USB Power Delivery ENGINEERING CHANGE NOTICE

Title: VCONN_Swap Clarification
Applied to: USB Power Delivery Specification Revision 3.0 V1.1

Brief description of the functional changes proposed:
Clarify the behaviour of a device attempting to become VCONN source, when the Port Partner does not support VCONN_Swap.

Benefits as a result of the proposed changes:
Ensures better inter-operability.

An assessment of the impact to the existing revision and systems that currently conform to the USB specification:
None.

An analysis of the hardware implications:
None.

An analysis of the software implications:
None.

An analysis of the compliance testing implications:
This provides clarity for Compliance Testing which may have been lacking before.

USB Power Delivery ENGINEERING CHANGE NOTICE

Actual Change

(a). Section 6.3.11, Page 110

From Text:

6.3.11 VCONN_Swap Message

The ***VCONN_Swap*** Message ***Shall*** be supported by any Port that can operate as a VCONN Source.
The ***VCONN_Swap*** Message ***May*** be sent by either Port Partner to request an exchange of VCONN Source. The recipient of the Message ***Shall*** respond by sending an ***Accept*** Message, ***Reject*** Message or ***Wait*** Message.

- If an ***Accept*** Message is sent, the Port Partners ***Shall*** perform a VCONN Swap. The new VCONN Source ***Shall*** send a ***PS_RDY*** Message within ***tVCONNSourceOn*** to indicate that it is now sourcing VCONN. The initial VCONN Source ***Shall*** cease sourcing VCONN within ***tVCONNSourceOff*** of receipt of the last bit of the ***EOP*** of the ***PS_RDY*** Message.
- If a ***Reject*** Message is sent, the requester is informed that the recipient is unable, or unwilling, to do a VCONN Swap and no action ***Shall*** be taken. A ***Reject*** Message ***Shall*** only be sent by the Port that is not presently the Vconn Source in response to a ***VCONN_Swap*** Message. The Port that is presently the Vconn Source ***Shall Not*** send a ***Reject*** Message in response to ***VCONN_Swap*** Message.
- If a ***Wait*** Message is sent, the requester is informed that a VCONN Swap might be possible in the future but that no immediate action ***Shall*** be taken. A ***Wait*** Message ***Shall*** only be sent by the Port that is not presently the Vconn Source in response to a ***VCONN_Swap*** Message. The Port that is presently the Vconn Source ***Shall Not*** send a ***Wait*** Message in response to ***VCONN_Swap*** Message.

The DFP (Host), UFP (Device) roles and Source of V_{BUS} ***Shall*** remain unchanged as well as the Rp/Rd resistors on the CC wire during the VCONN Swap process.
Note: VCONN ***Shall*** be continually sourced during the VCONN Swap process in order to maintain power to the Cable Plug(s) i.e. make before break.
Before communicating with a Cable Plug a Port ***Shall*** ensure that it is the VCONN Source and that the Cable Plugs are powered, by performing a VCONN swap if necessary. Since it cannot be guaranteed that the present VCONN Source is supplying VCONN, the only means to ensure that the Cable Plugs are powered is for a Port wishing to communicate with a Cable Plug to become the VCONN Source. If a ***Not_Supported*** Message is returned in response to the ***VCONN_Swap*** Message then the Port is allowed to become the VCONN Source until a Hard Reset or Detach.
Note: even when it is presently the VCONN Source, the Sink is not permitted to initiate an AMS with a Cable Plug unless Rp is set to ***SinkTxOk*** (see Section 6.9).

To Text:

6.3.11 VCONN_Swap Message

The ***VCONN_Swap*** Message ***Shall*** be supported by any Port that can operate as a VCONN Source.
The ***VCONN_Swap*** Message ***May*** be sent by either Port Partner to request an exchange of VCONN Source. The recipient of the Message ***Shall*** respond by sending an ***Accept*** Message, ***Reject*** Message, ~~or~~ ***Wait*** Message or ***Not_Supported*** Message.

- If an ***Accept*** Message is sent, the Port Partners ***Shall*** perform a VCONN Swap. The new VCONN Source ***Shall*** send a ***PS_RDY*** Message within ***tVCONNSourceOn*** to indicate that it is now sourcing VCONN. The initial VCONN Source ***Shall*** cease sourcing VCONN within ***tVCONNSourceOff*** of receipt of the last bit of the ***EOP*** of the ***PS_RDY*** Message.

- If a ***Reject*** Message is sent, the requester is informed that the recipient is unable, or unwilling, to do a VCONN Swap and no action ***Shall*** be taken. A ***Reject*** Message ***Shall*** only be sent by the Port that is not presently the Vconn Source in response to a ***VCONN_Swap*** Message. The Port that is presently the Vconn Source ***Shall Not*** send a ***Reject*** Message in response to ***VCONN_Swap*** Message.
- If a ***Wait*** Message is sent, the requester is informed that a VCONN Swap might be possible in the future but that no immediate action ***Shall*** be taken. A ***Wait*** Message ***Shall*** only be sent by the Port that is not presently the Vconn Source in response to a ***VCONN_Swap*** Message. The Port that is presently the Vconn Source ***Shall Not*** send a ***Wait*** Message in response to ***VCONN_Swap*** Message.
- If a ***Not_Supported*** Message is sent, the requester is informed that Vconn Swap is not supported. The Port that is not presently the Vconn Source ***May*** turn on Vconn when a ***Not_Supported*** Message is received in response to a ***VCONN_Swap*** Message.

The DFP (Host), UFP (Device) roles and Source of V_{BUS} ***Shall*** remain unchanged as well as the Rp/Rd resistors on the CC wire during the VCONN Swap process.
Note: VCONN ***Shall*** be continually sourced during the VCONN Swap process in order to maintain power to the Cable Plug(s) i.e. make before break.

Before communicating with a Cable Plug a Port ***Shall*** ensure that it is the VCONN Source and that the Cable Plugs are powered, by performing a VCONN swap if necessary. Since it cannot be guaranteed that the present VCONN Source is supplying VCONN, the only means to ensure that the Cable Plugs are powered is for a Port wishing to communicate with a Cable Plug to become the VCONN Source. If a ***Not_Supported*** Message is returned in response to the ***VCONN_Swap*** Message then the Port is allowed to become the VCONN Source until a Hard Reset or Detach.
Note: even when it is presently the VCONN Source, the Sink is not permitted to initiate an AMS with a Cable Plug unless Rp is set to ***SinkTxOk*** (see Section 6.9).

(b). Section 6.12.1, Table 6-61, Page 213

From Text:

Table 6-61 Applicability of Control Messages

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Note 4: ***Shall*** be supported by any Port that can operate as a VCONN Source.

To Text:

Table 6-61 Applicability of Control Messages

...

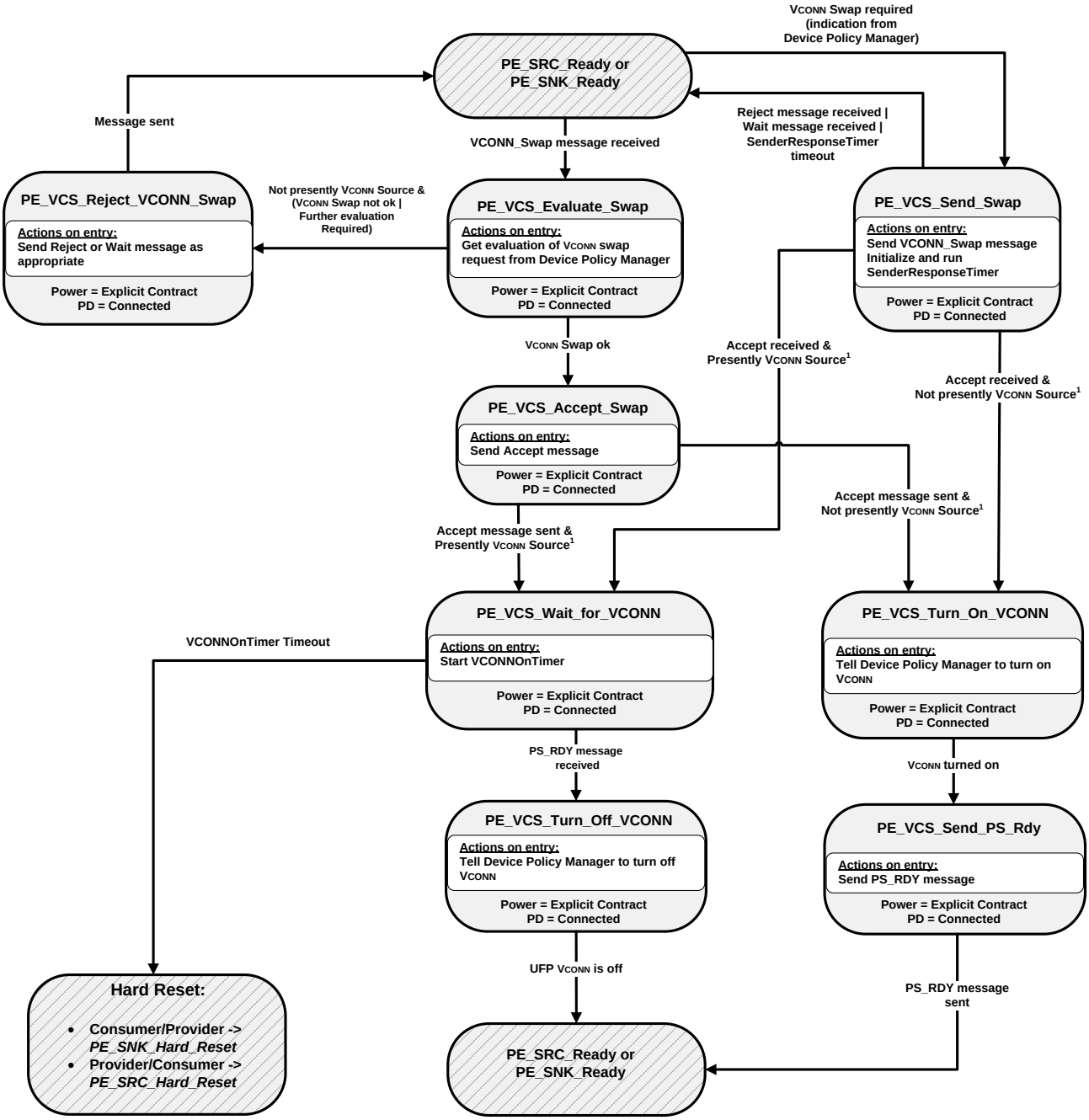
Note 4: ***Shall*** be supported by any Port that can supply VCONN.

(c). Section 8.3.3.17, Page 480

From Text:

The State Diagram in this section ***Shall*** apply to Ports that supply VCONN. Figure 8-113 shows the state operation for a Port on sending or receiving a VCONN Swap request.

Figure 8-113 VCONN Swap State Diagram



[1] A Port is presently the VCONN Source if it has the responsibility for supplying VCONN even if VCONN has been turned off.

8.3.3.17.1.1 PE_VCS_Send_Swap State

The ***PE_VCS_Send_Swap*** state is entered from either the ***PE_SRC_Ready*** or ***PE_SNK_Ready*** state when the Policy Engine receives a request from the Device Policy Manager to perform a VCONN Swap.

On entry to the ***PE_VCS_Send_Swap*** state the Policy Engine ***Shall*** send a ***VCONN_Swap*** Message and start the ***SenderResponseTimer***.

The Policy Engine ***Shall*** transition to the ***PE_VCS_Wait_For_VCONN*** state when:

- An ***Accept*** Message is received and
- DFP current has VCONN turned on.

The Policy Engine ***Shall*** transition to the ***PE_VCS_Turn_On_VCONN*** state when:

- An ***Accept*** Message is received and
- DFP current has VCONN turned off.

The Policy Engine ***Shall*** transition back to either the ***PE_SRC_Ready*** or ***PE_SNK_Ready*** state for a DFP when:

- A ***Reject*** Message is received or
- A ***Wait*** Message is received or
- The ***SenderResponseTimer*** times out.

8.3.3.17.1.2 PE_VCS_Evaluate_Swap State

The ***PE_VCS_Evaluate_Swap*** state is entered from either the ***PE_SRC_Ready*** or ***PE_SNK_Ready*** state when the Policy Engine receives a ***VCONN_Swap*** Message.

On entry to the ***PE_VCS_Evaluate_Swap*** state the Policy Engine ***Shall*** request the Device Policy Manager for an evaluation of the VCONN Swap request. Note: Ports that are presently the VCONN Source must always accept a VCONN swap request (see Section 6.3.11).

The Policy Engine ***Shall*** transition to the ***PE_VCS_Accept_Swap*** state when:

- The Device Policy Manager indicates that a VCONN Swap is ok.

The Policy Engine ***Shall*** transition to the ***PE_VCS_Reject_Swap*** state when:

- The Port is not presently the VCONN Source and
- The Device Policy Manager indicates that a VCONN Swap is not ok or
- The Device Policy Manager indicates that a VCONN Swap cannot be done at this time.

8.3.3.17.1.3 PE_VCS_Accept_Swap State

On entry to the ***PE_VCS_Accept_Swap*** state the Policy Engine ***Shall*** send an ***Accept*** Message.

The Policy Engine ***Shall*** transition to the ***PE_VCS_Wait_For_VCONN*** state when:

- The ***Accept*** Message has been sent and
- The UFP's VCONN is on.

The Policy Engine ***Shall*** transition to the ***PE_VCS_Turn_On_VCONN*** state when:

- The ***Accept*** Message has been sent and
- The UFP's VCONN is off.

8.3.3.17.1.4 PE_VCS_Reject_Swap State

On entry to the ***PE_VCS_Reject_Swap*** state the Policy Engine ***Shall*** request the Protocol Layer to send:

- A ***Reject*** Message if the device is unable to perform a VCONN Swap at this time.
- A ***Wait*** Message if further evaluation of the VCONN Swap request is required. Note: in this case it is expected that the DFP will send a ***VCONN_Swap*** Message at a later time.

The Policy Engine ***Shall*** transition back to either the ***PE_SRC_Ready*** or ***PE_SNK_Ready*** state when:

- The ***Reject*** or ***Wait*** Message has been sent.

8.3.3.17.1.5 PE_VCS_UFP_Wait_for_VCONN State

On entry to the ***PE_VCS_Wait_For_VCONN*** state the Policy Engine ***Shall*** start the ***VCONNOnTimer***.
The Policy Engine ***Shall*** transition to the ***PE_VCS_Turn_Off_VCONN*** state when:

- A ***PS_RDY*** Message is received.

The Policy Engine ***Shall*** transition to either the ***PE_SRC_Hard_Reset*** or ***PE_SNK_Hard_Reset*** state when:

- The ***VCONNOnTimer*** times out.

8.3.3.17.1.6 PE_VCS_Turn_Off_VCONN State

On entry to the ***PE_VCS_Turn_Off_VCONN*** state the Policy Engine ***Shall*** tell the Device Policy Manager to turn off VCONN.
The Policy Engine ***Shall*** transition back to either the ***PE_SRC_Ready*** or ***PE_SNK_Ready*** state for a UFP when:

- The UFP's VCONN is off.

8.3.3.17.1.7 PE_VCS_Turn_On_VCONN State

On entry to the ***PE_VCS_Turn_On_VCONN*** state the Policy Engine ***Shall*** tell the Device Policy Manager to turn on VCONN.
The Policy Engine ***Shall*** transition to the ***PE_VCS_Send_Ps_Rdy*** state when:

- The UFP's VCONN is on.

8.3.3.17.1.8 PE_VCS_Send_PS_Rdy State

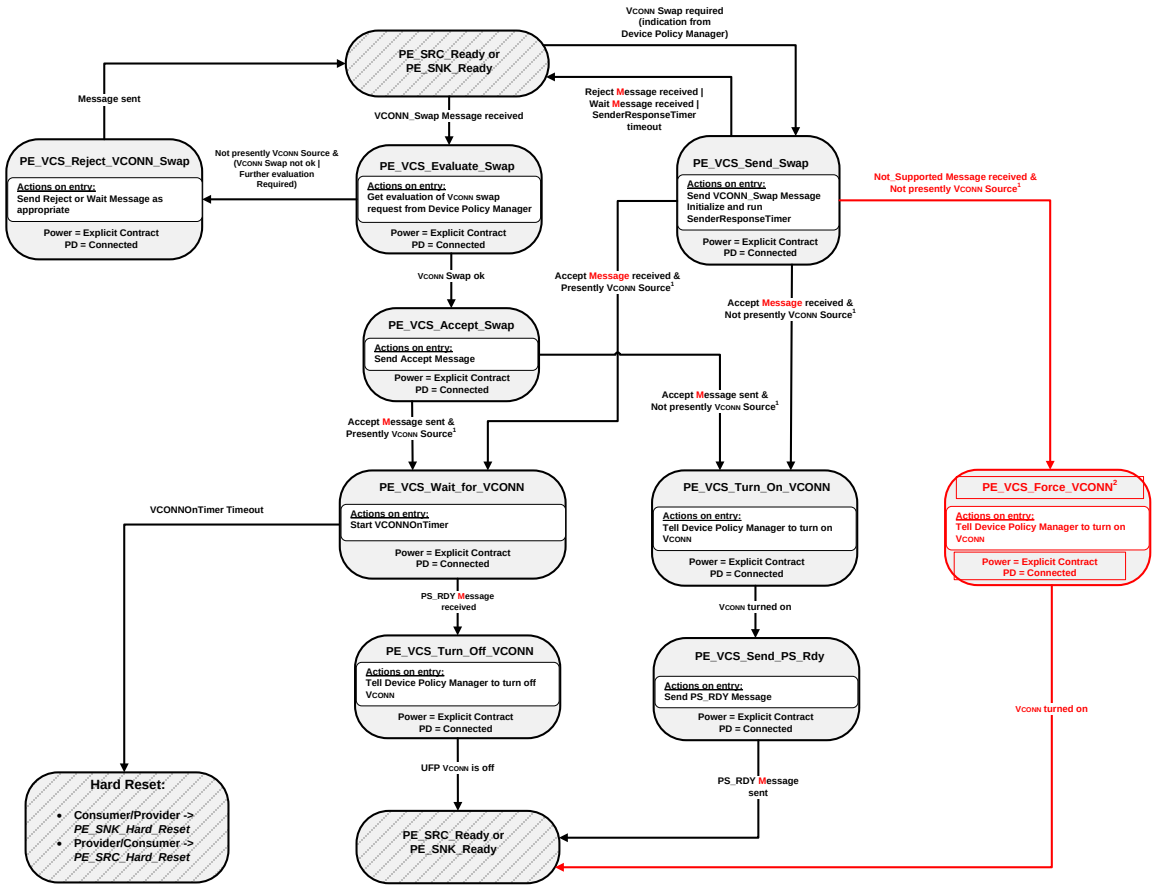
On entry to the ***PE_VCS_Send_Ps_Rdy*** state the Policy Engine ***Shall*** send a ***PS_RDY*** Message.
The Policy Engine ***Shall*** transition back to either the ***PE_SRC_Ready*** or ***PE_SNK_Ready*** state for a UFP when:

- The ***PS_RDY*** Message has been sent.

To Text:

The State Diagram in this section ***Shall*** apply to Ports that supply VCONN. Figure 8-113 shows the state operation for a Port on sending or receiving a VCONN Swap request.

Figure 8-113 VCONN Swap State Diagram



[1] A Port is presently the VCONN Source if it has the responsibility for supplying VCONN even if VCONN has been turned off.
[2] The ***PE_VCS_Force_VCONN*** state is ***Optional***.

8.3.3.17~~.1~~.1 PE_VCS_Send_Swap State

The ***PE_VCS_Send_Swap*** state is entered from either the ***PE_SRC_Ready*** or ***PE_SNK_Ready*** state when the Policy Engine receives a request from the Device Policy Manager to perform a VCONN Swap.

On entry to the ***PE_VCS_Send_Swap*** state the Policy Engine ***Shall*** send a ***VCONN_Swap*** Message and start the ***SenderResponseTimer***.

The Policy Engine ***Shall*** transition to the ***PE_VCS_Wait_For_VCONN*** state when:

- An ***Accept*** Message is received and
- The Port is presently the VCONN Source. ~~current has VCONN turned on.~~

The Policy Engine ***Shall*** transition to the ***PE_VCS_Turn_On_VCONN*** state when:

- An ***Accept*** Message is received and
- The Port is not presently the VCONN Source. ~~current has VCONN turned off.~~

The Policy Engine ***Shall*** transition back to either the ***PE_SRC_Ready*** or ***PE_SNK_Ready*** state ~~for a DFP~~ when:

- A ***Reject*** Message is received or
- A ***Wait*** Message is received or
- The ***SenderResponseTimer*** times out.

The Policy Engine ***May*** transition to the ***PE_VCS_Force_VCONN*** state when:

- A ***Not_Supported*** Message is received and
- The Port is not presently the VCONN Source.

8.3.3.17~~.1~~.2 PE_VCS_Evaluate_Swap State

The ***PE_VCS_Evaluate_Swap*** state is entered from either the ***PE_SRC_Ready*** or ***PE_SNK_Ready*** state when the Policy Engine receives a ***VCONN_Swap*** Message.

On entry to the ***PE_VCS_Evaluate_Swap*** state the Policy Engine ***Shall*** request the Device Policy Manager for an evaluation of the VCONN Swap request. Note: Ports that are presently the VCONN Source must always accept a VCONN swap request (see Section 6.3.11).

The Policy Engine ***Shall*** transition to the ***PE_VCS_Accept_Swap*** state when:

- The Device Policy Manager indicates that a VCONN Swap is ok.

The Policy Engine ***Shall*** transition to the ***PE_VCS_Reject_Swap*** state when:

- The Port is not presently the VCONN Source and
- The Device Policy Manager indicates that a VCONN Swap is not ok or
- The Device Policy Manager indicates that a VCONN Swap cannot be done at this time.

8.3.3.17~~.1~~.3 PE_VCS_Accept_Swap State

On entry to the ***PE_VCS_Accept_Swap*** state the Policy Engine ***Shall*** send an ***Accept*** Message.

The Policy Engine ***Shall*** transition to the ***PE_VCS_Wait_For_VCONN*** state when:

- The ***Accept*** Message has been sent and
- The ~~UFP~~Port's VCONN is on.

The Policy Engine ***Shall*** transition to the ***PE_VCS_Turn_On_VCONN*** state when:

- The ***Accept*** Message has been sent and
- The ~~UFP~~Port's VCONN is off.

8.3.3.17~~.1~~.4 PE_VCS_Reject_Swap State

On entry to the ***PE_VCS_Reject_Swap*** state the Policy Engine ***Shall*** request the Protocol Layer to send:

- A ***Reject*** Message if the device is unable to perform a VCONN Swap at this time.
- A ***Wait*** Message if further evaluation of the VCONN Swap request is required. Note: in this case it is expected that the ~~DFP~~Port will send a ***VCONN_Swap*** Message at a later time.

The Policy Engine ***Shall*** transition back to either the ***PE_SRC_Ready*** or ***PE_SNK_Ready*** state when:

- The ***Reject*** or ***Wait*** Message has been sent.

8.3.3.17~~.1~~.5 PE_VCS_UFP_Wait_for_VCONN State

On entry to the ***PE_VCS_Wait_For_VCONN*** state the Policy Engine ***Shall*** start the ***VCONNOnTimer***.

The Policy Engine ***Shall*** transition to the ***PE_VCS_Turn_Off_VCONN*** state when:

- A ***PS_RDY*** Message is received.

The Policy Engine ***Shall*** transition to either the ***PE_SRC_Hard_Reset*** or ***PE_SNK_Hard_Reset*** state when:

- The ***VCONNOnTimer*** times out.

8.3.3.17~~.1~~.6 PE_VCS_Turn_Off_VCONN State

On entry to the ***PE_VCS_Turn_Off_VCONN*** state the Policy Engine ***Shall*** tell the Device Policy Manager to turn off VCONN.

The Policy Engine ***Shall*** transition back to either the ***PE_SRC_Ready*** or ***PE_SNK_Ready*** state ~~for a UFP~~ when:

- The ~~UFP~~Port's VCONN is off.

8.3.3.17~~.1~~.7 PE_VCS_Turn_On_VCONN State

On entry to the ***PE_VCS_Turn_On_VCONN*** state the Policy Engine ***Shall*** tell the Device Policy Manager to turn on VCONN.

The Policy Engine ***Shall*** transition to the ***PE_VCS_Send_Ps_Rdy*** state when:

- The ~~UFP~~Port's VCONN is on.

8.3.3.17~~.1~~.8 PE_VCS_Send_PS_Rdy State

On entry to the ***PE_VCS_Send_Ps_Rdy*** state the Policy Engine ***Shall*** send a ***PS_RDY*** Message.

The Policy Engine ***Shall*** transition back to either the ***PE_SRC_Ready*** or ***PE_SNK_Ready*** state ~~for a UFP~~ when:

- The ***PS_RDY*** Message has been sent.

8.3.3.17.9 PE_VCS_Force_VCONN State

On entry to the ***PE_VCS_Force_VCONN*** state the Policy Engine ***Shall*** tell the Device Policy Manager to turn on VCONN.

The Policy Engine ***Shall*** transition back to either the ***PE_SRC_Ready*** or ***PE_SNK_Ready*** state when:

- The Port's VCONN is on.

(d). Section 8.3.3.25, Table 8-62, Page 510

From Text:

State name	Reference
USB Type-C VCONN Swap	
PE_VCS_Send_Swap	Section 8.3.3.17.1.1
PE_VCS_Evaluate_Swap	Section 8.3.3.17.1.2
PE_VCS_Accept_Swap	Section 8.3.3.17.1.3
PE_VCS_Reject_Swap	Section 8.3.3.17.1.4
PE_VCS_Wait_For_VCONN	Section 8.3.3.17.1.5
PE_VCS_Turn_Off_VCONN	Section 8.3.3.17.1.6
PE_VCS_Turn_On_VCONN	Section 8.3.3.17.1.7
PE_VCS_Send_Ps_Rdy	Section 8.3.3.17.1.8

To Text:

State name	Reference
USB Type-C VCONN Swap	
PE_VCS_Send_Swap	Section 8.3.3.17.~~1.~~1
PE_VCS_Evaluate_Swap	Section 8.3.3.17.~~1.~~2
PE_VCS_Accept_Swap	Section 8.3.3.17.~~1.~~3
PE_VCS_Reject_Swap	Section 8.3.3.17.~~1.~~4
PE_VCS_Wait_For_VCONN	Section 8.3.3.17.~~1.~~5
PE_VCS_Turn_Off_VCONN	Section 8.3.3.17.~~1.~~6
PE_VCS_Turn_On_VCONN	Section 8.3.3.17.~~1.~~7
PE_VCS_Send_Ps_Rdy	Section 8.3.3.17.~~1.~~8
PE_VCS_Force_VCONN	Section 8.3.3.17.9