

# USB Power Delivery ENGINEERING CHANGE NOTICE

## Title: Source Power Rules Update

### Applied to: USB Power Delivery Specification Revision 3.2 Version 1.0

<b>Brief description of the functional changes proposed:</b>
This ECN updates Chapter 10 to clarify what capabilities Sources are included in Source Capabilities messages sent to a Sink. This ECR also revises the Power Rules to relax the lower current/power requirements for higher voltages so that Sources are not required to offer very wide power ranges that might be more complicated and impact the ability to meet efficiency requirements.

<b>Benefits as a result of the proposed changes:</b>
Removes ambiguity about the intentions of the Source Power Rules, eases requirements for higher voltage chargers, and clarifies the relationship of the power rules to Source Capabilities messaging and Port Present PDP.

<b>An assessment of the impact to the existing revision and systems that currently conform to the USB specification:</b>
No intended impact.

<b>An analysis of the hardware implications:</b>
May ease design of higher voltage charger designs given the relaxation of low current/power rules. Firmware updates might be needed if designs are not already exposing the right PDOs in Source Capabilities messages.

<b>An analysis of the software implications:</b>
No intended implications.

<b>An analysis of the compliance testing implications:</b>
Likely some updates and potentially some simplifications to testing procedures.

# USB Power Delivery ENGINEERING CHANGE NOTICE

## Actual Change Requested

### (a). Section 10.1

#### From:

### 10.1 Introduction

The flexibility of power provision on USB Type-C® is expected to lead to adapter re-use and the increasingly widespread provision of USB power outlets in domestic and public places and in transport of all kinds. Environmental considerations could result in unbundled adapters. Rules are needed to avoid incompatibility between the Sources and the Sinks they are used to power, in order to avoid user confusion and to meet user expectations. This section specifies a set of rules that Sources and Sinks **shall** follow. These rules provide a simple and consistent user experience.

The PDP Rating is a manufacturer declared value placed on packaging to help the user understand the capabilities of a charger or the size of charger required to power their device. For PDP values of 10W and above the PDP **shall** be declared as an integer number of Watts. For PDP values less than 10W, the PDP **shall** be declared in increments of 0.5W.

The Source Power rules define a PDP to provide a simple way to tell the user about the capabilities of their power adapter or device. PDP Rating is akin to the wattage rating of a light bulb – bigger numbers mean more capability.

The Sink Power rules define a PDP to provide a simple way to tell the user which Sources will provide adequate power for their Sink.

#### To:

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The Sink Power rules define a PDP to provide a simple way to tell the user which Sources will provide adequate power for their Sink.

# USB Power Delivery ENGINEERING CHANGE NOTICE

## (b). Section 10.2

From:

### 10.2 Source Power Rules

In order to meet the expectations of the user, the Maximum Current/Power in the Source Capabilities PDO or APDO for Sources with a PDP Rating of x Watts **Shall** be as follows:

- Maximum current for Normative and **Optional** Fixed/Variable supply PDOs **Shall** be either RoundUp(x/Voltage) or RoundDown(x/Voltage) to the nearest 10mA.
- Maximum current for SPR Programmable Power Supply APDOs **Shall** be as defined in [Table 10.10 “SPR Programmable Power Supply PDOs and APDOs based on the Port Maximum PDP”](#). Note that when the Constant Power bit is set in the APDO, the programmable power supply's output current is as defined in [Table 10.10 “SPR Programmable Power Supply PDOs and APDOs based on the Port Maximum PDP”](#) however the programmable power supply will limit its output current so that the product of its actual output Voltage times the output current does not exceed the PDP.
- If a 9V Prog, 15V Prog or 20V Prog Programmable Power Supply APDO is advertised when not required by [Table 10.10 “SPR Programmable Power Supply PDOs and APDOs based on the Port Maximum PDP”](#), then the maximum current **Shall** be RoundDown (x/Prog Voltage) to the nearest 50mA. When the PPS Power Limited bit is clear the Source **Shall** provide this current at Max Voltage.
- Maximum power for **Optional** Battery supply PDOs **Shall** be  $\leq x$ .

To:

### 10.2 Source Power Rules

The Source power rules defined in this section include both **Normative** and **Optional** rules. For all of the defined rules, the capabilities a Source exposes are based on the Port Maximum PDP, or if power constrained, the Port Present PDP of the port.

For a Guaranteed Capability port, the Source **Shall** always include in every **Source Capabilities** or **EPR Source Capabilities** Message sent to a Sink all the PDO/APDOs that are defined by the **Normative** (and **Optional** when implemented) rules based on the port's Port Maximum PDP and mode of operation (i.e., SPR or EPR).

For a Managed Capability port, except before the First Explicit Contract or before the Explicit Contract after the Port Present PDP changes on a shared capacity port, the Source **Shall** always include in every **Source Capabilities** or **EPR Source Capabilities** Message sent to a Sink all the PDO/APDOs that are defined by the **Normative** (and **Optional** when implemented) rules based on the port's Port Present PDP and mode of operation (i.e., SPR or EPR). After the First Explicit Contract, this requirement assures that the attached Sink will always know what voltages (or voltage modes) are presently available from the Source.

In order to meet the expectations of the user, the Maximum Current/Power in the Source Capabilities PDO or APDO for Sources with a PDP Rating of x Watts **Shall** be as follows:

- Maximum current for Normative and **Optional** Fixed/Variable supply PDOs **Shall** be either RoundUp(x/Voltage) or RoundDown(x/Voltage) to the nearest 10mA.

# USB Power Delivery ENGINEERING CHANGE NOTICE

- Maximum current for SPR Programmable Power Supply APDOs **shall** be as defined in [Table 10.10 “SPR Programmable Power Supply PDOs and APDOs based on the Port Maximum PDP”](#). Note that when the Constant Power bit is set in the APDO, the programmable power supply's output current is as defined in [Table 10.10 “SPR Programmable Power Supply PDOs and APDOs based on the Port Maximum PDP”](#) however the programmable power supply will limit its output current so that the product of its actual output Voltage times the output current does not exceed the PDP.
- If a 9V Prog, 15V Prog or 20V Prog Programmable Power Supply APDO is advertised when not required by [Table 10.10 “SPR Programmable Power Supply PDOs and APDOs based on the Port Maximum PDP”](#), then the maximum current **shall** be RoundDown (x/Prog Voltage) to the nearest 50mA. When the PPS Power Limited bit is clear the Source **shall** provide this current at Max Voltage.
- Maximum power for **Optional** Battery supply PDOs **shall** be  $\leq x$ .

## (c). Section 10.2.2

From:

### 10.2.2 Normative Voltages and Currents

The Voltages and currents an SPR Source with a PDP Rating of x Watts **shall** support are as defined in [Table 10.2 “SPR Normative Voltages and Minimum Currents”](#).

# USB Power Delivery ENGINEERING CHANGE NOTICE

**Table 10.2 “SPR Normative Voltages and Minimum Currents”**

Port Maximum PDP Rating (W)	5V Fixed	9V Fixed	15V Fixed	20V Fixed	SPR AVS
$0.5 \leq x \leq 15$	$(PDP/5)A^3$	-	-	-	-
$15 < x \leq 27$	$3A^2$	$(PDP/9)A^3$	-	-	-
$27 < x \leq 45$	$3A^2$	$3A^2$	$(PDP/15)A^3$	-	(9V – 15V): (15V Fixed Max Current) A
$45 < x \leq 60$	$3A^2$	$3A^2$	$3A^2$	$(PDP/20)A^3$	(9V – 15V): (15V Fixed Max Current) A <sup>4</sup> (15V – 20V): (20V Fixed Max Current) A
$60 < x \leq 100$	$3A^2$	$3A^2$	$3A^2$	$(PDP/20)A^{1,3}$	(9V – 15V): (15V Fixed Max Current) A <sup>4,5</sup> (15V – 20V): (20V Fixed Max Current) A <sup>1,5</sup>
<sup>1)</sup> Requires a 5A cable. <sup>2)</sup> The Fixed PDOs Maximum Current field <b>Shall</b> advertise at least 3A, but <b>May</b> advertise up to RoundUp (PDP/Voltage) to the nearest 10mA. Requires a 5A cable if over 3A is advertised. <sup>3)</sup> The Fixed PDOs Maximum Current field <b>Shall</b> advertise either RoundDown (PDP/Voltage) or RoundUp (PDP/Voltage) to the nearest 10mA. <sup>4)</sup> SPR AVS current for this voltage range is the maximum current as advertised by the 15V Fixed Source PDO. This current can be higher than 3A (refer to Note 2). Requires a 5A cable if over 3A is advertised. <sup>5)</sup> The Sink is allowed to request up to the 20V Fixed Max Current when the requested voltage is 15.0V.					

SPR Managed Capability ports when power constrained are defined to offer higher voltages at lower Port Present PDP (as per [Table 10.3 “SPR Source Capabilities When Port Present PDP is less than Port Maximum PDP”](#)) than the port’s Port Maximum PDP (as per [Table 10.2 “SPR Normative Voltages and Minimum Currents”](#)) because these voltages would otherwise be available if the Managed Capability port power hadn’t been constrained. Managed Capability ports are required to be properly identified to the user based on the port’s Port Maximum PDP.

# USB Power Delivery ENGINEERING CHANGE NOTICE

**Table 10.3 “SPR Source Capabilities When Port Present PDP is less than Port Maximum PDP”**

Port Present PDP (W)	5V Fixed	9V Fixed	15V Fixed	20V Fixed	SPR AVS with Max Voltage of 15V or 20V per Table 10.2 “SPR Normative Voltages and Minimum Currents” <sup>6</sup>
$0.5 \leq x \leq 15$	$(PDP/5)A^3$	$(PDP/9)A^{3, 7}$	$(PDP/15)A^{3, 7}$	$(PDP/20)A^{3, 7}$	(9V – 15V): (15V Fixed Max Current) A <sup>4</sup> (15V – 20V): (20V Fixed Max Current) A
$15 < x \leq 27$	$3A^2$	$(PDP/9)A^3$			
$27 < x \leq 45$	$3A^2$	$3A^2$	$(PDP/15)A^3$		
$45 < x \leq 60$	$3A^2$	$3A^2$	$3A^2$	$(PDP/20)A^3$	
$60 < x \leq 100$	$3A^2$	$3A^2$	$3A^2$	$(PDP/20)A^{1, 3}$	(9V – 15V): (15V Fixed Max Current) A <sup>4, 5</sup> (15V – 20V): (20V Fixed Max Current) A <sup>1, 5</sup>

1)

Requires a 5A cable.

2)

The Fixed PDOs Maximum Current field **Shall** advertise at least 3A, but **May** advertise up to RoundUp (PDP/Voltage) to the nearest 10mA. Requires a 5A cable if over 3A is advertised.

3)

The Fixed PDOs Maximum Current field **Shall** advertise either RoundDown (PDP/Voltage) or RoundUp (PDP/Voltage) to the nearest 10mA.

4)

SPR AVS current for this voltage range is the maximum current as advertised by the 15V Fixed Source PDO. This current can be higher than 3A (refer to Note 2). Requires a 5A cable if over 3A is advertised.

5)

The Sink is allowed to request up to the 20V Fixed Max Current when the requested voltage is 15.0V.

6)

The Max Voltage for SPR AVS is what is allowed by [Table 10.2 “SPR Normative Voltages and Minimum Currents”](#) based on the port’s Port Maximum PDP.

7)

This SPR Fixed voltage is only available if allowed by [Table 10.2 “SPR Normative Voltages and Minimum Currents”](#) based on the port’s Port Maximum PDP.

In reference to [Table 10.3 “SPR Source Capabilities When Port Present PDP is less than Port Maximum PDP”](#), [Table 10.4 “SPR Source Port Present PDP less than Port Maximum PDP Examples”](#) gives examples of which SPR capabilities are Advertised based on Port Present PDP on a Managed Capability port and the port’s Port Maximum PDP and cable’s current rating.

# USB Power Delivery ENGINEERING CHANGE NOTICE

Table 10.4 “SPR Source Port Present PDP less than Port Maximum PDP Examples”

Port Maximum PDP and Cable Rating	Port Present PDP	Offers				
		5V Fixed	9V Fixed	15V Fixed	20V Fixed	SPR AVS
80W / 5A	65W	3A <sup>1</sup>	3A <sup>1</sup>	3A <sup>1</sup>	3.25A	9V – 15V: 3A 15V – 20V: 3.25A
80W / 5A	40W	3A <sup>1</sup>	3A <sup>1</sup>	2.67A	2A	9V – 15V: 2.67A 15V – 20V: 2A
80W / 3A	40W	3A <sup>1</sup>	3A	2.67A	2A	9V – 15V: 2.67A 15V – 20V: 2A
40W / 5A	40W	3A <sup>1</sup>	3A <sup>1</sup>	2.67A	Not Offered	9V – 15V: 2.67A
40W / 3A	40W	3A <sup>1</sup>	3A	2.67A	Not Offered	9V – 15V: 2.67A
80W / 5A	20W	3A <sup>1</sup>	2.22A	1.33A	1A	9V – 15V: 1.33A 15V – 20V: 1A
80W / 3A	20W	3A <sup>1</sup>	2.22A	1.33A	1A	9V – 15V: 1.33A 15V – 20V: 1A
40W / 5A	20W	3A <sup>1</sup>	2.22A	1.33A	Not Offered	9V – 15V: 1.33A
40W / 3A	20W	3A <sup>1</sup>	2.22A	1.33A	Not Offered	9V – 15V: 1.33A
<sup>1)</sup> The Fixed PDO Maximum Current field will advertise at least 3A but <b>May</b> advertise up to RoundUp (PDP/voltage) to the nearest 10mA.						

To:

## 10.2.2 Normative Voltages and Currents

The Voltages and currents an SPR Source with a PDP Rating of x Watts **shall** support are as defined in [Table 10.2 “SPR Normative Voltages and Minimum Currents”](#).

# USB Power Delivery ENGINEERING CHANGE NOTICE

**Table 10.2 “SPR Normative Voltages and Minimum Currents”**

Port Maximum PDP Rating (W)	5V Fixed	9V Fixed	15V Fixed	20V Fixed	SPR AVS
$0.5 \leq x \leq 15$	$(PDP/5)A^3$	-	-	-	-
$15 < x \leq 27$	$3A^2$	$(PDP/9)A^3$	-	-	-
$27 < x \leq 45$	$3A^2$	$3A^2$	$(PDP/15)A^3$	-	(9V – 15V): (15V Fixed Max Current) A
$45 < x \leq 60$	$3A^2$	$3A^2$	$3A^2$	$(PDP/20)A^3$	(9V – 15V): (15V Fixed Max Current) A <sup>4</sup> (15V – 20V): (20V Fixed Max Current) A
$60 < x \leq 100$	$3A^2$	$3A^2$	$3A^2$	$(PDP/20)A^{1,3}$	(9V – 15V): (15V Fixed Max Current) A <sup>4,5</sup> (15V – 20V): (20V Fixed Max Current) A <sup>1,5</sup>
<p>1) Requires a 5A cable.</p> <p>2) The Fixed PDOs Maximum Current field <b>Shall</b> advertise at least 3A, but <b>May</b> advertise up to RoundUp (PDP/Voltage) to the nearest 10mA. Requires a 5A cable if over 3A is advertised.</p> <p>3) The Fixed PDOs Maximum Current field <b>Shall</b> advertise either RoundDown (PDP/Voltage) or RoundUp (PDP/Voltage) to the nearest 10mA.</p> <p>4) SPR AVS current for this voltage range is the maximum current as advertised by the 15V Fixed Source PDO. This current can be higher than 3A (refer to Note 2). Requires a 5A cable if over 3A is advertised.</p> <p>5) The Sink is allowed to request up to the 20V Fixed Max Current when the requested voltage is 15.0V.</p>					

SPR Managed Capability ports when power constrained are defined to offer higher voltages at lower Port Present PDP (as per [Table 10.3 “SPR Source Capabilities When Port Present PDP is less than Port Maximum PDP”](#)) than the port’s Port Maximum PDP (as per [Table 10.2 “SPR Normative Voltages and Minimum Currents”](#)) because these voltages would otherwise be available if the Managed Capability port power hadn’t been constrained. **Managed Capability ports are required to be properly identified to the user based on the port’s Port Maximum PDP.**



# USB Power Delivery ENGINEERING CHANGE NOTICE

**Table 10.3 “SPR Source Capabilities When Port Present PDP is less than Port Maximum PDP”**

Port Present PDP (W)	5V Fixed	9V Fixed	15V Fixed	20V Fixed	SPR AVS with Max Voltage of 15V or 20V per Table 10.2 “SPR Normative Voltages and Minimum Currents” <sup>8</sup>
$0.5 \leq x \leq 15$	$(PDP/5)A^3$	$(PDP/9)A^{3,7,8}$	$(PDP/15)A^{3,7,8}$	$(PDP/20)A^{3,7,8}$	(9V – 15V): (15V Fixed Max Current) A <sup>4,6,8</sup> (15V – 20V): (20V Fixed Max Current) A <sup>6,8</sup>
$15 < x \leq 27$	$3A^2$	$(PDP/9)A^3$	$(PDP/15)A^{3,7}$	$(PDP/20)A^{3,7}$	(9V – 15V): (15V Fixed Max Current) A <sup>4</sup> (15V – 20V): (20V Fixed Max Current) A <sup>6</sup>
$27 < x \leq 45$	$3A^2$	$3A^2$	$(PDP/15)A^3$		
$45 < x \leq 60$	$3A^2$	$3A^2$	$3A^2$	$(PDP/20)A^3$	(9V – 15V): (15V Fixed Max Current) A <sup>4</sup> (15V – 20V): (20V Fixed Max Current) A
$60 < x \leq 100$	$3A^2$	$3A^2$	$3A^2$	$(PDP/20)A^{1,3}$	(9V – 15V): (15V Fixed Max Current) A <sup>4,5</sup> (15V – 20V): (20V Fixed Max Current) A <sup>1,5</sup>
<p>1) Requires a 5A cable.</p> <p>2) The Fixed PDOs Maximum Current field <b>shall</b> advertise at least 3A, but <b>may</b> advertise up to RoundUp (PDP/Voltage) to the nearest 10mA. Requires a 5A cable if over 3A is advertised.</p> <p>3) The Fixed PDOs Maximum Current field <b>shall</b> advertise either RoundDown (PDP/Voltage) or RoundUp (PDP/Voltage) to the nearest 10mA.</p> <p>4) SPR AVS current for this voltage range is the maximum current as advertised by the 15V Fixed Source PDO. This current can be higher than 3A (refer to Note 2). Requires a 5A cable if over 3A is advertised.</p> <p>5) The Sink is allowed to request up to the 20V Fixed Max Current when the requested voltage is 15.0V.</p> <p>6) The Max Voltage for SPR AVS is what is allowed by <a href="#">Table 10.2 “SPR Normative Voltages and Minimum Currents”</a> based on the port’s Port Maximum PDP.</p> <p>7) This SPR Fixed voltage is only available if allowed by <a href="#">Table 10.2 “SPR Normative Voltages and Minimum Currents”</a> based on the port’s Port Maximum PDP.</p> <p>8) <b>SPR Sources <i>May</i> (are not required to) offer A/PDOs at this Port Present PDP.</b></p>					

In reference to [Table 10.3 “SPR Source Capabilities When Port Present PDP is less than Port Maximum PDP”](#), Table [Table 10.4 “SPR Source Port Present PDP less than Port Maximum PDP Examples”](#) gives examples of which SPR capabilities are Advertised based on Port Present PDP on a Managed Capability port and the port’s Port Maximum PDP and cable’s current rating.

# USB Power Delivery ENGINEERING CHANGE NOTICE

Table 10.4 “SPR Source Port Present PDP less than Port Maximum PDP Examples”

Port Maximum PDP and Cable Rating	Port Present PDP	Offers				
		5V Fixed	9V Fixed	15V Fixed	20V Fixed	SPR AVS
80W / 5A	65W	3A <sup>1</sup>	3A <sup>1</sup>	3A <sup>1</sup>	3.25A	9V – 15V: 3A 15V – 20V: 3.25A
80W / 5A	40W	3A <sup>1</sup>	3A <sup>1</sup>	2.67A	2A	9V – 15V: 2.67A 15V – 20V: 2A
80W / 3A	40W	3A <sup>1</sup>	3A	2.67A	2A	9V – 15V: 2.67A 15V – 20V: 2A
40W / 5A	40W	3A <sup>1</sup>	3A <sup>1</sup>	2.67A	Not Offered	9V – 15V: 2.67A
40W / 3A	40W	3A <sup>1</sup>	3A	2.67A	Not Offered	9V – 15V: 2.67A
80W / 5A	20W	3A <sup>1</sup>	2.22A	1.33A	1A	9V – 15V: 1.33A 15V – 20V: 1A
80W / 3A	20W	3A <sup>1</sup>	2.22A	1.33A	1A	9V – 15V: 1.33A 15V – 20V: 1A
40W / 5A	20W	3A <sup>1</sup>	2.22A	1.33A	Not Offered	9V – 15V: 1.33A
40W / 3A	20W	3A <sup>1</sup>	2.22A	1.33A	Not Offered	9V – 15V: 1.33A
80W / 3A	15W	3A	1.67A <sup>2</sup>	1A <sup>2</sup>	0.75A <sup>2</sup>	9V – 15V: 1A <sup>2</sup> 15V – 20V: 0.75A <sup>2</sup>
40W / 3A	15W	3A	1.67A <sup>2</sup>	1A <sup>2</sup>	Not Offered	9V – 15V: 1A <sup>2</sup>

1) The Fixed PDO Maximum Current field will advertise at least 3A but **May** advertise up to RoundUp (PDP/voltage) to the nearest 10mA.

2) These capabilities are not required but may be offered at this Port Present PDP.

## (d). Section 10.2.3.3

From:

### 10.2.3.3 Optional Normative Extended Power Range (EPR)

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# USB Power Delivery ENGINEERING CHANGE NOTICE

**Table 10.12 “EPR Source Capabilities based on the Port Maximum PDP and using an EPR Capable Cable”**

Port Maximum PDP (W)	SPR Fixed and AVS	28V Fixed	36V Fixed <sup>3</sup>	48V Fixed	EPR AVS <sup>3, 4</sup>
100 < x ≤ 140	Required per <i>Table 10.2 “SPR Normative Voltages and Minimum Currents”</i> (or <i>Table 10.3 “SPR Source Capabilities When Port Present PDP is less than Port Maximum PDP”</i> when applicable)	(PDP/28) A <sup>2</sup>	<b>N/A</b> <sup>1</sup>	<b>N/A</b> <sup>1</sup>	(15V – PDP/5A): 5A (>PDP/5A – 28V): (PDP/AVS Voltage) A
140 < x ≤ 180		5A	(PDP/36) A <sup>2</sup>	<b>N/A</b> <sup>1</sup>	(15V – PDP/5A): 5A (>PDP/5A – 36V): (PDP/AVS Voltage) A
180 < x ≤ 240		5A	5A	(PDP/48) A <sup>2</sup>	(15V – PDP/5A): 5A (>PDP/5A – 48V): (PDP/AVS Voltage) A

1)

EPR Sources are disallowed from offering Fixed Voltages that are above the defined Voltages for a given PDP, e.g., 36V is disallowed for any PDP of 140W or lower.

2)

The Fixed PDOs Maximum Current field **shall** advertise either RoundDown (PDP/Voltage) or RoundUp (PDP/Voltage) to the nearest 10mA.

3)

EPR Sources **shall** reject any request for more than the Advertised PDP, i.e., when output voltage and operating current requested in the Sink RDO is outside of the defined AVS voltage and current range represented by the advertised PDP, the RDO will be rejected.

4)

The current available for a given AVS Voltage is as indicated in this column. The current defined here is describing the top edge of the Valid Operating Region as illustrated in *Figure 10-6 “Valid EPR AVS Operating Region”*. The AVS APDO does not have a Maximum Current field, so the maximum current has to be calculated from the PDP.

**Table 10.13 “EPR Source Capabilities when Port Present PDP is less than Port Maximum PDP and using an EPR-capable cable”**

# USB Power Delivery ENGINEERING CHANGE NOTICE

Port Present PDP (W)	SPR Fixed and AVS	28V Fixed	36V Fixed <sup>4</sup>	48V Fixed <sup>4</sup>	EPR AVS with Max Voltage of 28V, 36V or 48V per Table 10.12 <sup>2, 5, 6</sup>
7.5 ≤ x ≤ 15	Required per <a href="#">Table 10.2 “SPR Normative Voltages and Minimum Currents”</a> (or <a href="#">Table 10.3 “SPR Source Capabilities When Port Present PDP is less than Port Maximum PDP”</a> when applicable)	(PDP/28) A <sup>1</sup>	(PDP/36) A <sup>1</sup>	(PDP/48) A <sup>1</sup>	(15V – PDP/5A): 5A (>PDP/5A – Max Voltage): (PDP/AVS Voltage) A
15 < x ≤ 27					
27 < x ≤ 45					
45 < x ≤ 60					
60 < x ≤ 100	<a href="#">Table 10.3 “SPR Source Capabilities When Port Present PDP is less than Port Maximum PDP”</a> with a Port Present PDP of 100W.	5A			
100 < x ≤ 140					
140 < x ≤ 180		5A	5A		
180 < x ≤ 240					

<sup>1)</sup> The Fixed PDOs Maximum Current field **shall** Advertise either RoundDown (PDP/Voltage) or RoundUp (PDP/Voltage) to the nearest 10mA.

<sup>2)</sup> EPR Sources **shall** reject any Request for more than the Advertised PDP, i.e., when output voltage and operating current requested in the Sink RDO is outside of the defined AVS voltage and current range represented by the advertised PDP, the RDO will be rejected.

<sup>3)</sup> EPR Sources **shall Not** offer an AVS APDO at this Port Present PDP.

<sup>4)</sup> This EPR Fixed voltage is only available if allowed by [Table 10.12 “EPR Source Capabilities based on the Port Maximum PDP and using an EPR Capable Cable”](#) based on the port’s PDP Rating.

<sup>5)</sup> The Max Voltage for AVS is what is allowed by [Table 10.12 “EPR Source Capabilities based on the Port Maximum PDP and using an EPR Capable Cable”](#) based on the port’s Port Maximum PDP.

<sup>6)</sup> The current available based on AVS voltage is as indicated in this column. The current defined here is describing the top edge of the Valid Operating Region as illustrated in [Figure 10-6 “Valid EPR AVS Operating Region”](#). AVS APDO does not have a Maximum Current field so the maximum current has to be calculated from the PDP.

**Note:** EPR Managed Capability ports when power constrained are defined to offer higher voltages at lower Port Present PDP (as per [Table 10.13 “EPR Source Capabilities when Port Present PDP is less than Port Maximum PDP and using an EPR-capable cable”](#)) than the port’s Port Maximum PDP (as per [Table 10.12 “EPR Source Capabilities based on the Port Maximum PDP and using an EPR Capable Cable”](#)) because these voltages would otherwise be available if the Managed Capability port power hadn’t been constrained. Managed Capability ports are required to be properly identified to the user based on the port’s Port Maximum PDP.

In reference to [Table 10.13 “EPR Source Capabilities when Port Present PDP is less than Port Maximum PDP and using an EPR-capable cable”](#), [Table 10.14 “EPR Source Examples when Port Present PDP is less than Port Maximum PDP”](#) gives examples of which EPR capabilities, in addition to the required SPR Fixed PDOs and SPR AVS APDO, are Advertised based on Port Present PDP and the port’s Port Maximum PDP.

# USB Power Delivery ENGINEERING CHANGE NOTICE

Table 10.14 “EPR Source Examples when Port Present PDP is less than Port Maximum PDP”

Port Maximum PDP	Port Present PDP	Offers			
		28V Fixed	36V Fixed	48V Fixed	AVS
200W	108W	3.86A	3A	2.25A	48V@108W
160W	108W	3.86A	3A	Not offered	36V@108W
120W	108W	3.86A	Not offered	Not offered	28V@108W
200W	72W	2.57A	2A	1.5A	48V@72W
160W	72W	2.57A	2A	Not offered	36V@72W
120W	72W	2.57A	Not offered	Not offered	28V@72W
200W	36W	1.29A	1A	0.75A	48V@36W
160W	36W	1.29A	1A	Not offered	36V@36W
120W	36W	1.29A	Not offered	Not offered	28V@36W

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To:

## 10.2.3.3 Optional Normative Extended Power Range (EPR)

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# USB Power Delivery ENGINEERING CHANGE NOTICE

**Table 10.12 “EPR Source Capabilities based on the Port Maximum PDP and using an EPR Capable Cable”**

Port Maximum PDP (W)	SPR Fixed and AVS	28V Fixed	36V Fixed <sup>3</sup>	48V Fixed	EPR AVS <sup>3, 4</sup>
100 < x ≤ 140	Required per <i>Table 10.2 “SPR Normative Voltages and Minimum Currents”</i> (or <i>Table 10.3 “SPR Source Capabilities When Port Present PDP is less than Port Maximum PDP”</i> when applicable)	(PDP/28) A <sup>2</sup>	<b>N/A</b> <sup>1</sup>	<b>N/A</b> <sup>1</sup>	(15V – PDP/5A): 5A (>PDP/5A – 28V): (PDP/AVS Voltage) A
140 < x ≤ 180		5A	(PDP/36) A <sup>2</sup>	<b>N/A</b> <sup>1</sup>	(15V – PDP/5A): 5A (>PDP/5A – 36V): (PDP/AVS Voltage) A
180 < x ≤ 240		5A	5A	(PDP/48) A <sup>2</sup>	(15V – PDP/5A): 5A (>PDP/5A – 48V): (PDP/AVS Voltage) A

1)

EPR Sources are disallowed from offering Fixed Voltages that are above the defined Voltages for a given PDP, e.g., 36V is disallowed for any PDP of 140W or lower.

2)

The Fixed PDOs Maximum Current field **shall** advertise either RoundDown (PDP/Voltage) or RoundUp (PDP/Voltage) to the nearest 10mA.

3)

EPR Sources **shall** reject any request for more than the Advertised PDP, i.e., when output voltage and operating current requested in the Sink RDO is outside of the defined AVS voltage and current range represented by the advertised PDP, the RDO will be rejected.

4)

The current available for a given AVS Voltage is as indicated in this column. The current defined here is describing the top edge of the Valid Operating Region as illustrated in *Figure 10-6 “Valid EPR AVS Operating Region”*. The AVS APDO does not have a Maximum Current field, so the maximum current has to be calculated from the PDP.

**Table 10.13 “EPR Source Capabilities when Port Present PDP is less than Port Maximum PDP and using an EPR-capable cable”**

# USB Power Delivery ENGINEERING CHANGE NOTICE

Port Present PDP (W)	SPR Fixed and AVS	28V Fixed	36V Fixed <sup>4</sup>	48V Fixed <sup>4</sup>	EPR AVS with Max Voltage of 28V, 36V or 48V per Table 10.12 <sup>2, 5, 6</sup>		
					28V	36V	48V
7.5 ≤ x ≤ 15	Required per <i>Table 10.2 “SPR Normative Voltages and Minimum Currents”</i> (or <i>Table 10.3 “SPR Source Capabilities When Port Present PDP is less than Port Maximum PDP”</i> when applicable)	(PDP/28) A <sup>3</sup>	(PDP/36) A <sup>3</sup>	(PDP/48) A <sup>3</sup>	<div>15V – Max Voltage): (PDP/AVS Voltage) A<sup>3</sup></div> <div></div> <div></div> <div></div> <div>Up to 75W: 15V – Max Voltage): (PDP/AVS Voltage) A</div> <div>Above 75W: (15V – PDP/5A): 5A</div> <div>(&gt;PDP/5A – Max Voltage): (PDP/AVS Voltage) A</div>		
15 < x ≤ 27		(PDP/28) A <sup>1</sup>	(PDP/36) A <sup>1</sup>	(PDP/48) A <sup>1</sup>			
27 < x ≤ 45							
45 < x ≤ 60							
60 < x ≤ 100	<i>Table 10.3 “SPR Source Capabilities When Port Present PDP is less than Port Maximum PDP”</i> with a Port Present PDP of 100W.	5A					
100 < x ≤ 140							
140 < x ≤ 180		5A	5A				
180 < x ≤ 240							

1)

The Fixed PDOs Maximum Current field **shall** Advertise either RoundDown (PDP/Voltage) or RoundUp (PDP/Voltage) to the nearest 10mA.

2)

EPR Sources **shall** reject any Request for more than the Advertised PDP, i.e., when output voltage and operating current requested in the Sink RDO is outside of the defined AVS voltage and current range represented by the advertised PDP, the RDO will be rejected.

3)

EPR Sources **shall Not May** (are not required to) offer an AVS A<sup>1</sup> PDOs at this Port Present PDP. When offered, the Fixed PDOs Maximum Current field **shall** Advertise either RoundDown (PDP/Voltage) or RoundUp (PDP/Voltage) to the nearest 10mA.

4)

This EPR Fixed voltage is only available if allowed by *Table 10.12 “EPR Source Capabilities based on the Port Maximim PDP and using an EPR Capable Cable”* based on the port’s PDP Rating.

5)

The Max Voltage for AVS is what is allowed by *Table 10.12 “EPR Source Capabilities based on the Port Maximim PDP and using an EPR Capable Cable”* based on the port’s Port Maximum PDP.

6)

The current available based on AVS voltage is as indicated in this column. The current defined here is describing the top edge of the Valid Operating Region as illustrated in *Figure 10-6 “Valid EPR AVS Operating Region”*. AVS APDO does not have a Maximum Current field so the maximum current has to be calculated from the PDP.

**Note:** EPR Managed Capability ports when power constrained are defined to offer higher voltages at lower Port Present PDP (as per [Table 10.13 “EPR Source Capabilities when Port Present PDP is less than Port Maximum PDP and using an EPR-capable cable”](#)) than the port’s Port Maximum PDP (as per [Table 10.12 “EPR Source Capabilities based on the Port Maximum PDP and using an EPR Capable Cable”](#)) because these voltages would otherwise be available if the Managed Capability port power hadn’t been constrained. Managed Capability ports are required to be properly identified to the user based on the port’s Port Maximum PDP.

In reference to [Table 10.13 “EPR Source Capabilities when Port Present PDP is less than Port Maximum PDP and using an EPR-capable cable”](#), [Table 10.14 “EPR Source Examples when Port Present PDP is less than Port Maximum PDP”](#) gives examples of which EPR capabilities, in addition to the required SPR Fixed PDOs and SPR AVS APDO, are Advertised based on Port Present PDP and the port’s Port Maximum PDP.

# USB Power Delivery ENGINEERING CHANGE NOTICE

Table 10.14 “EPR Source Examples when Port Present PDP is less than Port Maximum PDP”

Port Maximum PDP	Port Present PDP	Offers			
		28V Fixed	36V Fixed	48V Fixed	AVS
200W	108W	3.86A	3A	2.25A	48V@108W
160W	108W	3.86A	3A	Not offered	36V@108W
120W	108W	3.86A	Not offered	Not offered	28V@108W
200W	72W	2.57A	2A	1.5A	48V@72W
160W	72W	2.57A	2A	Not offered	36V@72W
120W	72W	2.57A	Not offered	Not offered	28V@72W
200W	36W	1.29A	1A <sup>1</sup>	0.75A <sup>1</sup>	48V@36W <sup>1</sup>
160W	36W	1.29A	1A <sup>1</sup>	Not offered	36V@36W <sup>1</sup>
120W	36W	1.29A	Not offered	Not offered	28V@36W

1) **These capabilities are not required but may be offered at this Port Present PDP.**