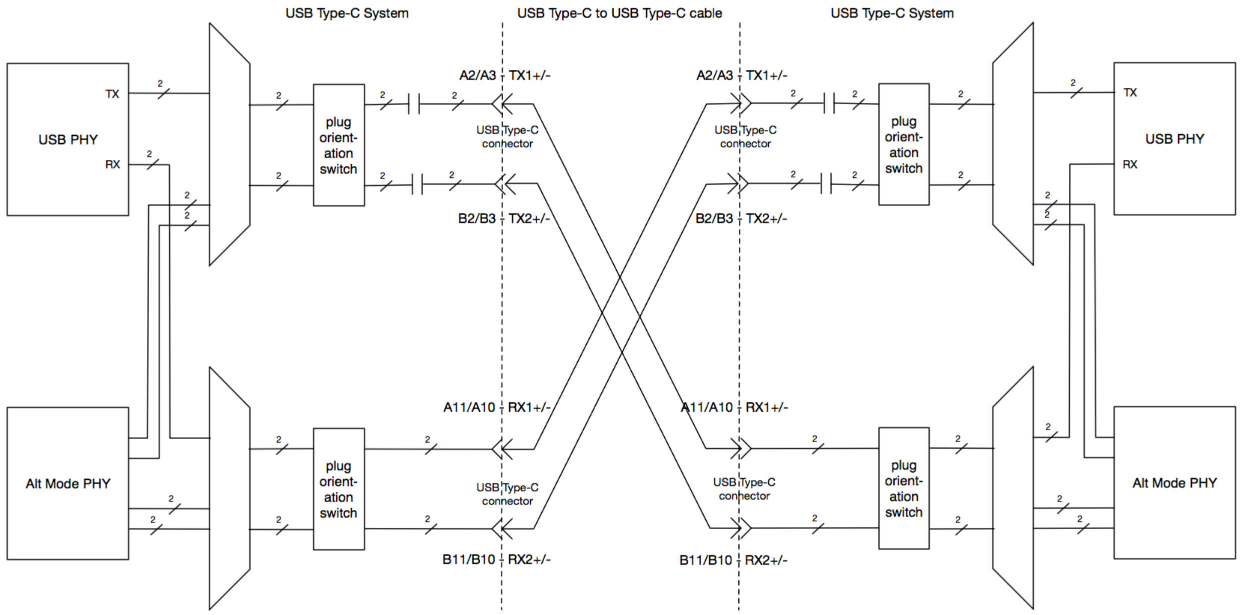

Figure 5-YY shows the key components in a typical Alternate Mode implementation using either a Type-C to Alternate Mode connector cable, or a Type-C Alternate Mode Direct Attach device. In both cases it is necessary that the system path behind the RX pins on the USB receptacle be isolated from external common mode. This requirement is met by incorporating capacitors in or behind the USB Type-C plug on the Alternate Mode cable or Alternate Mode device.

In the case where the Alt Mode System is required to implement DC blocking capacitors within the system between active system components and the Alt Mode connector, then this provides the necessary isolation and further capacitors in the USB Type-C to Alt Mode adapter cable are not necessary, and may indeed impair signal integrity.

Figure 5-YY Alternate Mode Implementation using a Type-C to Alternate Mode cable or device