USB Type-C ENGINEERING CHANGE NOTICE

Title: Allow Legacy TBT3 Gen 3 Passive Cables to Operate at Gen 4 Speed in USB4 Mode.
Applied to: USB Type-C Specification Release 2.2, October 2022

Brief description of the functional changes proposed:
True Thunderbolt 3 Passive Cables marked with TBT3 Gen 3 are practically identical to Passive USB4 Gen3 cables. In the USB Type-C Specification R2.2, with changes to support USB4 V2.0, USB4 Gen3 passive cables were promoted to Gen4 capable, however Table 5-1 still lists that the electrically identical TBT3 Gen 3 cable is limited to 40Gbps instead of 80Gbps. This change will make it clear the true passive TBT3 Gen3 cable is effectively a passive Gen4 USB4 cable, while also explicitly also describing the TBT3 Gen3 active linear redriver cable, which is still limited to 40Gbps.

Benefits as a result of the proposed changes:
Allows for more pre-USB4 cables from the Thunderbolt 3 era to be usable with future USB4v2 hardware at their full potential speed.

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:
USB4 v2 Hosts must carefully distinguish between TBT3 Gen3 active linear redriver cables and TBT3 Gen3 Passive cables. In the case that a Gen3 Passive cable is detected, allow 80Gbps. If a Gen 3 LRD is detected, limit to 40Gbps. This should already be covered by Figure 5-1 USB4 Discovery and Entry Flow Model.

An analysis of the compliance testing implications:
When USB4 V2.0 compliance is set up, I recommend including a Thunderbolt 3 Gen 3 Passive Cable and a Thunderbolt 3 Gen 3 Active LRD as two cables to test with. USB4 v2.0 hosts must allow for Gen4 operation with the Passive cable, but limit to Gen3 performance with the Gen3 Active LRD.

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Actual Change Requested

(a). Table 5-1
From Text:

Table 5-1 Certified Cables Where USB4-compatible Operation is Expected

	Cable Signaling	USB4 Operation	Notes
USB Type-C Full-Featured Cables (Passive)	*USB 3.2* Gen1	20 Gbps	This cable will indicate support for *USB 3.2* Gen1 (001b) in the USB Signaling field of its Passive Cable VDO response. Note: even though this cable isn't explicitly tested, certified or logo'ed for *USB 3.2* Gen2 operation, *USB4* Gen2 operation will generally work.
	USB 3.2 Gen2 (*USB4* Gen2)	20 Gbps	This cable will indicate support for *USB 3.2* Gen2 (010b) in the USB Signaling field of its Passive Cable VDO response.
	USB4 Gen4 (*USB4* Gen3)	80 Gbps	This cable will indicate support for *USB4* Gen3 (011b) or *USB4* Gen4 (100b) in the USB Signaling field of its Passive Cable VDO response.
Thunderbolt™ 3 Cables (Passive)	TBT3 Gen2	20 Gbps	This cable will indicate support for *USB 3.2* Gen1 (001b) or *USB 3.2* Gen2 (010b) in the USB Signaling field of its Passive Cable VDO response.
	TBT3 Gen3	40 Gbps	In addition to indicating support for *USB 3.2* Gen2 (010b) in the USB Signaling field of its Passive Cable VDO response, this cable will indicate that it supports TBT3 Gen3 in the Discover Mode VDO response.
USB Type-C FullFeatured Cables (Active)[1]	*USB4* Gen2	20 Gbps	This cable will indicate support for *USB4* Gen2 (010b) in the USB Signaling field of its Active Cable VDO response.
	USB4 Gen3	40 Gbps	This cable will indicate support for *USB4* Gen3 (011b) in the USB Signaling field of its Active Cable VDO response.
	USB4 Gen4	80 Gbps	This cable will indicate support for *USB4* Gen4 (100b) in the USB Signaling field of its Active Cable VDO response.

Note:

1. SuperSpeed USB active cables do not support *USB4*–compatible operation.

To Text:

Table 5-1 Certified Cables Where USB4-compatible Operation is Expected

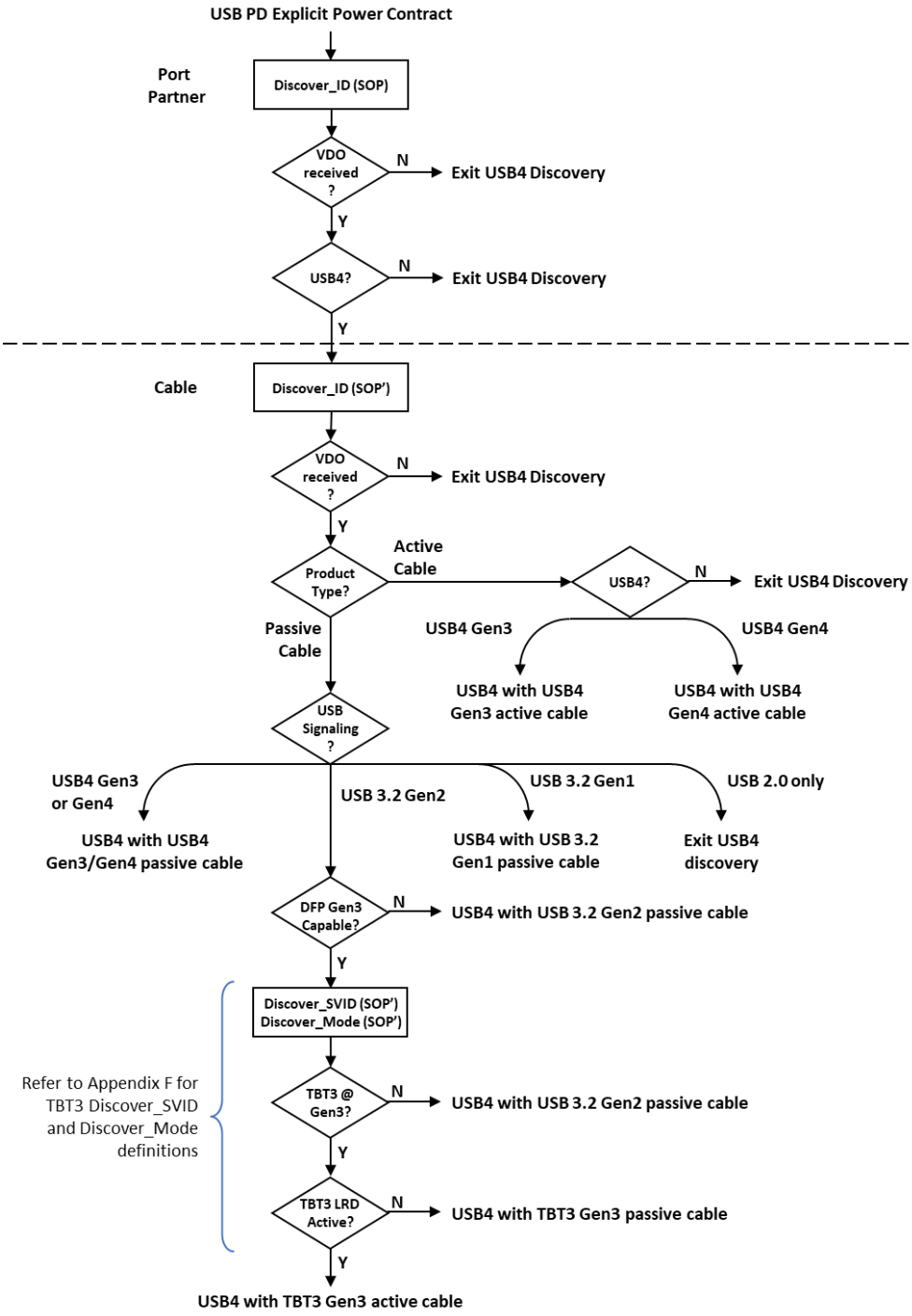
	Cable Signaling	USB4 Operation	Notes
USB Type-C Full-Featured Cables (Passive)	*USB 3.2* Gen1	20 Gbps	This cable will indicate support for *USB 3.2* Gen1 (001b) in the USB Signaling field of its Passive Cable VDO response. Note: even though this cable isn't explicitly tested, certified or logo'ed for *USB 3.2* Gen2 operation, *USB4* Gen2 operation will generally work.
	USB 3.2 Gen2 (USB4 Gen2)	20 Gbps	This cable will indicate support for *USB 3.2* Gen2 (010b) in the USB Signaling field of its Passive Cable VDO response.
	USB4 Gen4 (*USB4* Gen3)	80 Gbps	This cable will indicate support for *USB4* Gen3 (011b) or *USB4* Gen4 (100b) in the USB Signaling field of its Passive Cable VDO response.
Thunderbolt™ 3 Cables (Passive)	TBT3 Gen2 (*USB 3.2* Gen1 or *USB4* Gen2)	20 Gbps	This cable will indicate support for *USB 3.2* Gen1 (001b) or *USB 3.2* Gen2 (010b) in the USB Signaling field of its Passive Cable VDO response.
	TBT3 Gen3 (*USB4* Gen4)	80 Gbps	In addition to indicating support for *USB 3.2* Gen2 (010b) in the USB Signaling field of its Passive Cable VDO response, this cable will indicate that it supports TBT3 Gen3 in the Cable Speed parameter and Passive Cable in the Active_Passive parameter of the Discover Mode VDO response.[2]
Thunderbolt™ 3 Cables (Active Linear Re-driver)	TBT3 Gen3 (*USB4* Gen3)	40 Gbps	In addition to indicating support for *USB 3.2* Gen2 (010b) in the USB Signaling field of its Passive Cable VDO response, this cable will indicate that it supports TBT3 Gen3 in the Cable Speed parameter, and Active Cable in the Active_Passive parameter of the Discover Mode VDO response.[2]
USB Type-C Full-Featured Cables (Active)[1]	*USB4* Gen2	20 Gbps	This cable will indicate support for *USB4* Gen2 (010b) in the USB Signaling field of its Active Cable VDO response.
	USB4 Gen3	40 Gbps	This cable will indicate support for *USB4* Gen3 (011b) in the USB Signaling field of its Active Cable VDO response.
	USB4 Gen4	80 Gbps	This cable will indicate support for *USB4* Gen4 (100b) in the USB Signaling field of its Active Cable VDO response.

Note:

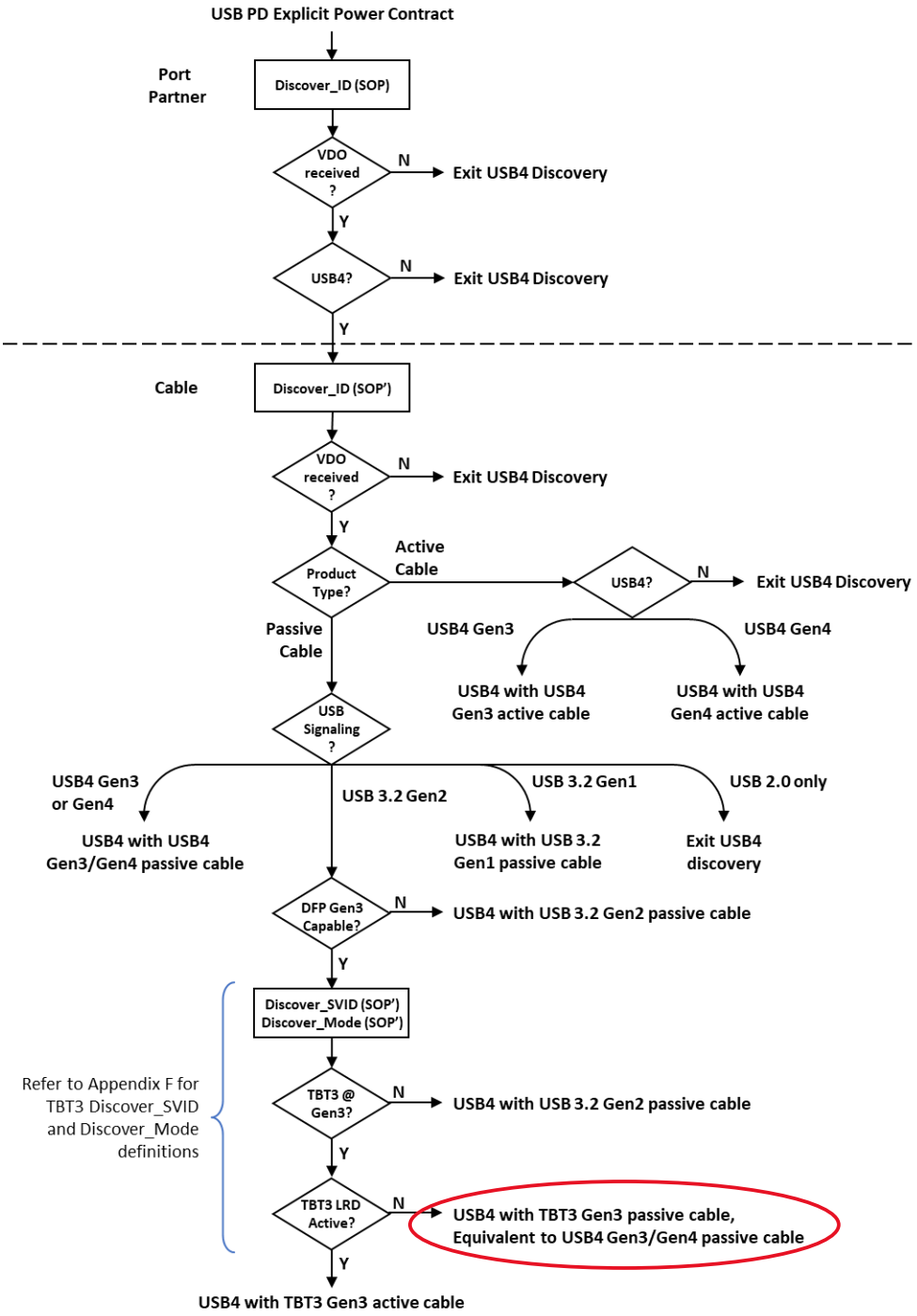
1. SuperSpeed USB active cables do not support *USB4*–compatible operation.
2. See Appendix F.2.6 and Table F-11 TBT3 Cable Discover Modes VDO Responses

(b). Figure 5-1 USB4 Discovery and Entry Flow Model

From:


USB PD Explicit Power Contract
Port Partner
Discover_ID (SOP)
VDO received ?
N
Exit USB4 Discovery
Y
USB4?
N
Exit USB4 Discovery
Y
Cable
Discover_ID (SOP')
VDO received ?
N
Exit USB4 Discovery
Y
Product Type?
Active Cable
USB4?
N
Exit USB4 Discovery
Passive Cable
USB4 Gen3
USB4 Gen4
USB4 with USB4 Gen3 active cable
USB4 with USB4 Gen4 active cable
USB Signaling ?
USB4 Gen3 or Gen4
USB 3.2 Gen2
USB 3.2 Gen1
USB 2.0 only
USB4 with USB4 Gen3/Gen4 passive cable
USB4 with USB 3.2 Gen1 passive cable
Exit USB4 discovery
DFP Gen3 Capable?
N
USB4 with USB 3.2 Gen2 passive cable
Y
Discover_SVID (SOP')
Discover_Mode (SOP')
Refer to Appendix F for TBT3 Discover_SVID and Discover_Mode definitions
TBT3 @ Gen3?
N
USB4 with USB 3.2 Gen2 passive cable
Y
TBT3 LRD Active?
N
USB4 with TBT3 Gen3 passive cable
Y
USB4 with TBT3 Gen3 active cable

To:


USB PD Explicit Power Contract
Port Partner
Discover_ID (SOP)
VDO received ?
N
Exit USB4 Discovery
Y
USB4?
N
Exit USB4 Discovery
Y
Cable
Discover_ID (SOP')
VDO received ?
N
Exit USB4 Discovery
Y
Product Type?
Active Cable
USB4?
N
Exit USB4 Discovery
USB4 Gen3
USB4 Gen4
USB4 with USB4 Gen3 active cable
USB4 with USB4 Gen4 active cable
Passive Cable
USB Signaling ?
USB4 Gen3 or Gen4
USB4 with USB4 Gen3/Gen4 passive cable
USB 3.2 Gen2
USB 3.2 Gen1
USB4 with USB 3.2 Gen1 passive cable
USB 2.0 only
Exit USB4 discovery
DFP Gen3 Capable?
N
USB4 with USB 3.2 Gen2 passive cable
Y
Discover_SVID (SOP')
Discover_Mode (SOP')
Refer to Appendix F for TBT3 Discover_SVID and Discover_Mode definitions
TBT3 @ Gen3?
N
USB4 with USB 3.2 Gen2 passive cable
Y
TBT3 LRD Active?
N
USB4 with TBT3 Gen3 passive cable, Equivalent to USB4 Gen3/Gen4 passive cable
Y
USB4 with TBT3 Gen3 active cable